



Glossary of Terminology:

The glossary is organized alphabetically. Literature sources are listed on the References Page.

Alimeda - an important genus of calcareous green algae in coral reef environments

Aquarius - *Aquarius* is an underwater ocean laboratory located in the NOAA Florida Keys National Marine Sanctuary. The laboratory is deployed three and half miles offshore, at a depth of 60 feet, next to spectacular coral reefs. Scientists live in *Aquarius* during ten-day missions using saturation diving to study and explore the coastal ocean. *Aquarius* is owned by NOAA and is operated by the National Undersea Research Center at the University of North Carolina at Wilmington



The *Aquarius*, an underwater ocean laboratory located in the NOAA Florida Keys National Marine Sanctuary. (Photo: NOAA/OAR National Undersea Research Program)

in adnot. - in an annotation (*in adnotatio*)

in hospite - within the host

in litt. - in correspondence or communicated in writing; used for an unpublished source of information (*in litteris*)

in situ hybridization - a method of detecting the presence of specific nucleic acid sequences within a cytological preparation. A DNA or RNA probe is labeled, radioactively or chemically, and hybridized to a cytological preparation to detect RNA, or to a denatured cytological preparation to detect complementary DNA. The hybridization is detected by autoradiography (for radioactive probes) or by chromogenic reactions or fluorescence (for chemically-labeled probes)

in syn. - in synonymy (*in synonymis*)

in vitro - a laboratory experiment or study performed outside the body of a living organism in a test tube, petri dish, or other vessel

in vivo - studies conducted in intact living organisms or cells

inc. sed. - of uncertain taxonomic position or affinities (*incertae sedis*)

nomen illegitimum - in taxonomy, an illegitimate name; a validly published name that must be rejected for the purposes of priority in accordance with the International Code of Zoological Nomenclature

nomen negatum - in taxonomy, a denied name: an unavailable name which has incorrect original spellings as defined by the International Code of Zoological Nomenclature

nomen novum - in taxonomy, a new name which is published to replace an earlier name (and valid only if the latter is preoccupied) and which is expressly proposed as a replacement name; a new name, not to be confused with a new species, or a new genus, etc., which represent new taxa. It is commonly applied to names proposed to replace junior homonyms

nomen nudum - in taxonomy, a naked name, i.e., a name that, if published before 1931, was not accompanied by a description, definition, or indication, or if published after 1930, is not accompanied by a statement that purports to give characters differentiating the taxon; or is not accompanied by a definite bibliographic reference to such a statement; or is not proposed expressly as a replacement for a pre-existing available name. A *nomen nudum* is not an available name

nomen nullum - in taxonomy, a null name, i.e., an unavailable name which, as defined by the International Code of Zoological Nomenclature, is a non-demonstrably intentional change of an original spelling, i.e. a form of incorrect subsequent spelling

nomen oblitum - in taxonomy, a forgotten name; an unused senior synonym rejected under the provisions of the International Code of Zoological Nomenclature

nomen vetitum - in taxonomy, an impermissible name; an unavailable name published for divisions of the genus group other than genus and subgenus, which are not accepted by the International Code of Zoological Nomenclature

q. v. - which see (*quod vide*)

q.e. - which is (*quod est*)

sens. lat. - in the broad sense (*sensu lato*)

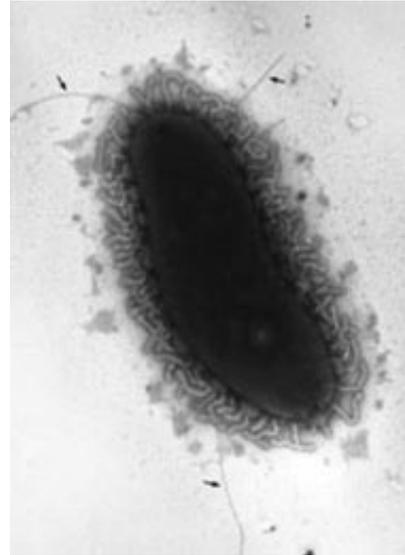
t. c. - in the volume cited (*tomus citate*)

t. - according to; on the evidence of (*teste*)

tom. - volume (*tomus*)

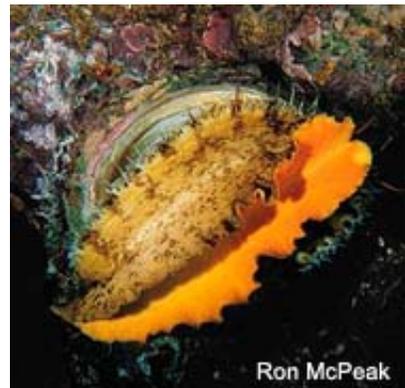
v. et. - see also (*vide etiam*)

Vibrio - a genus of motile, gram-negative, rod-shaped bacteria characterized by short, slightly sinuous filaments and an undulatory motion. Some species in this genus cause cholera in humans and other diseases in other animals, including corals



Vibrio vulnificus pili, a bacterium normally found in temperate estuarine waters, and as a colonizer of molluscan shellfish, such as oysters. (Photo: NOAA Northwest Fisheries Science Center)

abalone - a univalve mollusk (class Gastropoda) of the genus *Haliotis*. Abalones are harvested commercially for food consumption. The shell is lined with mother-of-pearl and used for commercial (ornamental) purposes



Sea otters are in direct competition with humans for abalone. (Photo: Ron McPeak)

abatement - reducing the degree or intensity of, or eliminating

abaxial - away from, or distant from the axis

abdomen - in higher animals, the portion of the body that contains the intestines and other viscera other than the lungs and heart; in arthropods, the rearmost segment of the body, which contains part of the digestive tract and all the reproductive organs



The ventral surface of the abdomen of an American lobster. Prominent are the swimmerettes, uropods, and telson.

abdominal fin - a term used to describe the location of the pelvic (ventral) fins when they are inserted far behind pectorals. This is the more primitive condition. More recently evolved conditions have the pelvic fins in the thoracic or jugular positions. A salmon, for example, has its pelvic fins in the abdominal position. An angelfish has the pelvic fins in the thoracic position, and blennies have the pelvic fins in the jugular position, anterior to the pelvic girdle

abductor - a type of muscle whose function is to move an appendage or body part away from the body of an animal. Abductors work antagonistically with adductors

abiogenic - refers to things not involved with or produced by living organisms

abiotic - refers to nonliving objects, substances or processes

ablation - the experimental removal or killing of some part of an organism

abnormal - not normal; contrary to the usual structure, position, behavior or rule

aboral - situated opposite to, or away from the mouth; normally used to describe radially symmetrical animals, such as starfishes, sea urchins, and jellyfishes



Spines protect the aboral surface of a sea urchin. (Photo: NOAA)

abraded - worn or frayed

abbranchiate - lacking gills

abrasion - the mechanical process of gradually breaking down a hard layer

absolute zero - the temperature at which all motion will cease (0 degrees Kelvin or -273.15 degrees C)

absorption - the biological process that follows digestion, by which the products of digestion are transferred into the organism's internal environment, enabling them to reach the cells

absorptive feeder - an animal, such as a parasitic tapeworm, that absorbs digested food products through the body wall



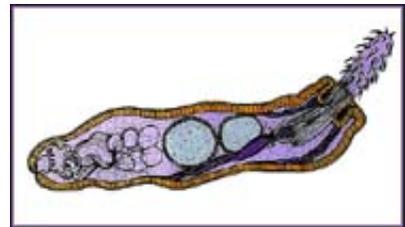
A parasitic tapeworm is an absorptive feeder. The narrowest point is the "head" or scolex which attaches the parasite to the intestinal lining by means of suckers and/or little hooks. Predigested nutrients are absorbed through the wall of each of the progressively larger segments. These animals have no digestive canal. (Photo: HHS/Centers for Disease Control and Prevention)

Acanthaster - the Crown-of-Thorns starfish genus.
Acanthaster planci is a voracious Indo-Pacific predator of corals



Crown-of-Thorns starfish (*Acanthaster sp.*), a voracious predator of corals.

acantho- - a prefix meaning "with spines"



The phylum Acanthocephala contains about 1,000 species of spiny-headed worms. All are endoparasites in the intestinal tract of vertebrates, especially fishes. (Image: Dr. Rick Gillis, Biol. Dept., Univ. of Wisconsin)

acanthocaulus - a juvenile coral of some species that is attached to the substrate either directly or on a stalk

acaudal - lacking a tail

accessory pigment - a photosynthetic pigment which absorbs light and transfers energy to chlorophylls during photosynthesis

acclimation (acclimatization) - a change that occurs in an organism to allow it to tolerate a new environment

accretion - growth by virtue of an increase in intercellular material

accuracy - the closeness by which a set of measurements approaches the true value

acellular - describes the construction of an organism or tissue that is a mass of protoplasm which is not divided into cells, e.g., some structural parts of slime molds and fungi

aciculate - needle-like or having needle-like parts

acid - a substance that increases the hydrogen ion concentration in a solution

acid rain - the precipitation of sulfuric acid and other acids as rain. The acids form when sulfur dioxide and nitrogen oxides released during the combustion of fossil fuels combine with water and oxygen in the atmosphere

acidic - having a pH of less than 7

acoelomate - an animal that does not have a true coelom or body cavity, i.e., a body cavity between the outer wall and the gut and lined with mesoderm. Acoelomate phyla include the flatworms (Platyhelminthes), ribbonworms (Nemertea), and jaw worms (Gnathostomulida)



Acoelomate flatworms such as this *Pseudoceros sp.* lack a coelom (body cavity). (Photo: Adam Petrusek)

acolonial coral - a solitary coral that does not form a colony

acantium - a thread-like part of a coral polyp's or anemone's digestive system and employed as defensive or aggressive structures when extruded

acoustic scattering - the irregular reflection, refraction, or diffraction of a sound in many directions

acoustic tag - a sound transmitter attached to an aquatic animal to track its movements



Radio tag (anterior) and acoustic tag (posterior) attached to a loggerhead turtle. (Photo: ALan Rees/ARCHELON)

acquired - developed in response to the environment, not inherited, such as a character trait resulting from environmental effects (acquired characteristic)

acquired character - a non-inherited character, of function or structure, developed in an organism as a result of environmental influences during the individual's life

Acropora - a genus of hard (stony) corals that contain the elkhorn and staghorn corals



Staghorn coral (*Acropora* sp.).

acrorhagus - a sac, covered with nematocysts, that protrudes from below the sweeper tentacles or on the column of certain anthozoans

acrosome - a protrusion on the anterior end of a sperm cell that contains digestive enzymes that enables the sperm cell to penetrate the layers around the oocyte (ovum)

actinophore - a pterygiophore and its associated fin ray

Actinopterygii - a class of bony fishes comprising the ray-finned fishes, which make up about half of all vertebrate species known. They are found in most aquatic habitats from the abyssal depths of the ocean, greater than 10,000 m, to high altitude freshwater streams and ponds; a few species can even move about on land for short periods of time. Ray-finned fishes constitute a major human food source



This squirrel fish is a member of the class Actinopterygii, the ray-finned fishes. Note the hard and soft rays in its fins.

actinotroch - a larval form found in the Phoronida (horseshoe worms)

action potential - the electrical signal which rapidly propagates along the membrane of the axon of nerve cells, as well as over the surface of some muscle and glandular cells. It is caused by change in membrane electrical potential, the underlying cause of which is a change in flow of ions across the membrane due to voltage-activated ion channels. It leads to an all-or-nothing action current, the nervous impulse

activator - a substance or physical agent that stimulates transcription of a specific gene or operon

active site - a specific region of an enzyme where a substrate binds and catalysis takes place

active transport - the pumping of molecules or ions through a membrane against their concentration gradient. This action requires the expenditure of energy through ATP hydrolysis

aculeate - bearing a sharp point

aculeiform - having a sharp point; needle-shaped

acuminate - a shape which gradually tapers to a point



The fierasfer, *Carapus bermudensis*, possess an acuminate shape. The tapered end allows the fish to retreat tail first, for protection, into the digestive canal of a sea cucumber when threatened. (Photo: D. Flescher, NOAA/National Marine Fisheries Service)

acute - sudden or brief

adaptation - changes in gene frequencies resulting from selective pressures being placed upon a population by environmental factors. This results in a greater fitness of the population to its ecological niche

adaptive behavior - any behavior that enables an organism to adjust to a particular situation or environment

adaptive radiation - the evolution of a single evolutionary stock into a number of different species

adaptive value - the degree to which a characteristic helps an organism to survive and reproduce, or affords greater fitness in its environment

adductor - a type of muscle whose function is to pull an appendage or body part inwards, towards the body of an animal

adenine - one of the four nitrogenous bases in DNA that make up the letters ATGC. Adenine is the "A". The others are guanine, cytosine, and thymine. Adenine always pairs with thymine

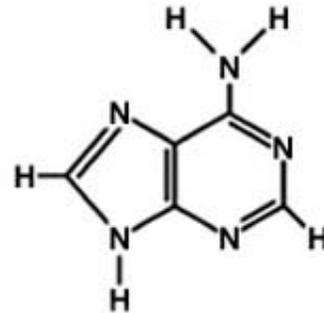


Diagram of the chemical structure of adenine, one of the four nitrogenous bases in DNA.

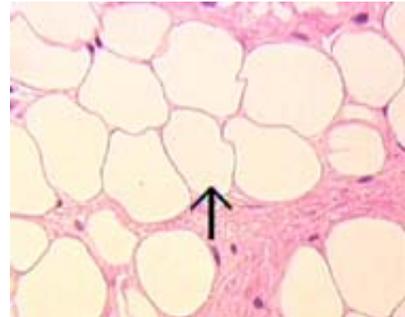
adenosine triphosphate (ATP) - a nucleoside triphosphate, ATP is the predominant supplier of metabolic energy in living cells. ATP supplies the chemical energy to drive endergonic reactions (requiring work or the expenditure of energy), perform mechanical work, provide heat and even produce bioluminescence

adenovirus - a group of DNA-containing viruses which cause diseases in animals. In humans, they produce acute respiratory tract infections with symptoms resembling the common cold. They are used in gene cloning, as vectors for expressing large amounts of recombinant proteins in animal cells. They are also used to make live-virus vaccines against more dangerous pathogens

adhesion - the molecular force of attraction between two unlike materials that acts to hold them together

adhesive egg - an egg which adheres on contact to a substrate or to other eggs

adipocyte - a fat cell



Adipose tissue. The large empty looking structures are adipocytes (fat cells). (Photo: University of Saskatuwan Biology Dept.)

adipose fin - in fishes, a small fleshy fin which lacks fin rays. It is found in fishes such as salmon, and most catfishes



The adipose fin of this chum salmon lies between the dorsal and caudal fins. (Image: U.S. Fish and Wildlife Service)

addressed - pressed close to or lying flat against something; apressed

adradial canal - one of eight non-branched ciliated canals which originates from the gastric pouches of scyphozoan medusae. The flow of digested food materials is toward the ring canal

adult - a fully developed and sexually mature animal, physically capable of reproducing under appropriate physiological, ecological and sociobiological conditions



An adult Nassau grouper. It is sexually mature and capable of reproducing.

advanced - new, unlike the evolutionary ancestral or primitive condition

adventitious root - a root that originates from any part of the plant other than the root system

aerenchyma - a specialized parenchymous tissue in seagrass leaves that has regularly arranged air spaces or lacunae. These internal air spaces serve for flotation and exchange of gasses

aerial photography - photographs taken from an aircraft or satellite utilized to interpret environmental conditions and geographic features

aerobic - deriving energy from a process requiring free oxygen

aerobic respiration - a form of respiration in which molecular oxygen is consumed and carbon dioxide and water are produced

aesthete - unique to chitons (Polyplacophora -Mollusca), aesthetes are photosensitive mantle cells, present in very high densities. Although they are involved in light responses, their exact function is unknown

agar - a gelatinous material extracted from the walls of some red algae, mainly species of *Gelidium* and *Gracilaria*. Agar is used as a support medium, when supplemented by appropriate buffers and/or nutrients and other ingredients, for cultures of microorganisms and tissues, electrophoresis, etc

age class - a group of individuals of a species all of the same age

age distribution - the frequency of different ages or age groups in a given population

age structure - the relative proportion of individuals in each age group in a population

aggregate - a group of species, other than a subgenus, within a genus, or a group of subspecies within a species. An aggregate may be denoted by a group name

aggregate - a collection of units or particles forming a body or mass (noun); to form such a body or mass (verb)

aggressive mimicry - a type of mimicry which results in a deceived species being preyed upon or parasitized by a predator species. The mimic's cues may be visual, auditory, olfactory or behavioral

Agnatha - agnathans are the most primitive and ancient of the vertebrates. As the name "Agnatha" implies, they lack jaws. Paired fins are also generally absent, and the adult retains the notochord. The skeleton is cartilaginous. The agnathans include the lampreys and hagfishes



The mouth of a jawless agnathan, the sea lamprey. Adults feed by attaching themselves to their prey, rasping a hole in the skin, and consuming blood and body fluids. (Photo: Minnesota Sea Grant)

agonistic behavior - aggressive, negative behaviors, such as fighting, threatening, and fleeing

agricultural pollution - the liquid and solid wastes from all types of farming, including runoff from pesticides, fertilizers and feedlots; erosion and dust from plowing, animal manure, carcasses, crop residues and debris

AGRRA (Atlantic and Gulf Rapid Reef Assessment) - an international collaboration of scientists and managers aimed at determining the regional condition of reefs in the Western Atlantic and Gulf of Mexico

Agulhas ring - large pulses of warm and salty water of Indian Ocean origin which enter the Atlantic Ocean directly south of the Cape of Good Hope in the form of anticyclonic eddies. The process of ring detachment is associated with perturbations of the Agulhas Current that retroflects south of Africa

ahermatypic coral - a coral that lacks zooxanthellae and does not build reefs

AIMS (Australian Institute of Marine Science) - the Australian Institute of Marine Science (AIMS) was established by the Commonwealth government in 1972 to generate and transfer the knowledge needed for the sustainable use and protection of the marine environment through innovative, world-class scientific and technological research. It is a federally-funded and independent statutory authority governed by a Council appointed by the Australian government. AIMS has its headquarters at Cape Ferguson, 25km east of Townsville in North Queensland



AIMS field operations jetty at Cape Ferguson. (Photo: AIMS)

air bladder - an air sac located in the coelomic cavity of many fishes. In some fishes it may retain a tubular connection with the pharynx or esophagus; also known as a gas bladder or swim bladder, it functions variously as a hydrostatic organ, a sound conductor, a sound production organ, and in respiration. It is absent in sharks and rays, and some bony fishes

air compressor - an apparatus that compresses or pressurizes air for scuba tanks. Air is compressed from the atmospheric level (14.7 psi at sea level) to the capacity of the tank, which is generally between 2500-3000 psi

alate - winged

albedo - the ratio of the amount of light reflected by an object and the amount light falling on it (incident light); a measure of the reflectivity or intrinsic brightness of an object (a white, perfectly reflecting surface would have an albedo of 1.0; a black perfectly absorbing surface would have an albedo of 0.0)

albinism - hereditary absence of pigment in an organism. Albino animals have no color in their skin, scales, hairs and eyes. The term is also used for absence of chlorophyll in plants. Some organisms exhibit partial albinism. White tigers, for example, possess black stripes on a white background



An albino catfish. The fish's skin cells contain no dark melanin granules.

alcohol - any of a class of organic compounds in which one or more hydroxyl groups are attached to a carbon compound

alcyonarian - a soft coral of the order Alcyonacea, class Anthozoa, phylum Cnidaria. They consist of a firm body, throughout which calcareous spicules are dispersed. The surface is studded with polyps. They are closely related to the scleractinian (hard or stony) corals but lack the rigid, stony exoskeleton



Alcyonarians are colonial soft corals that lack the CaCO_3 exoskeleton of the hard or stony corals. An endoskeleton of calcareous spicules provide support for the body, which is studded with polyps.

alecithal - a type of egg that does not contain yolk

Alee effect - the social dysfunction and failure to mate successfully when population density falls below a certain threshold

algae - unicellular, multicellular, solitary, or colonial organisms that contain chlorophyll. They lack roots, stems, leaves, flowers, and seeds. Algae are in the Kingdom Protista

algaecide - a chemical agent specifically designed and used to kill or inhibit the growth of algae; also called 'algicide'

algaestat - a chemical agent which retards and prevents the reproduction and growth of algae

algal bloom - a sudden spurt of algal growth that can indicate potentially hazardous changes in local water chemistry

algal galls - a response of gorgonia (*Pseudoplexaura spp.*) to tissue invasion by the algae, *Entocladia endozoica*, in Florida and Caribbean waters. The host gorgonia react to the algal filaments by producing capsules (galls) composed of skeletal elements that isolate the algae from the host tissue, at the expense of the skeletons' tensile strength and elasticity. The gorgonium readily breaks apart at the sites of the weakened skeleton. For more information and illustrations, see: http://www.coral.noaa.gov/coral_disease/algal_galls.shtml

algal reef - a reef, usually exposed to wave action, composed of coralline algae and vermatid gastropods. The coralline algae occur in forms of cups or funnels



Coralline algae makes up part of an algal reef.

algal ridge - a low ridge at the seaward margin of a reef flat, largely composed of skeletons of calcareous algae. A synonym of **Lithothamnion ridge**

algal turf - densely packed algae, usually filamentous, which rise less than one centimeter above the substratum upon which they are growing. A synonym of turf algae

algin - a polysaccharide derived from brown algae. Algins are used for many industrial processes

alien species - a species which does not naturally occur within an area and which has usually arrived as a result of deliberate or accidental human intervention. Alien species often have adverse effects on native species as a result of competition

alimentary canal - the canal, including the stomach and intestines, leading from the mouth to the anus

alkaline - having a pH of more than 7. Alkaline solutions are also said to be basic

All Islands Coral Reef Initiative - a cooperative effort among Hawaii, American Samoa, Guam, the Commonwealth of the Northern Mariana Islands, Puerto Rico, and the U.S. Virgin Islands to improve the management of coral reefs in island areas

all-or-none law - an action that occurs either completely or not at all, such as the generation of an action potential by a neuron, or the contraction of a muscle cell

allantois - a vascularized extra-embryonic membrane of amniote embryos that forms as a narrow outgrowth of the hind portion of the gut. In birds and reptiles, it stores waste products of embryonic metabolism. The allantois fuses with the chorion to form the chorio-allantoic membrane in birds and reptiles, and a part of the placenta in mammals

allele - one of the variant forms of a gene at a particular locus, or location, on a chromosome. Different alleles produce variation in inherited characteristics. In an individual, one form of the allele (the dominant one) may be expressed more than another form (the recessive one)

allelochemical - a chemical substance produced by one organism that is toxic or inhibitory to the growth or well being of another

allelopathic substance - a substance produced by one organism that adversely affects another organism

allelopathy - a particular form of amensalism found in plants. In this interaction, one species produces and releases chemical substances that inhibit the growth of another species

allergen - an antigen that provokes an immune response

allochthonous population - an organism or a population of organisms foreign to a given ecosystem; they have arrived from elsewhere

allograft - a piece of tissue or an organ transferred from one individual to another individual of the same species

allometric growth - type of differential growth in which parts of the same organism grow at different rates. For example, in humans, the head and body grow at different rates, resulting in a human adult with completely different proportions from those of an infant

alloparent - an animal which exhibits parental behavior towards another animal's offspring

allopatric speciation - the evolution of a new species because of the isolation of a small group of individuals from the other members of a population

allopatric species - species occupying mutually exclusive geographical areas

allopolyploid - a type of polyploid species resulting from two different species interbreeding and combining their chromosomes

allotopic - refers to species with overlapping ranges but do not occupy the same space. They do not "live together"

allotype - in taxonomy, a paratype of the opposite sex to the holotype

alluvial - relating to mud and/or sand deposited by flowing water

alluvium - sediments deposited by erosional processes, usually by streams

almost atoll - an atoll whose rim is less than 75 percent complete as a circle at low tide

alpha particle - a particle emitted from the nucleus of an atom, containing two protons and two neutrons, identical to the nucleus (without the electrons) of a helium atom

alternation of generations - a life cycle in which a multicellular diploid stage is followed by a haploid stage, and so on; found in land plants and many algae and fungi

alternative hypothesis - in statistics, the hypothesis that is adopted when the null hypothesis is rejected

altimetry - a technique to measure the height of the sea surface from radar pulses transmitted from a satellite



Artist's rendition of a satellite measuring altimetry.

altruism - a form of behavior in which an individual risks lowering its fitness for the benefit of another; in evolutionary biology, an organism is said to behave altruistically when its behavior benefits other organisms, at a cost to itself. The costs and benefits are measured in terms of reproductive fitness, or expected number of offspring

alveolus - one of thousands of tiny air sacs at the end of the bronchioles in lungs. Alveoli are the sites of gaseous exchange between the atmosphere and the blood. Oxygen passes into the lung capillaries and CO₂ passes from the capillaries into the lungs and is exhaled

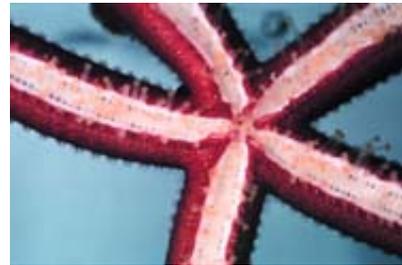
ambient noise - acoustic signals originating from a variety of underwater sources, such as propeller cavitation, engine noises, animal sounds, wind, waves, and rain



The sounds produced by the spotted boxfish, *Ostracion meleagris*, contribute to the ambient noise on Pacific reefs. (Photo: Hawai'i Coral Reef network)

ambient pressure - the pressure surrounding an organism. On land, it results from the weight of the atmosphere. At depth, it comes from the weight of the water plus the weight of the atmosphere

ambulacrum - a row of tube feet of an echinoderm



The ray of a starfish revealing the ambulacral groove and tube feet.

ambush predator - a predator that hides and waits for prey to pass in close proximity rather than actively hunting for it

amensalism - a type of symbiosis where two (or more) organisms from different species live in close proximity to one another, and where one of the members suffers as a result of the relationship while the other is unaffected by it

amino acid - the building block of a protein. Twenty different amino acids are used to synthesize proteins. The shape and other properties of each protein is dictated by its precise sequence of amino acids. Humans must include adequate amounts of 9 of the 20 amino acids in their diet. These "essential" amino acids cannot be synthesized from other precursors

amino acid sequence - the order of amino acids as they occur in a polypeptide chain. This is referred to as the 'primary structure' of proteins

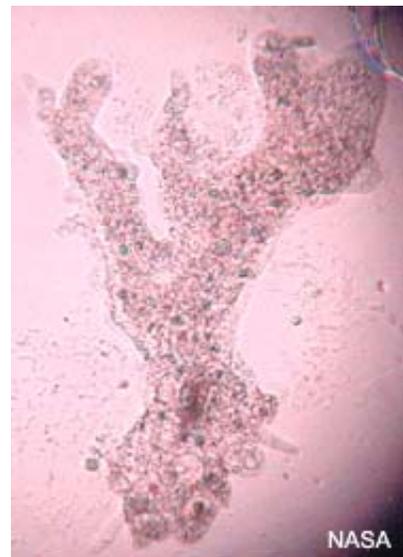
amino group - a nitrogen atom single-bonded to two hydrogen atoms (-NH_2); imparts basic properties to an amino acid

amitosis - an unusual form of cell division in which the nucleus cleaves without change in its component structure (such as the formation of chromosomes), followed by the division of the cytoplasm. Amitosis may occur chiefly in highly specialized cells which are incapable of long-continued multiplication, in transitory structures, and in early stages of degeneration

amnion - a non-vascular extra-embryonic membrane of amniote embryos that forms a fluid-filled cavity surrounding the embryo. It protects the embryo by functioning as a shock absorber

amniote - a vertebrate whose embryo is surrounded by a fluid-filled sac, the amnion; characteristic of reptiles, birds, and mammals

amoeba - a-naked freshwater or marine protozoan protist that forms temporary pseudopodia for food and water capture, and locomotion -



An amoeba thrusting out pseudopodia (false feet). (Photo: NASA)

amoebocyte - a phagocytic cell found circulating in the body cavity of coelomates, particularly annelids and mollusks, or crawling by amoeboid movement through the interstitial spaces of sponges; an amoeboid cell in sponges that transports nutrients and is found in the matrix between the epidermal and collar cells; any cell having the shape or properties of an amoeba

amoeboid - amoeba-like

amoeboid movement - a type of motility of a cell in which cytoplasmic streaming (directional flow of cytoplasm) extrudes outward of the cell to form pseudopodia (false feet) so that the cell can change its location

Amphibia - a class of vertebrates that consists of frogs, toads, newts, salamanders, and caecilians. These organisms live at the land/water interface and spend most of their life cycle in water. With exception of some tree frogs, all must reproduce in water or otherwise moist conditions. Amphibians are not typically marine



The African Bullfrog, *Pyxicephalus adspersus*. This amphibian is an inhabitant of Namibia. (Photo: Copyright Miguel Vences and Frank Glaw, 1998)

amphiblastula - a sponge larva that appears as a hollow ball with anterior flagellated cells and posterior larger and nonflagellated cells (megascleres)



Amphiblastula larva of a sponge. (Photo: Copyright BIODIDAC)

amphidiploid - an allopolyploid; an organism produced by hybridization of two species followed by chromosome doubling

amphimixis - sexual reproduction involving the fusion of male and female gametes and the formation of a zygote

amphipathic - refers to molecules with both hydrophobic and hydrophilic regions. Proteins and lipids may be amphipathic

amplification - in genomics, the process of increasing the number of copies of a particular gene or chromosomal sequence

ampulla - a membranous vesicle

ampullae of Lorenzini - small vesicles and pores around the head of a shark that form part of an extensive subcutaneous sensory network system that detects weak magnetic fields produced by other fishes, at least over short ranges. This enables the shark to locate prey that are buried in the sand, or orient to nearby movement. The ampullae may also allow the shark to detect changes in water temperature



The ampullae of Lorenzini are small vesicles and pores that form part of a subcutaneous sensory network of sharks. These vesicles and pores are found around the head of the shark and are visible to the naked eye. They appear as dark spots in this photograph of a porbeagle shark head. (Photo: Dr. Steven Campana, Bedford Institute of Oceanography)

anabolism - the metabolic processes that consumes energy and involve the synthesis of larger, complex molecules from simpler ones

anadromous species - a species that spends its adult life in the ocean but swims upriver to freshwater spawning grounds in order to reproduce, e.g., Pacific salmon



The chinook salmon is an anadromous fish which spends most of its life in the ocean, but returns to fresh water streams for spawning

anaerobe - an organism that can live in the absence of oxygen

anaerobic - deriving energy from a process that does not require free oxygen

anagenesis - the evolutionary process whereby one species evolves into another without any splitting of the phylogenetic tree

anal fin - the single fin situated on the ventral midline of a fish, behind the anus, and anterior to the caudal fin



Anal fin of a bony fish. (Photo: John Lyons, University of Wisconsin)

analogous structure - a body part that serves the same function in different organisms, but differs in structure and embryological development, e.g., the wing of an insect and a bird

analysis of covariance - an analysis of variance in which the data are adjusted or controlled for the presence of one or more other variables

analysis of variance - a statistical technique for testing for differences in the means of several data populations

anamniote - an aquatic vertebrate whose embryonic stage is not surrounded by an amnion. Fishes and amphibians are anamniotes



Fish eggs and larvae. These aquatic vertebrates do not possess an amnion during embryonic development. (Photo: NOAA/National Marine Fisheries Service)

anastomose - a term that refers to coral branches which grow back together after the initial division

anastomosis - the union or connecting of branches forming a meshwork or a network

ancestor - any organism, population, or species from which some other organism, population, or species is descended

ancestral - in evolution, a trait that has been inherited unchanged from an ancestor

ancestral trait - a trait shared by a group of organisms as a result of descent from a common ancestor

ancestrula - the first (parental) zooid of a bryozoan colony, formed from a settled and metamorphosed larva. It is often smaller and morphologically distinct from the zooids that bud from it

androgen - a principal male steroid hormone, such as testosterone, which stimulates the development and maintenance of the male reproductive system and secondary male sexual characteristics

androgenesis - male parthenogenesis, i.e., the development of a haploid embryo from a male nucleus. The maternal nucleus is eliminated or inactivated subsequent to fertilization of the ovum, and the haploid individual (referred to as androgenetic) contains the genome of the male gamete only in its cells

anemone - a cnidarian of the class Anthozoa that possesses a flexible cylindrical body and a central mouth surrounded by tentacles



A sea anemone of the Phylum Cnidaria, Class Anthozoa. The tentacles bear stinging cells which are used for food capture and defense.

aneuploidy - the condition of having an abnormal number of chromosomes; a chromosome number that is not an exact multiple of the haploid number

angler - a person catching fish or shell fish with no intent to sell; includes people releasing the catch



A skiff, a guide, and an angler fishing for bonefish in Florida. (Photo: Bonefish and Tarpon Unlimited)

angstrom - a unit of length equal to one ten-thousandth of a micron (10^{-4} micron) or 10^{-10} of a meter

animal hemisphere - the half of an oocyte or egg which contains less yolk, or the corresponding half of an early embryo with the more actively dividing cells

animal pole - the pole of a spherical oocyte or egg that is closest to the nucleus and contains most of the cytoplasm. The opposite pole is the vegetal pole, which, depending upon the type of egg, contains most of the nutritive or yolk granules. There is a graded distribution of cytoplasm and yolk along an axis between the poles that passes through the nucleus. After the fertilized egg undergoes cleavage and develops into a blastula, the same "geographic" points or reference are used

Animalia - the kingdom of multicellular heterotrophic eukaryotes that are capable of motility during some stage of their life history

animated GIF (Graphics Interchange Format) file - a graphic image on a Web page that moves

anisogamous - characterized by reproducing by the fusion of gametes that differ only in size, as opposed to gametes that are produced by oogamous species. Gametes of oogamous species, such as egg and sperm cells, are highly differentiated

ankylose - to fuse together

anneal - the pairing of complementary DNA or RNA sequences, via hydrogen bonding, to form a double-stranded polynucleotide. It is most often used to describe the binding of a short primer or probe

Annelida - an animal phylum that comprises the segmented worms, and includes earthworms, leeches, and a number of marine and freshwater species



A marine segmented worm of the phylum Annelida.

Annual Composite HotSpot map - a map that composites all of the average monthly HotSpot (see HotSpot) images for a given year

annular - ring-shaped

anomaly - the deviation of a particular variable (e.g., temperature) from the mean or normal over a specified time

anonymous work - according to the International Code of Zoological Nomenclature, a published work that does not state the name of the author(s)

anoxic - the absence of free oxygen

antenna - one of the paired, flexible, and jointed sensory appendages on the head of a crustacean, an insect, or a myriapod (e.g., a centipede)



A spiny lobster displaying its paired uniramous antennae and biramous antennules. (Photo: Copyright Corel Corporation)

antennal gland - the main organ in crustaceans used for excretion and osmoregulation; the green gland

antennule - a small antenna, especially the first pair of antennae in crustaceans

anterior - morphologically, toward the head or front end of an individual, or proximal portion of a bodily part



Close up of the anterior end of a spotlight parrotfish supermale.

anthocaulus - a polyp that develops asexually on the skeletons of some coral species

anthocodium - the free oral end of an anthozoan polyp, the basal portion of which is united with other zooids in a common mass. It is a site of bioluminescence in some anthozoans

anthostele - the lower part of a cnidarian polyp, into which the distal portion of the polyp, the anthocodium (which includes the mouth and the tentacles) is withdrawn

Anthozoa - a class of Cnidaria that includes the stony corals, soft corals, sea anemones, gorgonians, and corallimorpharians



A deep-sea anemone photographed by the *Alvin 2001* during a survey of Blake Ridge off the U.S. Georgia coast (Deep East expedition).

anthropogenic - made by people or resulting from human activities

anthropomorphism - attributing a human characteristic to an inanimate object or a non-human species

anti-codon - a triplet of nucleotide bases (codon) in tRNA (transfer RNA) that pairs with (is complementary to) a triplet in mRNA (messenger RNA). For example, if the codon is UCG, the anticodon is AGC

antibiosis - the inhibition of growth of a microorganism by a substance produced by another microorganism

antibiotic - a chemical substance, e.g., penicillin, that kills or inhibits the growth of bacteria

antibody - a protein produced by higher animals in response to the presence of a specific antigen

antigen - a foreign macromolecule introduced into a host organism that elicits an immune response

antinutrient - a compounds that inhibits the normal uptake of nutrients

antioxidant - a molecule that is capable of reacting with free radicals and neutralizing them; a compound that slows the rate of oxidation reactions

Antipatharia - an order of corals which contains the black and horny corals



Black coral in the order Antipatharia.

antisense DNA - the strand of chromosomal DNA that is transcribed; a DNA sequence that is complementary to all or part of an mRNA molecule

anus - the posterior opening of the digestive tract, through which waste products of digestion are released

apex - the tip, top, point, or angular summit of anything

apex predator - an organism at the top of the food chain, relying on smaller organisms for food



This large blue shark is an apex predator in the ocean. (Photo: Greg Skomal, NOAA/NOS National Marine Sanctuaries)

aphotic zone - that portion of the ocean where light is insufficient for plants to carry on photosynthesis

apical - relating to or located at the tip (an apex)

Aplacophora - a class of Mollusca. They are a small group (less than 300 species) of wormlike mollusks that lack a shell. Some are associated with soft corals. Creeping species feed on cnidarians. Burrowing species are deposit feeders and carnivores

apobiosis - the local death of a part of an organism

apode fish - a fish which lacks pelvic (ventral) fins, such as the American or European eel

apomixis - the asexual production of diploid offspring without the fusion of gametes. The embryo develops by mitotic division of the maternal or paternal gamete, or in the case of plants, by mitotic division of a diploid cell of the ovule

apomorph - a derived character differing from the ancestral condition

apomorphy - a relatively derived or advanced or unique character state

apopinacocyte - in sponges, an endopinacocyte lining the excurrent canal

apopinacoderm - in sponges, a surface lined with apopinacocytes

apopyle - the opening of a choanocyte chamber of a sponge into an excurrent canal

aposematism - conspicuous warning coloration



A venomous lionfish (*Pterois volitans*) with conspicuous coloration. (Photo: Copyright Corel Corporation)

appendage - any body part that extends from the main axis or trunk or cephalized portion of an organism

appendicular - relating to the appendages, as opposed to axial, which refers to the trunk and head of an organism

apron reef - the initial stage of a fringing reef. It is discontinuous and covers a small area

aquarist - a hobblist or professional that keeps organisms in an aquarium

aqueous solution - a solution in which water is the solvent

aquifer - a subterranean layer of porous water-bearing rock, gravel, or sand capable of storing and conveying water to wells and streams

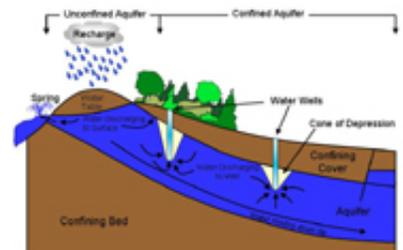


Diagram of an aquifer system. (Diagram: Texas A&M Univ.)

aquiferous system - water circulatory system in sponges composed of choanoderm, pores and chambers

aragonite - a mineral species of calcium carbonate (CaCO_3) with a crystal structure different from the other two forms of CaCO_3 (vaterite and calcite). It is precipitated from ocean surface waters mainly by organisms (e.g., coral) that use it to make their shells and skeletons

aragonite skeleton - skeletons primarily composed of the aragonite form of calcium carbonate

arborescent - having a large tree-like appearance

arborescent colony - a coral colony with a tree-like growth structure

arch- - a prefix meaning 'ultimate beginning'

Archaea - a group of organisms that resemble bacteria. However, these organisms are biochemically and genetically different from bacteria. Some species live in the most extreme environments found on Earth

Archaeobacteria - an ancient group of prokaryotes, over 3.5 billion years old; sometimes this group is placed into a separate kingdom, the Archaea. Most biologists currently place it within the Kingdom Monera. Archaeobacteria inhabit extreme environments

archaeocyte - in sponges, an amoeboid cell capable of phagocytosis. Archaeocytes are totipotent, having the capability of differentiating into other types of sponge cells

archenteron - the primitive endoderm-lined gut of an animal embryo formed during gastrulation. It is formed by the invagination of blastula cells (blastomeres) into the blastocoel. The archenteron develops into the digestive tract of the adult animal

archetype - the plan or fundamental structure on which a group of organisms, or their systems of organs, are assumed to have been constructed; as, for example, the vertebrate archetype

archi- - a prefix meaning primitive, original, or ancestral

arcuate - crescent-shaped

arenaceous - a condition of skeletal architecture in sponges in which sand and/or foreign spicule debris partly or completely replaces native spicules within the sponge skeleton; resembling or containing sand; or growing in sandy areas

Aristotle's lantern - a highly developed chewing apparatus used for feeding in some sea urchins

ARMDES (AIMS Reef Monitoring Data Entry System) adapted database - a data entry and analysis program running on Microsoft Access, which enables users to input data from line transects, manta tows, and fish visual censuses into a standard access database and to carry out basic analysis of the data. It was created by AIMS and is distributed free of charge

arrayed library - in genomics, Individual primary recombinant clones (hosted in phage, cosmid, YAC, or other vector) that are placed in two-dimensional arrays in microtiter dishes. Each primary clone can be identified by the identity of the plate and the clone location (row and column) on that plate. Arrayed libraries of clones can be used for many applications, including screening for a specific gene or genomic region of interest

ARS (autonomous replicating sequence) - any eukaryotic DNA sequence that initiates and supports chromosomal replication; also called autonomous(ly) replicating segment

arterial gas embolism - a hazardous condition for scuba divers that is characterized by air bubbles released from ruptured lung air pockets (alveoli) into the pulmonary circulation. The bubbles then travel to the arterial circulation, where they may block blood flow in the small arteries or capillaries of the brain or heart. The results may be fatal. Arterial gas embolism in divers may be caused by holding one's breath during an ascent, wherein the lungs expand to the danger point

Arthropoda - an animal phylum that contains lobsters, crabs, shrimp, mantis shrimp, barnacles and copepods, fairy shrimp (all crustaceans), insects, centipedes, millipedes, spiders, scorpions, horseshoe crabs, pycnogonids (sea spiders), ticks and mites. Approximately three quarters of a million species are described, many more than all the other animal phyla combined. The crustaceans are the arthropods associated with coral reefs



A spiny lobster (phylum Arthropoda).

articulated - jointed, as in for example, the soft fin rays of fishes

articulating - united by means of a moveable joint

artificial reef - an artificial structure placed on the ocean floor to provide a hard substrate for sea life to colonize. Artificial reefs are constructed by sinking dense materials, such as old ships and barges, concrete ballasted tire units, concrete and steel demolition debris and dredge rock on the sea floor within designated reef sites



These concrete blocks were the first artificial structures deployed to provide a substrate for reestablishing colonies of *Oculina* coral (*Oculina varicosa*) and simulating fish habitat on Oculina Bank (central Florida Atlantic coast), which were destroyed by bottom trawling in the 1990s.

artificial selection - the practice of choosing individuals from a population for reproduction (selective breeding), usually because these individuals possess one or more desirable traits

artisanal fishing - fishing which is typically a small-scale operation that uses simple fishing methods; fishing for subsistence by coastal or ethnic island groups using traditional methods; fishing with the purpose of catching/collecting aquatic products for sale

ascanoid - simplest body form of sponges, with canals leading directly from the surrounding water to the interior spongocoel

ascidian - a solitary or colonial sea squirt of the phylum Chordata, class Ascidiacea. The adult form does not resemble vertebrate chordate animals but the larval stage possesses all basic chordate characteristics. Adult ascidians are sedentary, filter-feeding, cylindrical or globular animals, usually found attached to a substrate. The soft body is surrounded by a thick gelatinous to leathery test, or tunic (which also gives them the name of tunicate), often transparent or translucent. The test is secreted by the body wall of the adult animal. It is composed of cellulose, a carbohydrate unique in the animal kingdom



These adult ascideans (sea squirts) resemble invertebrates, but they are closely related to vertebrates and other members of the phylum Chordata.

ASCII (American Standard Code for Information Interchange) - a set of codes for representing alphanumeric information (e.g., a byte with a value of 77 represents a capital M). Text files, such as those created with the text editor of a computer system, are often referred to as ASCII files

asexual embryogenesis - the sequence of events whereby embryos develop from somatic cells

asexual reproduction - reproduction that does not involve the union of sex cells (gametes) to produce a zygote. Examples in corals are budding and fragmentation

aspergillosis - a widespread fungal infection of Caribbean soft corals. It affects six species of sea fans and sea whips. The pathogen is *Aspergillus sydowii*, a terrestrial fungus which infects gorgonia after germination of spores on the coral surface. This is followed by penetration and spread of hyphae in coral tissue, resulting in highly visible lesions which may be associated with complete loss of tissue and skeleton. Lesions often occur at multiple sites across an infected colony. -Purple galls may be produced by the coral host to encapsulate fungal hyphae. For more information and illustrations, see: http://www.coral.noaa.gov/coral_disease/aspergillosis.shtml

astaxanthin - a carotenoid pigment found in crustaceans. Astaxanthins may give a green color to the musculature of fishes which feed on crustaceans

asymmetric competition - competition between two organisms (or species) in which one is much more adversely affected than the other

ata (atmosphere absolute) - one (1) ata is the atmospheric pressure at sea level

atmosphere - a unit of pressure, abbreviated as *atm*; "one atmosphere" is the pressure of the atmosphere at sea level, i.e., 760 mm Hg. Two atmospheres is twice this pressure, 1520 mm Hg, etc.; the air surrounding the earth, from sea level to outer space

atmospheric pressure - the pressure of the atmosphere at any given altitude or location; it is synonymous with barometric pressure

atoke - the anterior, nonreproductive part of a marine polychaete worm, as distinct from the posterior, reproductive part (epitoke) during the reproductive season

atoll - a horseshoe or circular array of reef islets, capping a coral reef system that encloses a lagoon, and perched around an oceanic volcanic seamount



A small Pacific atoll. Note the coral reef encircling the calm and shallow lagoon.

atom - the smallest component of an element, made up of neutrons, protons, and electrons

ATPase - an enzyme that functions in producing or using adenosine triphosphate (ATP)

atrial siphon - in tunicates, the opening that carries water, wastes, and gametes from the organism. Also called the excurrent or exhalent siphon/canal

atrium - a body cavity; a heart chamber which receives blood

attachment stage - a stage in an animal's life cycle when it ceases being free swimming or motile, and becomes attached to a substrate

attribute - a measurable component of a biological system

auricularia larva - larva of a sea cucumber; an early bipennaria larva of a starfish



Late-stage auricularia of *Stichopus californicus* - ca. 17-18 days old, raised in culture by T.H.J. Gilmour.

austral - relating to or coming from the south; of the south temperate region, between the antarctic and tropical regions

autapomorphy - an apomorphy (derived character differing from the ancestral condition) possessed by a species or clade that is shared with no other species or clade, i.e., a derived character found only in a terminal taxon

autecology - the ecology of a single species

author - in taxonomy, the person(s) to whom a work, a scientific name, or a nomenclatural act is attributed

autochthonous - native; indigenous; originating or occurring naturally in the place specified

autoimmune disease - a disease in which the organism produces antibodies against its own tissues

autoimmunity - a condition in which an organism mounts an immune response against one of its own organs or tissues; i.e., an organism's immune system attacking its own body

autologous cells - cells that are taken from an individual, cultured, and possibly genetically manipulated before being infused back into the original donor

automated bleaching early warning system - automated bleaching alerts/warnings directly from satellite and/or in situ derived indices

autopolyploid - a polyploid formed from the doubling of a single genome

autoradiography - a technique that uses X-ray film to visualize radioactively labeled molecules or fragments of molecules; it is used in analyzing length and number of DNA fragments after they are separated by gel electrophoresis

autosome - any chromosome that is not a sex chromosome; distinguished from a sex chromosome

autotomy - the voluntary shedding of an appendage by snapping it off the base; in corals, some, reproduce asexually by autotomy (fragmentation), for example, *Fungia sp*

autotrophic - relating to organisms that have a type of nutrition in which organic compounds used in metabolism are obtained by synthesis from inorganic compounds

autozooid - a feeding polyp of a bryozoan (Ectoprocta). Autozooids compose the majority of a bryozoan colony

auxotroph - a polyploid formed from the doubling of a single genome

available name - in taxonomy, any name which conforms to all mandatory provisions of the Code. There are general requirements of publication and date, language, name formation etc. An available name is not necessarily a valid name, as an available name may be in synonymy. Conversely a valid name must always be an available one

AVHRR (Advanced Very High Resolution Radiometer)

- a broad-band, four or five channel (depending on the model) scanner, sensing in the visible, near-infrared, and thermal infrared portions of the electromagnetic spectrum. This sensor is carried on NOAA's Polar Orbiting Environmental Satellites (POES). AVHRR is used for studying and monitoring vegetation conditions. Applications include agricultural assessment, land cover mapping, producing image maps of large areas and tracking regional and continental snow cover. AVHRR data are also used to retrieve various geophysical parameters such as sea surface temperatures (SST) and energy budget data



Artist's rendition of POES satellite.

avicularium - a small bryozoan heterozoid in which the zoecium and operculum form a beak-like, snapping structure that deters small predators



A magnified view of an avicularium from the marine colonial bryozoan *Bugula* sp. (Photo: Dr. Rick Gillis, Biol. Dept., Univ. of Wisconsin)

avirulent - unable to cause disease

AVTAS (AIMS Video Transect Analysis System) - video transects are systematically sampled by identifying the benthos occurring at fixed points along the transect to the highest taxonomic level possible. The AVTAS software is used to analyse the video transects. During analysis the data are saved into a Microsoft Access¼ database. In order to eliminate confounding in data analyses due to observer biases, transects from each site are analysed by two observers. The observer who actually surveyed the reef in the field analyses transect one from site one and then every alternate transect. A second observer analyses the remaining transects

axial - refers to the head and trunk of an individual

axial corallite - a corallite which forms the tip of a branch

axial skeleton - in a vertebrate skeleton, the skull, vertebral column, ribs, and sternum

axocoel - the most anterior of three coelomic spaces that appear during larval development of echinoderms

axon - the single motor branch of a neuron that passes the nervous impulse away from the cell body to another neuron or effector organ

axoneme - a bundle of microtubules and other proteins forming the core of each cilium or flagellum

azooxanthellate coral - a coral which does not have symbiotic zooxanthellae in its tissues

bacillus - a bacterium with a rod-like shape

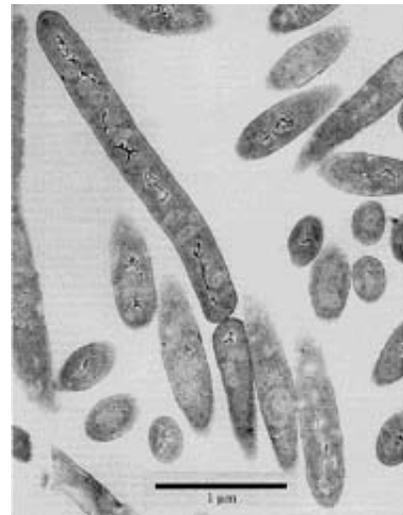


Image of rod-shaped bacterium, *Bacillus infernus*, collected from deep (20-2800 meters) terrestrial subsurface. (Photo: U.S. Dept. of Energy/Subsurface Microbial Culture Collection)

back reef - the shoreward side of a reef, including the area and sediments between the reefcrest/algal ridge and the land. It corresponds to the reef flat and lagoon of a barrier reef and platform margin reef systems



Emergent coral heads in a back reef zone. (Photo: Great Barrier Reef Marine Park Authority)

backcross - crossing an organism with one of its parents, or with the genetically equivalent organism. The offspring of such a cross are referred to as the backcross generation or backcross progeny

background level - the concentration or level of a substance or other factor in an environment that is not the result of human activities, e.g., background levels of chemicals, light, sound, etc

background noise - noise coming from sources other than the noise source being monitored

backscatter - the deflection of acoustic radiation in a scattering process through an angle greater than 90 degrees. Backscatter is the term commonly used to describe the return of energy from the seabed to the receiver in an active sonar

bacterial bleaching - loss of zooxanthellae with resultant bleaching caused by a specific bacterial infection, as opposed to environmental stress. The bacteria (*Vibrio sp.*) produce a toxin which cause lysis of the zooxanthellae. For additional information and illustrations, see: http://www.coral.noaa.gov/coral_disease/bacterial_bleaching.shtml

bacterial chlorophyll - chlorophylls (bacteriochlorophylls a, b, c, d, e, and g) found in photosynthetic bacteria. They differ from plant chlorophyll in chemical construction and absorption spectra characteristics

bacterial generation time - the time interval required for a bacterial cell to divide, or for a population of bacterial cells to double. Generation times for bacterial species growing in nature may be as short as 15 minutes or as long as several days

bactericide (bacteriocide) - a substance that kills bacteria

bacteriophage (phage) - a virus that attacks and infects bacterial cells. Phages consist of a protein coat enclosing the genetic material, DNA or RNA, that is injected into the bacterium. Upon infection, synthesis of host DNA, RNA and proteins ceases and the phage genome is used to direct the synthesis of phage nucleic acids and proteins using the host's transcriptional and translational apparatus

balanced polymorphism - a type of polymorphism in which the frequencies of the coexisting forms do not change noticeably over many generations

band - a thick, pigmented vertical marking that encircles the circumference of an organism's body



Chaetodon striatus, the banded butterfly fish, has two black bands of pigment encircling its body. (Image: NOAA)

bank - a broad elevation of the sea floor around which the water is relatively shallow but not a hazard to surface navigation

bank reef - large reef growths, generally having irregular shape, which develop over submerged highs of tectonic or other origin and are surrounded by deeper waters

bank/shelf - deepwater area extending offshore from the seaward edge of the fore reef to the beginning of the escarpment where the insular shelf drops off to the deep, oceanic water. If no reef crest is present, it is the flattened platform between the fore reef and the deep ocean waters or between the intertidal zone and open ocean

bar - a thick, pigmented vertical marking that does not encircle the body of an organism; an elongate submarine shoal



The royal gramma, *Gramma loreto*, has a darkly pigmented bar across its eye.

barbel - a slender elongate sensory structure protruding from the lips or jaws of certain fishes, such as catfishes, goatfishes, drums, cods, and many deep-sea fishes. Barbels may appear singly or in groups. They are primarily tactile in function but may also bear tastebuds, allowing the fish to taste its environment



A yellow goatfish with two prominent barbels protruding from its chin. (Photo: NOAA)

barophile - a microorganism which grows best (or can only grow) in high-pressure environments, such as deep-sea environments

barotrauma - an injury that results from rapid or extreme changes in pressure. Scuba divers may experience ear barotrauma, a condition of discomfort in the ear caused by pressure differences between the inside and the outside of the eardrum

barren zone - the region of a coral reef seaward of the lower palmata zone and just landward of the buttress or mixed zone

barrier island - a long, usually narrow accumulation of sand, that is separated from the mainland by open water (lagoons, bays, and estuaries) or by salt marshes



Cape Lookout National Seashore currently consists of 4 barrier islands. (Photo: U.S. National Park Service)

barrier reef - a long, narrow coral reef, roughly parallel to the shore and separated from it by a lagoon of considerable depth and width. It may lie a great distance from a continental coast. It is often interrupted by passes or channels



Healthy *Acropora* coral in Australia's Great Barrier Reef. (Photo: Ray Berkelmans/Great Barrier Reef Marine Park Authority)

basal plate - lower part of the coral cup, separating the polyp from the substratum. A synonym of pedal disc

basalt - a dark, fine-grained igneous rock composed of minerals rich in ferromagnesian silicates

base - a substance that reduces the hydrogen ion concentration in a solution

base - in genomics, a key component of DNA and RNA molecules. Four different bases are found in DNA: adenine (A), cytosine (C), guanine (G) and thymine (T). In RNA, uracil (U) substitutes for thymine; also known as nitrogenous bases; a base, a phosphate molecule and a sugar joined together constitute a nucleotide

base pair - two nitrogenous bases which form a "rung of the DNA ladder." A DNA nucleotide is made of a molecule of sugar, a molecule of phosphoric acid, and a base molecule. The bases are the "letters" that spell out the genetic code. In DNA, the code letters are A, T, G, and C, which stand for the chemicals adenine, thymine, guanine, and cytosine, respectively. In base pairing, adenine always pairs with thymine, and guanine always pairs with cytosine. In RNA, thymine is replaced by uracil

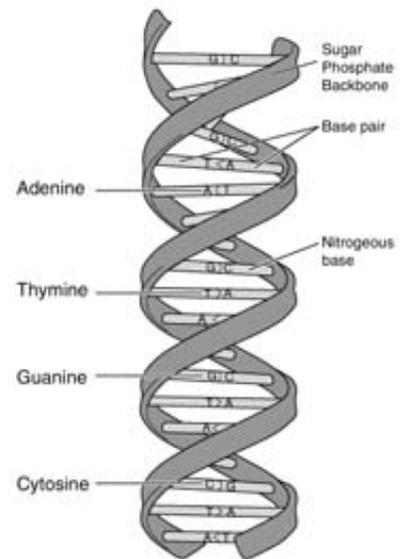


Diagram of a DNA molecule.
(Diagram: U.S. NIH/Human Genome Project)

base sequence - the order of nucleotide bases in a DNA molecule

baseline data - a quantitative level or value from which other data and observations of a comparable nature are referenced

basic research - research conducted with the sole goal of obtaining knowledge; in contrast with applied research

basilar - forming a foundation

basipinacocyte - a pinacocyte that adheres a sponge to a substrate by the external secretion of a collagenous matrix

Batesian mimicry - a type of mimicry in which a harmless species resembles a different species that is unpalatable, poisonous, or otherwise noxious or harmful to a predator

bathymetry - the science of measuring ocean depths to determine the topography of the sea floor

BCD (buoyancy control device) - the BCD is a mandatory piece of equipment for SCUBA diving. It is an expandable bladder, most commonly worn as an expandable vest, that can be inflated with air from the tank to increase buoyancy while diving. To decrease buoyancy, the BCD is deflated through special air-dump valves or hoses. It provides positive buoyancy for resting, swimming or lending assistance to others under water. The BCD allows maintenance of neutral buoyancy at any depth simply by adding or releasing air. It is also called a buoyancy compensator (BC)



A buoyancy control device (BCD). It is a vest-like expandable bladder that can be inflated with air to increase or decrease a scuba diver's buoyancy while diving.

beach - an aggregation of unconsolidated sediment, usually sand, that covers the shore

beche-de-Mer - commercially harvested sea cucumbers (Class Holothuroidea). In Asia, it is considered to be a delicacy



Image of the commercially harvested -beche de mer+.

behavioral isolating mechanism - a difference in behavior (usually reproductive behavior) that prevents genetic exchange between members of different populations or species

belt transect - a linear or circular transect with the observation area being a specified distance on either side of the transect line

benchmark - a measurement or standard that serves as a point of reference by which process performance is measured

benign introduction - the purposeful introduction of members of a species into an appropriate habitat, foreign to the "home" habitat or area, for the purposes of conservation of that species

benthic - bottom dwelling; living on or under the sediments or other substrate

benthic organism (benthos) - an organism whose habitat is on or near the bottom of a stream, lake, or ocean

benthic region - the bottom layer of a body of water



A benthic crab (phylum Arthropoda).

beta particle - a high-speed particle, identical to an electron, emitted from an atomic nucleus

bicentric distribution - the presence of a species (or other taxonomic unit) in two widely separated geographic areas

bifacial - describes plates which have corallites on both sides

bifurcate - a coral branch that divides into two equal branches

bilateral symmetry - a bilaterally symmetric organism is one that is symmetric about a plane running from its frontal end to its caudal end (head to tail), and has nearly identical right and left halves. Most animals are bilaterally symmetrical. The exceptions are sponges (no symmetry), cnidarian polyps and medusae, and ctenophores (radial symmetry), and echinoderms (partial radial symmetry).

Bilateria - group containing all multicellular animals with bilateral symmetry; the name has no taxonomic status

bimodal - a distribution in which the frequency curve has two peaks. A single peak is called a mode

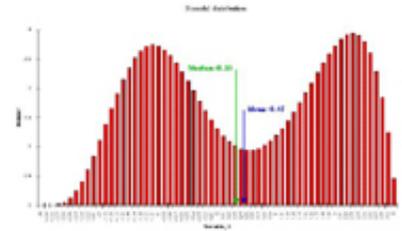
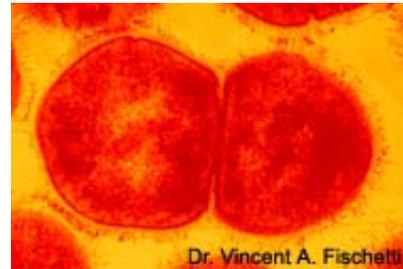


Chart showing a population of data having a bimodal distribution.

bimodal curve - a frequency curve characterized by two peaks

binary fission - type of cell division found in prokaryotic cells, in which dividing daughter cells each receive a copy of the parental chromosome



A bacterial cell reproducing by binary fission. The two resultant daughter cells are genetically identical. (Photo: Dr. Vincent A. Fischetti, Laboratory of Bacterial Pathogenesis and Immunology, Rockefeller University)

binding - the ability of molecules to stick to each other because of the exact shape and chemical nature of parts of their surfaces

binding site - the reactive part of a macromolecule that directly participates in its specific combination with another molecule

binomen - a two-part name given to a species in which the first part is the name of the genus and the second is the specific name

binomial nomenclature - a system of nomenclature where each animal has a dual name consisting of genus and species, e.g., the boulder coral, *Montastrea annularis*

bioaccumulation - the buildup of chemical substances in the cells or tissues of an organism

bioacoustics - a discipline of zoology that is concerned with sounds of biological origin: their mechanisms of production, physical properties, receptors and reception physiology, and the role of the sounds in behavior

bioassay - an assay for the activity or potency of a substance that involves testing its activity on living materials

biochemical cycle - the flow of an element through the living tissue and physical environment of an ecosystem, e.g., the carbon, hydrogen, oxygen, nitrogen, sulfur, and phosphorus cycles

biochemical genetics - the study of the relationships between genes and enzymes, specifically the role of genes in controlling the steps in biochemical pathways

biochemical oxygen demand (BOD) - the amount of oxygen taken up by microorganisms that decompose organic waste matter in water. It is therefore used as a measure of the amount of certain types of organic pollutant in water. A high BOD indicates the presence of a large number of microorganisms, which suggests a high level of pollution

biochip - an electronic device that uses organic molecules to form a semiconductor; a microchip that uses tiny strands of DNA to latch onto and quickly recognize thousands of genes at a time; collection of miniaturized test sites (microarrays) arranged on a solid substrate that permits many tests to be performed at the same time in order to achieve higher throughput and speed. A biochip can perform thousands of biological reactions, such as decoding genes, in a few seconds. Biochips can also be used to rapidly detect chemical agents used in biological warfare so that defensive measures can be taken

biochore - a group of similar biotopes

biocoenose - an assemblage of diverse organisms inhabiting a common biotope

biocoenosis - a community or natural assemblage of organisms. The term often is used as an alternative to ecosystem, but strictly it is the fauna/flora association excluding physical aspects of the environment

biodegradable - capable of undergoing rapid decomposition by microorganisms under aerobic and/or anaerobic conditions. Most organic materials are biodegradable

biodiversity - the total diversity and variability of living things and of the systems of which they are a part. This includes the total range of variation in and variability among systems and organisms at the bioregional, ecosystem and habitat levels, at the various organismal levels down to species, populations and individuals and at the level of the population and genes



A coral reef contains a great variety of species of all major kingdoms of living forms. (Photo: Dr. Anthony Picciolo)

biodiversity hot spot - an area that features exceptional concentrations of species, including many endemics. Many such hot spots also experience large habitat losses, putting these ecosystems at risk

bioerosion - erosion of the physical/geological environment by organism activities such as boring, scraping, etching, etc.

biogenesis - a central concept of biology that all living organisms are descended from predecessor living organisms

biogenic - refers to things which came about as a result of the activities of living organisms

biogenic reef - a mound-like layered structure built by and predominantly composed of organic remains such as shells and skeletons of sedentary organisms

biogenic rock - an organic rock produced by the physiological activities of plants or animals

biogeochemical cycle - the chemical interactions among the atmosphere, biosphere, hydrosphere, and lithosphere

biogeography - a branch of biology that deals with the geographical distribution of organisms

bioherm - a body of rock built up by or composed mainly of sedentary organisms, e.g., hard corals, calcareous algae or mollusks, and enclosed or surrounded by rock of different origin

bioinformatics - the analysis of biological information using computers and statistical techniques; the science of developing and utilizing computer databases and algorithms to accelerate and enhance biological research. Bioinformatics is particularly important as an adjunct to genomics research, because of the large volume of complex data generated

biolimiting - relating to the environmental factors determining or restricting the growth of a particular life form

biolistics - a technique to insert DNA into cells. The DNA is mixed with small metal particles, usually tungsten or gold, a fraction of a micrometer across. These are then fired into a cell at very high speed.

biological clock - an internal biological mechanism which controls certain biological rhythms and biocycles, such as metabolism, sleep cycles, and photosynthesis

biological control - the use of living organisms, such as parasites, disease agents, and predators, to control or eliminate other unwanted living organisms, rather than by using toxic chemicals or other means of elimination

Biological Data Profile of the Content Standard for Digital Geospatial Metadata - provides a common set of terminology and definitions for the documentation of biological data through the creation of extended elements and a profile of the FGDC Content Standard for Digital Geospatial Metadata. Its purpose is to provide a user-defined or theme-specific profile of the FGDC Content Standard for Digital Geospatial Metadata to increase its utility for documenting biological resources data and information. This standard can be used to specify metadata content for the full range of biological resources data and information. It also serves as the metadata content standard for the National Biological Information Infrastructure (NBII)

biological half-life - the time required for one-half of the total amount of a particular substance in a biological system to be consumed or broken down by biological processes when the rate of removal is approximately exponential. Toxic chemicals with a long biological half-life will tend to accumulate in the body and are more likely to be harmful. A substance with a short biological half-life may still accumulate if a portion of it it becomes tightly bound to bone or other tissues, even if most of it is quickly eliminated from the body

biological indicator - an organism, species or community whose characteristics show the presence of specific environmental conditions. Other terms used are indicator organism, indicator plant and indicator species

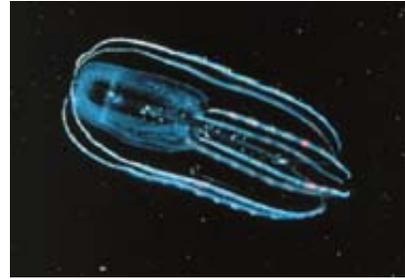
biological navigation - the ability of certain animals to navigate by instinct to specific sites. Depending upon the species, the cues involved may be related to star patterns, sun angle, polarized light, chemical scents or tastes, or the Earth's magnetic field

biological productivity - the amount of organic matter, carbon, or energy content that is accumulated during a given time period

biological rhythm - an overt, measurable activity generated by some internal oscillator (or 'clock')

biological survey - collecting, processing, and analyzing a representative portion of the resident aquatic community to determine its structural and/or functional characteristics

bioluminescence - light produced by organisms as a result of conversion of chemical energy to light energy



A bioluminescent comb jelly of the phylum Ctenophora.

biomagnification - the accumulation and amplification of chemical substances at each succeeding trophic level

biomass - an estimate of the amount of living matter per some unit volume or area

biome - a community of animals and plants occupying a climatically uniform area on a continental scale

biometrics - the use of statistics for the study of biological events

biophysics - the scientific study of the physics of organisms, their biological structure and processes

bioregion - any geographical region characterized by a distinctive biota

bioremediation - the use of organisms such as plants or microorganisms to aid in removing hazardous substances from an area

biosphere - the thin region surrounding the Earth that is capable of supporting life

biota - all life forms of a given area

biotechnology - biological techniques used in applied research research and product development. In particular, the use by industry of recombinant DNA, cell fusion, and new bioprocessing techniques; any technology that is applied to living organisms to make them more valuable to humans

biotope - an area of relatively uniform environmental conditions, occupied by a given plant community and its associated animal community

biotoxin - any poisonous or venemous substance produced by any living organism

bioturbation - the rearrangement of sediments by organisms that burrow through them and ingest them

biotype - a physiological variety or a group of individuals having distinctive genetic characters in common

bipectinate - having two margins which are toothed, like a comb; descriptive of the gills (ctenidia) of aquatic mollusks

bipectinate gill (ctenidium) - in mollusks, refers to having gill lamellae on both sides of the ctenidial axis

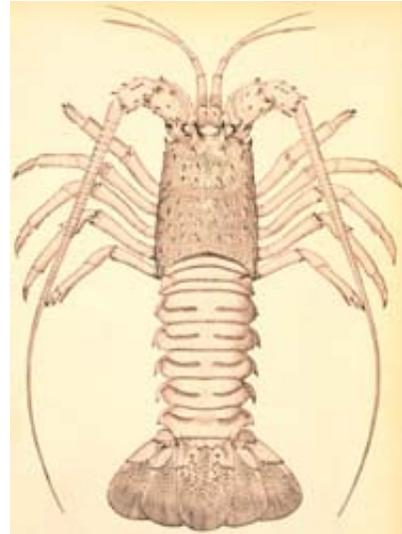
bipinnaria larva - an early starfish larva with ciliated bands running about the periphery



Mature bipinnaria of *Pisaster ochraceus*, ca 24 days old, raised in culture by T.H.J. Gilmour. (Photo: University of Saskatchewan Archives)

biradial symmetry - a body plan in some cnidarians that has two planes of symmetry rather than the several planes of a radially symmetrical animal, or the single plane of a bilaterally symmetrical one. Both planes of symmetry are longitudinal and are at right angles to each other. Both include the aboral-oral axis, which is the axis of symmetry

biramous appendage - a type of appendage that is characteristic of crustaceans. It forks from the basal protopodite to form two branches, the inner endopodite and the outer exopodite. Each of these branches can be composed of either one or more segments. There are many variations on this generalized structure; the branches often possess highly specialized extensions



Note the biramous antennules of the spiny lobster.

bit - the smallest unit of information that a computer can store and process. A bit has two possible values, 0 or 1, which can be interpreted as yes/no, true/false, or on/off

bitmap image - also called raster or paint images. They are made of individual dots called pixels (picture elements) that are arranged and colored differently to form a pattern. Compared to a vector image, bitmap images are great for photographs because they tend to offer greater subtleties for shading and texture but require more memory and take longer to print. Vector images are best for drawings that need sharper lines, more detail, and easy modification. Vector images require far less printing resources than bitmap images

Bivalvia (Pelecypoda) - a class of Mollusca that includes clams, oysters and mussels. Bivalves are laterally compressed and possess a shell composed of two valves that hinge dorsally and enclose the body. They are common inhabitants of coral reefs



A scallop (class Bivalvia) displays its rows of light-sensitive eyespots.

black coral - black corals are colonial cnidarians in the Order Antipatharia. They are found throughout the world's oceans, but are most common in tropical deep water habitats from 30-80 m depth. These species of black coral have rigid, erect skeletons that form branched, bush-like colonies. Black coral is commercially harvested primarily for jewelry, and may be globally threatened in many parts of the world as a result of over-harvesting



Black coral isn't really black. The name refers to the black color of their proteinaceous skeletons. The living colonies are made up of thousands of tiny coral polyps whose colors may be yellow, green or orange. (Photo: Dr. A. Bruckner, NOAA)

black-band disease - a world-wide disease of corals that is characterized by a dark ring, or band, that separates apparently healthy coral tissue from freshly exposed coral skeleton. It migrates across coral colonies and completely degrades coral tissue. The infecting agent is a synergistic assortment of photosynthetic and non-photosynthetic bacteria. For more details and illustrations, see: http://www.coral.noaa.gov/coral_disease/black_band.shtm



Black band disease. (Photo: Dr. A. Bruckner, NOAA)

bladder - any sac or cavity used to store liquids or gases

blade - a leaf-like structure

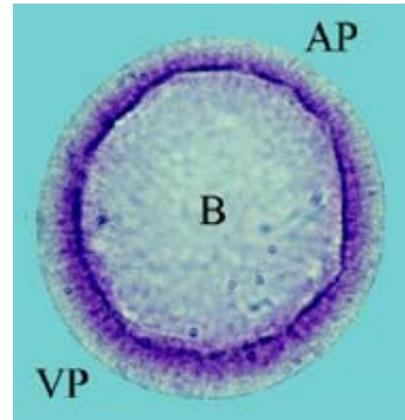
blastocoel - the fluid-filled cavity formed within the mass of cells of the blastula of many animals during the later stages of cleavage

blastocyst - a preimplantation embryo. The blastocyst consists of a sphere made up of an outer layer of cells (trophectoderm), a fluid-filled cavity (blastocoel), and a cluster of cells on the interior (inner cell mass)

blastomere - an undifferentiated cell of a cleaving embryo, and of the morula and blastula stages of embryonic development

blastopore - the opening into the archenteron (primitive gut) of a gastrula. In some animals it develops into the mouth and, in others, into the anus

blastula - a stage of embryonic development of animals near the end of cleavage (cell division), but before gastrulation. In animals where cleavage involves the whole egg, the blastula usually consists of a hollow ball of cells (blastomeres) surrounding a fluid-filled central cavity, the blastocoel



A late blastula characterized by a single layer of cells surrounding the central hollow area - the blastocoel (B). The blastomeres at the vegetal pole (VP) are taller than those at the animal pole (AP), making the vegetal pole appear slightly thicker. (Photo: Cell and Developmental Biology Online website (University of Guelph); URL: <http://www.uoguelph.ca/zoology/devobio/>)

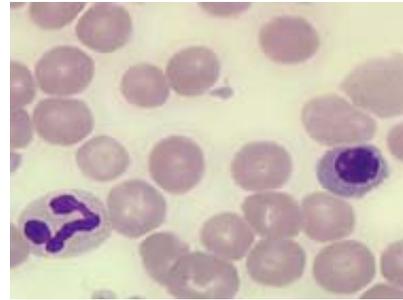
bleaching index - index based on the strength and duration of local HotSpots to monitor bleaching events

bleaching outbreaks - development of bleaching events

bleaching stressors - environment-induced stress that results in bleaching, e.g., disease, excessive or insufficient light, increased levels of ultraviolet radiation, sedimentation, pollution, salinity changes, and increased temperatures

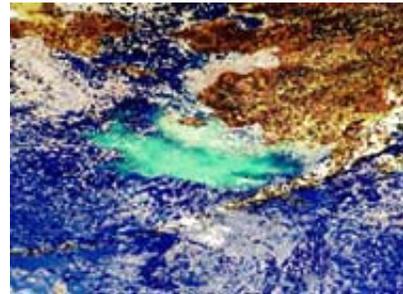
blind test - a method of testing or experimentation, in which an independent observer records the results of any test, drug, placebo, or procedure without knowing the identity of the samples or what result might be expected

blood - a circulating tissue composed of a fluid portion (plasma) with suspended formed elements (red blood cells, white blood cells, and platelets) that delivers nutrients and hormones to cells and removes wastes; In some invertebrates, the blood is called the haemolymph



Red and white blood cells. The white blood cells are the larger ones with irregular nuclei. The small particles are platelets. (Photo: U.S. National Institutes of Health)

bloom - a sudden increase in the biomass of phytoplankton or benthic algae in a given area



A SeaWiFS (Sea-viewing Wide Field-of-view Sensor) image of a coccolithophore bloom in the Bering Sea.

blotch - a patch or a spot of pigment with irregular edges



The blotch-necked moray (*Gymnothorax margaritophorus*) from American Samoa bears darkly pigmented blotches along its body. (Photo: NPS, Copyright Richard C. Wass)

blue coral - the blue coral, *Heliopora coerulea*, is an octocoral that has a massive aragonite skeleton and is an important reef builder in some areas



Blue coral (*Heliopora coerulea*) from American Samoa. (Photo: NPS, Eva DiDonato)

blue-green algae - the former name for the blue-green bacteria, now classified as Cyanobacteria. A group of prokaryotic cells that use chlorophyll on intracytoplasmic membranes for photosynthesis. The blue green color is due to the presence of phycobiliproteins. they occur as single cells, colonies or simple filaments



Blue-green algae (Cyanobacteria). (Photo: J. Waterbury, Woods Hole/ NASA Astrobiology Institute)

BOD (Biological (or Biochemical) Oxygen Demand) - the oxygen used in meeting the metabolic needs of aerobic microorganisms in water rich in organic matter (as water polluted by sewage)

bond - a physicochemical association between atoms

bond energy - the energy required to form a particular chemical bond

booties - short "boots" usually made of neoprene, worn inside open-heel fins. they protect a scuba diver's feet from rubbing against the fins while swimming, as well as protecting the entire foot while walking to and from a dive site. Booties also provide warmth



A pair of booties worn by scuba divers under an open-heel fin.

borer sponge - a sponge that chemically digests the limestone skeletons of corals during its search for food and living space, which breaks down the structure of the reef

boss - a columnar, flat-topped coral-algal growth or erosion structure usually found on the upper surfaces of spurs and buttresses

bottlebrush branching - describes a branch with compact radial sub-branches

bottom trawler - a fishing vessel that uses an open-mouthed fishing net drawn along the sea bottom. This type of fishing is destructive to shallow water and deep sea coral reef communities



Small stern trawler fishing. (Photo: David Comb/New England Biolabs)

Boyle's Law - if the temperature is kept constant, the volume of a given mass of gas is inversely proportional to the absolute pressure

bp (base pairs) - pairs of nucleotide bases in DNA

brachial - pertaining or belonging to the arm

brachiolaria larvae - a starfish larval stage following the bipinnaria stage. It has projecting arms and a developed stomach

brachy- - a prefix from the Greek, meaning "short"

brackish - mixed fresh and salt water



A brackish water area showing a mix of salt and freshwater marsh species in the Weeks Bay National Estuarine Research Reserve, AL. (Photo: NOAA)

bradycardia - an unusually slow heart rate

branchial - pertaining to gills

branchial plume - a respiratory structure or external gills, usually located on the dorsal side toward the posterior of dorid nudibranchs. This plume surrounds the anus and in some species, it may be retracted. The branchial plume is the major respiratory structure in nudibranchs



The feathery structure toward the posterior of this nudibranch gastropod (marine sea slug) is its respiratory organ.

branching colony - a coral growth pattern where branches are formed

branchiostegal - one of the dermal bony or cartilaginous struts that support the branchiostegal membranes of fishes. Sometimes called branchiostegal rays, but not to be confused with the fin rays

breaker zone - the area of a coral reef most exposed to breaking waves

breeding season - the time of the year during which mating occurs

bristles - stiff hairs

broadcast spawner - an organism that releases gametes directly into the sea for external fertilization

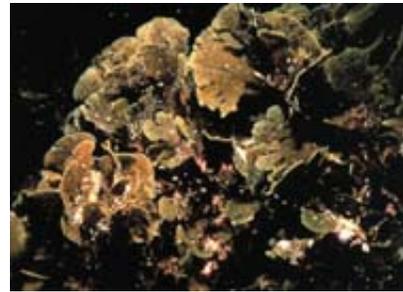
brood - all of the offspring that hatch from a single clutch of eggs or the offspring of a single birth; to incubate eggs

brooder - a coral which harbors or broods developing larvae within its polyps

brooding - the development of larvae within the gastrovascular cavity of an adult coral polyp

brooding - parental care of young

brown algae - brown algae belong to the Division Phaeophycophyta, whose approximately 1,500 species are almost exclusively marine. They include the largest of the seaweeds and the kelps. The brown algae have chlorophyll a and c, as well as carotenes and xanthophylls, but the green chlorophyll coloration is masked by the brown and yellow pigments. Brown algae are among the largest photosynthetic organisms on earth. The largest kelps may grow to more than 60 meters in length, forming dense underwater forests in colder waters. Many microscopic brown algae grow as epiphytes on underwater vegetation, forming networks of branched filaments, or broad encrustations. All species are multicellular and do not form colonies. Their life cycles are complex, involving alternation of generations. In general, they are not free-floating organisms, but are attached to rock, coral, or other firm surfaces. Sargassum weed, however, is a floating brown algae that stays afloat by producing gas-filled bladders



Brown algae. (Photo: NOAA)

brown tree snake - the mildly venomous brown tree snake (*Boiga irregularis*) is an introduced species on some Pacific islands that has become a serious pest, especially on Guam. In the absence of natural population controls and with vulnerable prey on Guam, the snakes have become an exceptionally common pest causing major ecological and economic problems. The snakes probably arrived on Guam hidden in ship cargo from the New Guinea area. By 1968, they had dispersed throughout the island and caused havoc by virtually wiping out Guam's native bird species and helped decimate their fruit bat populations. In addition to Guam, brown tree snakes have been sighted on Saipan, Tinian, Rota, Kwajalein, Wake, Oahu, Pohnpei, Okinawa, and Diego Garcia. To date, this snake is not known to be established on any of these islands except Guam



The brown tree snake (*Boiga irregularis*) is an invasive species that has caused great ecological and economic damage on Guam. (Photo: U. S. Geological Survey)

Bryozoa - an animal phylum synonymous with Ectoprocta that contains approximately 5,000 living species. They are all sessile colonial forms composed of zooids. Zooids are tubular, oval or box-like structures that contain a lophophore, which is a circular or horseshoe-shaped fold of the body wall that encircles the mouth and bears numerous ciliated tentacles. Most species form erect or encrusting colonies. They occur in many different habitats, including coral reefs



Bryozoa colony.

bubblegum coral - a deep water gorgonian, *Paragorgia arborea*, found in the North Pacific and North Atlantic Oceans at depths that may exceed 1400m. It can grow to 5m in height and 8 m in width. It is called the bubblegum coral because because it is usually orange or pink in color, and has a lumpy surface texture



Bubble gum coral on Gulf of Alaska Seamounts. (Photo: NOAA Ocean Explorer)

buccal - pertaining to the cheek or oral cavity

buccal siphon - in tunicates, the opening through which water enters into the pharyngeal basket. It is also called the incurrent, inhalant, or oral siphon/canal

budding - a type of asexual reproduction in which new individuals develop from the parent organism, forming a swelling similar in appearance to a bud, which separates from the parent as it grows; budding is a form of asexual reproduction in corals where a parent corallite forms daughter corallites

buddy - a scuba diving partner. For safe diving, a pair of divers (buddies) stay close to each other in order to offer assistance if needed



NOAA divers working in buddy pairs. (Photo: NOAA/National Undersea Research Program)

buddy breathing - two scuba divers sharing air from one second stage regulator



Scuba divers practicing buddy breathing. (Photo: John Buchanan)

buffer - a solution or liquid whose chemical makeup neutralizes acids or bases without a great change in pH

buffer zone - the region near the border of a protected area; a transition zone between areas managed for different objectives

bulbous - a rounded or swollen shape

buoy - a floating platform for navigational purposes or supporting scientific instruments that measure environmental conditions

buoyancy - the tendency of object to float or sink when placed in a liquid. Positively buoyant objects float, negatively buoyant objects sink, and neutrally buoyant objects stay in place

buttress - see spur and groove

bycatch - organisms taken in a fishery which are not of the species intended for harvest. For example, mammals or turtles captured in trawl or seine fishing

byssal thread - one of many thin, hairlike filaments secreted by certain mollusks for attachment to a substrate



The byssal gland is located within the foot of the mussel. It produces secretions which are used to form byssal threads for attachment to substrates. (Photo: Great Lakes Sea Grant Network Exotic Species Library, Ontario Ministry of Natural Resources)

byte - a memory and data storage unit composed of contiguous bits, usually eight. For example, file sizes are measured in bytes or megabytes (one million bytes). Bytes contain values of 0 to 255 and most often represent integer numbers or ASCII characters

c-card - a scuba diving certification card from scuba certifying agencies, such as NAUI, BSAC, NOAA, PADI, etc.

CaCO₃ (calcium carbonate) - a molecule consisting of calcium, carbon and oxygen secreted by corals to their skeleton. It is also secreted by mollusks to form their protective shells



This Queen Conch (*Strombus gigas*) utilizes calcium carbonate in forming its protective shell. (Photo: Andy Bruckner)

cadastral survey - a survey which creates, marks, defines, retraces or reestablishes the boundaries and subdivisions of the public land of the United States. It is derived from the word cadastre, meaning a public record, survey, or map of the value, extent, and ownership of land as a basis of taxation

calcareous - composed of or containing a substance made of calcium carbonate

calcareous ooze - a biogenous sediment that is made of the calcium carbonate shells and skeletons of marine organisms

calcification - the process by which corals and calcareous algae extract calcium from seawater and produce it as calcium carbonate

calcite - a mineral made up of a crystalline form of calcium carbonate

calcite skeleton - a skeleton composed of the calcite form of calcium carbonate

calibrate - to check or adjust the graduations of a quantitative measuring instrument

calicoblastic epithelium - a thin squamous epithelial layer of cells in stony (hard) corals which deposits the white calcium carbonate skeleton

caliculate - cup-shaped

calorie - a unit of measurement defined as 4.184 absolute joules or the amount of energy it takes to raise the temperature of one gram of water from 15 to 16 degrees Celsius (or 1/100th the amount of energy needed to raise the temperature of one gram of water at one atmosphere pressure from 0 degrees C to 100 degrees C). Food calories are actually equal to 1,000 calories (1 food calorie = 1 kilocalorie)

calyx - the upper or open end of the corallite or coral polyp cup; the central body of entoprocts (goblet worms) or crinoids (sea lilies and feather stars)

CaMPAM (Caribbean Marine Protected Area Management) - a network of managers of marine and coastal protected areas in the wider Caribbean organized to achieve goals of conservation and sustainable use of Caribbean coastal and marine environmental resources. General activities conducted through CaMPAM's membership include sharing experiences and addressing management challenges by facilitating training opportunities, information exchange, communication, and problem solving

cancellous - possessing a spongy or porous surface

canine tooth - a pointed, conical tooth that is located at the front or edge of the jaw. Canine teeth are used for piercing and grabbing prey



Moray eels are armed with sharp canine teeth used for capturing prey and also for defense. (Photo: Dr. Tom Doepner, Brown University)

canopy - the more or less continuous cover of branches and foliage formed collectively by the tops, or crowns, of adjacent trees

capsid - the protein coat of a virus particle

captaculum - a filamentous tactile organ with an adhesive, sucker-like end near mouth of a tusk shell (mollusks in the class Scaphopoda). The captacula are used to gather small particles of food in the sand and pass them to the mouth

carapace - a hard shield, or shell covering, found over all or part of the anterior dorsal portion of an animal. In lobsters, shrimps, crayfish, and crabs, the carapace is the part of the exoskeleton that covers the head and thorax and protects the dorsal and lateral surfaces. In many crustaceans, the term carapace is also used to describe the hard, protective covering of the cephalothorax, as that of the horseshoe crab. The carapace of a turtle's shell is composed of expanded ribs and vertebrae overlain by dermal plates and horny scales



The carapace is the hard shell covering of the cephalothorax of this spiny lobster.

carbohydase - an enzyme that acts upon a carbohydrate

carbohydrates - organic compounds composed of carbon, oxygen, and hydrogen; includes the simple sugars, double sugars, and complex sugars (starches)

carbon cycle - the cycling of carbon in the form of carbon dioxide, carbonates, organic compounds, etc., between various reservoirs, e.g., the atmosphere, the oceans, land and marine biota and, on geological time scales, sediments and rocks

carbon fixation - the conversion of inorganic carbon into organic carbon, usually by photosynthesis

carbonate compensation depth - the depth in the ocean below which material composed of calcium carbonate (CaCO_3) is dissolved and does not accumulate on the sea floor

carboxyl group - the $-\text{COOH}$ functional group, acidic in nature, found in all amino acids; the acid group of organic molecules

carcinogen - a chemical substance that causes cancer

CARICOMP (Caribbean Coastal Marine Productivity) - a regional coral reef, seagrass and mangrove monitoring program and network involving a number of Caribbean laboratories, parks and reserves to study land-sea interaction processes in the wider Caribbean region. Twenty-seven institutions in 17 countries participate in CARICOMP

carinate - shaped liked a keel or ridge

carnivore - an organism that feeds upon animals



A carnivore (barracuda) caught in the act.

carotene - a red, orange, or yellow pigment belonging to the group of carotenoids; a precursor of vitamin A

carotenoid - any of a group of red, orange, and yellow accessory pigments of plants or algae

carpogonium - the female gamete-producing reproductive organ in red algae, consisting of a single cell and its extension, the trichogyne

carposporangium - a single-celled structure in red algae that produces diploid carpospores on the carposporophyte

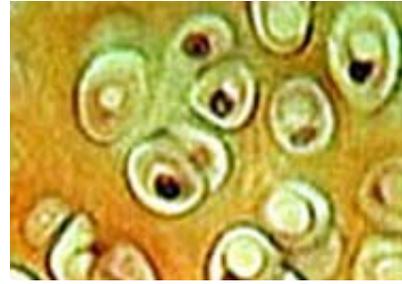
carpospore - a non-motile diploid spore formed on the carposporophyte stage of the red algae life cycle which germinates to form the tetrasporophyte stage

carposporophyte - the diploid stage of red algae which develops after fertilization of the carpogonium

CARRUS Alliance (Comparative Analysis of Reef Resilience Under Stress Alliance) - the CARRUS Alliance was organized at the 2004 International Coral Reef Symposium held in Okinawa. Its objective is to provide a basis for better understanding of coral reefs at the scale of the whole reef system. The Alliance consists of researchers conducting independently-supported long-term, interdisciplinary research on whole reef systems, including associated social and economic systems, united through agreements for the exchange of information, methods, expertise, and software. One focus of the Alliance will be on developing common research objectives, including the development of decision support systems to facilitate reef management. The Alliance will be linked to a variety of international efforts

carrying capacity - the maximum population size that can be regularly sustained by an environment; the point where the population size levels off in the logistic growth model

cartilage - a type of connective tissue where the functional component is the rubbery intercellular matrix that is secreted by cartilage-producing cells called chondrocytes. Cartilage exists in several forms, from glassy to fibrous in appearance



A microscopic section of hyaline cartilage. The cartilage cells (chondrocytes) exist in little cavities (lacunae) in the smooth, glassy cartilaginous matrix. (Photo: NIH/ National Cancer Institute)

CASI (Compact Airborne Spectrographic Imager) - a digital airborne multispectral sensor

catabolism - a destructive metabolic process by which organisms convert substances into excreted compounds

catadromous species - a species that spawns in the ocean but lives parts of its life in fresh water, e.g., American eel



The American eel is a catadromous species that spawns in the ocean, near the Sargasso Sea, but grows to maturity in freshwater streams.

catalysis - the acceleration of a chemical reaction by a catalyst.

catalyst - a substance that accelerates a chemical reaction, but is not consumed or changed in the process

catenation - linking of multiple copies of a macromolecule to each other

cation - a particle that carries a positive electrical charge. The cation gets this positive charge from losing negatively charged electrons

caudal - pertaining to the tail; denoting a position more toward the tail of an animal, e.g., the tail fin of a fish is called the caudal fin. Caudal vertebrae are the vertebrae which extend into the tail of an animal



Caudal fin of a shark. The dorsal lobe of the caudal fin is elongated. (Photo: Copyright Corel Corporation)

caudal peduncle - the narrowest portion of a fish's body, located just posterior to the anal fin and just anterior to the caudal fin



The caudal peduncle of the spotted unicorn fish (*Naso brevirostris*) is located between the anal and caudal fins. (Photo: Copyright Richard C. Wass)

cay - a small, low coastal island or emergent reef of sand or coral; flat mound of sand and admixed coral fragments built upon a reef flat or just above high tide level. A synonym of **key**, as in the Florida Keys

CD-ROM (Compact Disk-Read Only Memory) - an optical medium. A CD-ROM 5.25-inch disk can hold about 650 megabytes of information

CDHC (Coral Disease and Health Consortium) - in response to the dramatic increase of coral diseases observed over recent years, the U.S. Coral Reef task force (2002) recommended the creation of the CDHC from a cross-section of internationally recognized experts in coral diseases, biomedical and veterinary sciences, pathology, chemistry, biology, biotechnology, and marine management. It organizes and coordinates the scientific resources of the U.S. and its territories to meet the challenge of globally declining coral reefs

cDNA (complementary DNA) - a strong, cloned DNA copy of otherwise fragile mRNA, made using reverse transcriptase. A cDNA is so-called because its sequence is the complement of the original mRNA sequence. However, when double-stranded cDNA is synthesized, it contains both the original sequence and its complement

cDNA library - a collection of cDNA clones that were generated *in vitro* from the mRNA sequences isolated from an organism, or a specific tissue or cell type, or population

cell - the smallest unit of living matter. All organisms are composed of cells and cell products (Cell Theory). Organisms exist either as single cells (unicellular) or as multicellular units



This example of a single-celled organism, the dinoflagellate *Gambierdiscus toxicus*, produces toxins including ciguatoxin and maitotoxin. The toxins are associated with ciguatera fish poisoning.

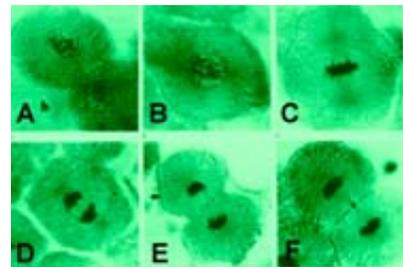
cell adhesion - adherence of cells to surfaces or to other cells

cell body - the enlarged portion of a neuron which contains most of the organelles

cell culture - the *in vitro* growth of cells derived from multicellular organisms. The cells are usually of one type

cell cycle - the period between the formation of a cell by the division of its parent cell and the formation of two new cells by cell division

cell division - the separation of one cell into two daughter cells, involving both nuclear division (karyokinesis) and subsequent cytoplasmic division (cytokinesis). Genetically, the daughter cells are identical to the mother cell (mitosis); however, in gametogenesis (meiosis), the resultant daughter cells (gametes) have the chromosome number reduced by one-half



Cell division by mitosis. A-B: Prophase - the replicated (daughter) chromosomes (chromatids) undergo extensive condensation. They are greatly thickened and shortened but are still contained within the nuclear membrane. Prophase ends with the sudden breakdown of the nuclear membrane. C: Metaphase - the

replicated chromosomes converge toward the center of the cell. D: Anaphase - sister chromatids split at their centromeres. These daughter chromosomes then begin to separate from each other, and move toward one of the two spindle polar regions. E-F: Telophase/Cytokinesis - Chromatids arrive at opposite poles of cell, and new membranes form around the daughter nuclei. The chromosomes disperse and are no longer visible. Cytokinesis or the partitioning of the cell may also begin during this stage. In animal cells, cytokinesis results when a fiber ring composed of a protein (actin) around the center of the cell contracts and pinches the cell into two daughter cells, each with one identical nucleus. Chromosomal replication occurs during the interphase between mitotic activities. (Photo: Dept. of Biology, University of New Mexico)

cell line - cells that have been extracted from human or animal tissue and now grow and replicate continuously outside the living organism

cell membrane - the structure enveloping a cell, enclosing the cytoplasm and forming a selective permeability barrier which permits the passage of solvents and solutes into and out of cells. It consists of lipids, proteins and some carbohydrates

cell wall - an extracellular material that forms the outer surface of plant, fungus, and certain bacterial cells. It is external to the cell membrane and serves in a structural and supporting role. The cell wall is composed primarily of cellulose and lignin in plants, chitin in Fungi, and peptidoglycans in bacteria

cellular differentiation - genetically-induced divergence in the structure and function of cells as they become specialized during a multicellular organism's development

cellulolytic enzyme - an enzyme that acts upon cellulose

cellulose - a polysaccharide that is composed of unbranched chains of glucose. It is the major structural carbohydrate of plants

cement - the chemically precipitated calcium carbonate present in spaces within skeletons or between grains of internal sediment

Cenozoic - the current geologic era, which began 66.4 million years ago and continues to the present

Centigrade Temperature Scale - a thermometric scale in which 0 degrees C (Celsius) marks the freezing point of water and 100 degrees C indicates the boiling point of water at sea level

centiMorgan - the unit of genetic map distance between two loci that show one (1) percent recombination

Central Dogma (of molecular biology) - the principal statement of the molecular basis of gene action. Genetic information is stored in and transmitted as DNA. Genes are expressed by being copied as RNA (transcription), which is processed into mRNA (messenger RNA) via splicing and polyadenylation. The information in mRNA is translated into a protein sequence using a genetic code to interpret three-base codons as instructions to add one of twenty amino acids, or to stop translation; or more simply put, DNA carries the genetic information which is transcribed to RNA and subsequently translated to protein. Francis Crick, the co-discoverer of the double helix structure of DNA, coined the term "Central Dogma" in 1958 to characterize the all-important cellular processes whereby DNA is "transcribed" into RNA and RNA is "translated" into protein

centrifugation - the spinning of a mixture at very high speeds to separate substances of different densities



A centrifuge used to "spin down" materials.

centriole - one of two small cylindrical cell organelles composed of nine triplet microtubules. They form the asters during cell division

centrolecithal - a type of egg cell that has its yolk in the very center of the cytoplasm, such that the initial meroblastic cleavage of the zygote happens all around the embryo. Most arthropods have centrolecithal eggs

centromere - the center part of a chromosome that appears 'pinched', in between the short arm (p) and the long arm (q). The centromere holds the two chromatids together, and during cell division (mitosis) it is the site of attachment for the spindle fibers

centrosome - a granular region of a cell which contains two centrioles and is a center of microtubule organization during the division of the nucleus

cephalic - pertaining to the head

cephalization - the localization of neural coordinating centers and sensory organs at the anterior end of the body

Cephalopoda - a class of the phylum Mollusca that includes squids, octopods, cuttlefishes and nautili. Many species are inhabitants of coral reefs



Squid (class Cephalopoda) with egg mass.

cephalothorax - the region of the body in decapod crustaceans that is covered by the carapace, with the boundary between the fused head and thorax indicated by the cervical groove. In lobsters, the cephalothorax is called the "body"; in shrimps, it is called the "head"

ceras - one of many multifunctional horn or lobe-shaped or leaf-like process on the back or side of a nudibranch mollusk (sea slug). It has a major function as a respiratory organ (a gill), and with a branch of the digestive gland, it also serves as an organ for the exchange of gases and other molecules with the blood. The ceras also stores stinging nematocysts in a structure called the cnidosac, from the cnidarians upon which they feed, which gives it a defensive function. Its ability to change color also gives it a protective camouflage function



Cerata (plural of ceras) of *Aeolidiella foulisi* showing the brown duct of the digestive gland and the whitish cnidosac at the tip.

cetacean - a marine mammal of the Order Cetacea. The Cetacea includes whales, dolphins and porpoises



The killer whale is actually a dolphin in the cetacean family, Delphinidae

chaeta - a stiff hair or bristle, made of chitin, characteristic of annelid worms. In the earthworm they occur in small groups projecting from the skin in each segment and function in locomotion. The chaetae of marine polychaete worms are borne in larger groups on paddle-like appendages called parapodia

Chaetodontidae - a family of fishes (butterfly fish) whose number and behavior may serve as indicators of reef health



A pair of butterfly fishes (Chaetodontidae). Their presence and behavior serve as biological indicators of reef health.

chain transect - a linear transect where a chain is used to mark the line under study. By following the surface contour of the reef, chain transects provide data that may be used to calculate the estimated spatial index (the ratio of reef surface contour to linear distance of the reef)

CHAMP (Coral Health And Monitoring Program) - a NOAA program whose mission is to provide services to help improve and sustain coral reef health throughout the world. Long term goals are: establish an international network of coral reef researchers for the purpose of sharing knowledge and information on coral health and monitoring; provide near real-time data products derived from satellite images and monitoring stations at coral reef areas; provide a data repository for historical data collected from coral reef areas; and add to the general fund of coral reef knowledge

character - in taxonomy, any attribute of organisms used for recognizing, differentiating or classifying taxa

character displacement - the process by which two closely related species, with overlapping ecological requirements, interact so as to cause one or both of them to diverge evolutionarily in one or more traits. They differ more when they co-occur than when they do not

Charles Law - under conditions of constant pressure and quantity, there is a direct relationship between the volume and absolute temperature for an ideal gas

chela - a pinching claw of a decapod crustacean, composed of a moveable finger, the dactylus, and a fixed finger, a distal extension of the propodus



The large pinching claw of this crustacean is the chela. The entire leg bearing the chela is termed the cheliped. (Photo: NOAA)

Cheliceramorpha - an order of arthropods that includes horseshoe crabs, daddy-longlegs, and extinct "sea-scorpions, spiders and scorpions, mites and ticks, " Most of its marine representatives are extinct, but were prominent in the Paleozoic



The horseshoe crab is an arthropod in the order Cheliceramorpha

cheliped - one or more pairs of thoracic legs of decapod crustaceans that terminate in a chela, or claw. The entire cheliped is often referred to as a claw



A cheliped of this American lobster (*Homarus americanus*) is a leg bearing a pinching claw.

chemical bond - the link between two atoms within a molecule. Different types of chemical bonds include hydrogen bonds, covalent bonds, and ionic bonds

chemiluminescence - a chemical reaction that gives off energy in the form of light instead of heat



Commercially available light sticks contain a solution in a glass vial. When the vial is broken, a second solution mixes with the first and light (chemiluminescence) is generated. Different dyes give off different colors when they are caused to fluoresce by the light of the chemiluminescent reaction. (Photo: American Chemical Society)

chemoautotroph - an organism that utilizes oxidation of inorganic chemicals for its energy and carbon from inorganic carbon dioxide for cell growth; these organisms are also called chemolithotrophs

chemocline - a sharp gradient in chemical concentration

chemokinesis - the response by a motile cell to a soluble chemical that involves an increase or decrease in speed, or frequency of movement, or a change in the frequency or magnitude of turning behavior

chemoorganotroph - an organism that obtains energy from the oxidation of organic compounds and cellular carbon from preformed organic compounds

chemoreceptor - a receptor that is stimulated by the presence of certain chemical substances

chemosynthesis - the process whereby chemical energy is used to synthesize organic compounds from inorganic compounds, e.g., the oxidation of ammonia to nitrite by nitrifying bacteria

chemotaxis - a unidirectional response of motile cells or organisms in which the direction of movement is affected by the gradient of a diffusible substance

chemotrophs - organisms (usually bacteria) that derive energy from inorganic reactions; also known as chemosynthetic organisms

chi-square - a statistical technique whereby variables are categorized to determine whether a distribution of scores is due to chance or experimental factors

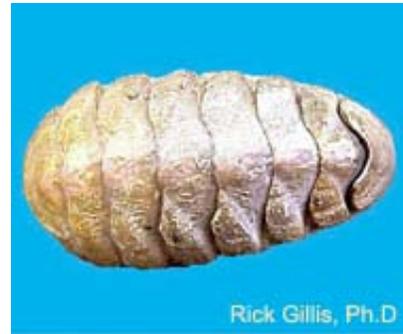
chi-square distribution - a distribution in which a variable is distributed like the sum of the squares of any given independent random variable, each of which has a normal distribution with a mean of zero and a variance of one

chi-square test - a statistical test based on the comparison of a test statistic to a chi-square distribution. It is used to reject or not reject the hypothesis that two or more population distributions do not differ from one another

chimera - the individual produced by grafting an embryonic part of one individual onto an embryo of either the same or of a different species

chitin - a polysaccharide made up of chains of N-acetyl-D-glucosamine, a derivative of glucose. Chitin is structurally very similar to cellulose and serves to strengthen the supporting structures of various invertebrates. It also occurs in fungi

chiton - a marine mollusk of the Subclass Polyplacophora, which contains about 600 species of sedentary animals commonly known as chitons. They are found from shallow waters to depths of about 400 m. A chiton has a broad foot and a shell consisting of eight overlapping plates



A dorsal view of a chiton shell. Chitons are distinguished from all other mollusks by the presence of their convex shell, which is divided into eight articulating plates (valves). (Photo: Rick Gillis, Ph.D., Biology Dept., University of Wisconsin-La Crosse)

chlorocruorin - a greenish iron-containing respiratory pigment dissolved in the blood plasma of certain marine polychaete worms. It may give the green color to the blood of these worms

chlorofluorocarbons (CFC) - gases that can be dissociated by solar radiation, which release chlorine, which in turn destroys ozone

chlorophyll - a green pigment present in green plants and cyanobacteria. Chlorophyll is essential in the transformation of light energy to chemical energy in photosynthesis

chlorophyll a - the major photosynthetic pigment found in all oxygen-evolving photosynthetic organisms (higher plants, and red and green algae)

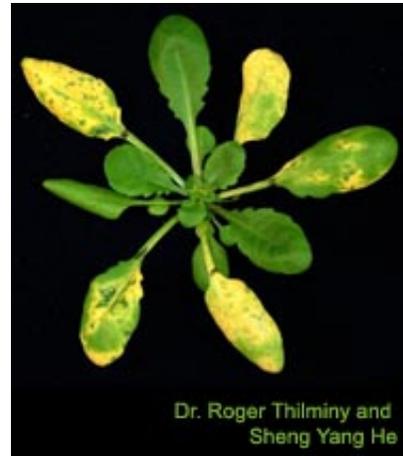
chlorophyll b - the chlorophyll generally characteristic of higher plants and green algae. It is absent in other types of algae

chlorophyll c - the chlorophyll present in brown algae, diatoms, and flagellates

chlorophyll d - the chlorophyll present in red algae, together with chlorophyll a

chloroplast - a disk-like organelle with a double membrane, found in some protists and all green plant cells, that contains chlorophyll and is the site of photosynthesis

chlorosis - the yellowing or bleaching of plant tissues due to the loss of chlorophyll or failure of chlorophyll synthesis. It can be caused by insufficient light or nutrients, and also by certain diseases



Disease symptoms (necrotic lesions surrounded by chlorosis) caused by a bacterial infection. (Photo: Dr. Roger Thilminy and Sheng Yang He, Michigan State University)

choanocyte (collar cell) - a flagellated cell that lines the interior of the central cavity (spongocoel) of a sponge. Choanocytes have a tubular collar with an extended flagellum that faces the spongocoel and creates currents that force water into the interstices of the sponge. Suspended food particles, such as plankton, are trapped by the choanocytes and passed to an amoebocyte that carries the food to other cells

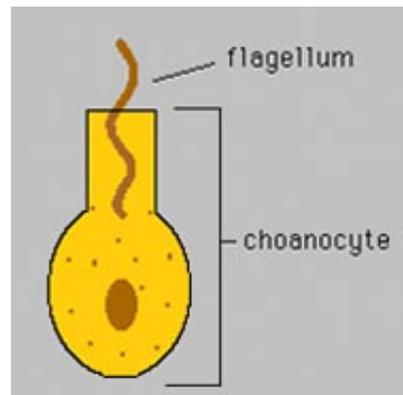


Diagram of choanocyte. The flagella create water currents that bring nutrients into the interior of a sponge. (Diagram: U.S. Environmental Protection Agency)

choanocyte chamber - in sponges, a cavity lined with choanocytes and located between incurrent and excurrent systems

choanoderm - in sponges, a surface lined with choanocytes

choanosome - the internal region of a sponge, including the choanocyte chambers

Chondrichthyes - the class of cartilaginous fishes that includes sharks, rays, skates, and chimaeras. Their skeleton is composed of cartilage, not bone



A manta ray, a member of the class Chondrichthyes. (Photo: NOAA)

Chordata - an animal phylum that includes sea squirts (tunicates), lampreys and hagfishes, fishes, amphibians, reptiles, birds and mammals. Many species of marine chordates play prominent roles in the ecology of coral reef ecosystems



The phylum Chordata includes the mammals such as this large humpback whale (*Megaptera novaeangliae*).

chorion - a thick, vascularized extra-embryonic membrane of amniote embryos that forms around the entire undersurface of the eggshell in birds and reptiles, and in direct contact with the uterine wall in mammals. It unites with the allantois to form the major structure for exchange between the embryo and the outside (birds and reptiles) or the maternal circulation (mammals)

chromatid - each of a pair of identical DNA molecules after DNA replication, joined at the centromere

chromatin - replicated DNA and associated proteins; highly folded ribbon-like complexes of deoxyribonucleic acid (DNA) and a class of proteins called histones; protein/DNA complex making the chromosome

chromatophore - a cell whose cytoplasm contains pigment granules that can be rapidly concentrated or dispersed, producing an overall effect of altering the color, color pattern or tone of the whole or part of an animal



This flounder is rarely noticed unless disturbed because of its remarkable ability to change color to match the substrate, by concentrating or dispersing pigment granules in its chromatophores.

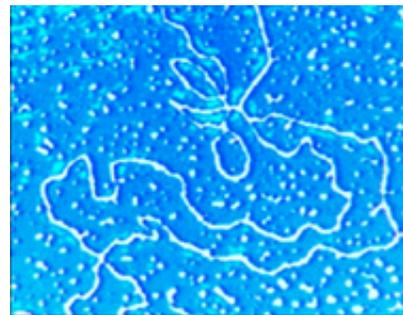
chromoplast - a plastid containing pigments other than chlorophyll, usually yellow or orange carotenoids

chromosomal aberration - any change in chromosome structure or number. Although chromosomal aberrations can be mechanisms for enhancing genetic diversity, such alterations are usually deleterious or ill-adaptive; includes deficiency, duplication, inversion, translocation, aneuploidy, polyploidy, or any other change from the normal pattern

chromosomal deletion - a mutation resulting from the loss of a small segment of DNA

chromosomal mutation - a mutation involving a long segment of DNA. These mutations can involve deletions, insertions, or inversions of sections of DNA. In some cases, deleted sections may attach to other chromosomes, disrupting both the chromosomes that loses the DNA and the one that gains it; any type of change in the chromosome structure or number

chromosome - one of the threadlike "packages" of genes and other DNA in the nucleus of a cell. Different species of organisms have different numbers of chromosomes. In sexually reproducing species, each parent contributes one chromosome of each pair, so offspring get half of their chromosomes from the maternal parent and half from the paternal parent. Bacterial cells do not possess a nucleus, therefore their chromosomes are located in the cellular cytoplasm



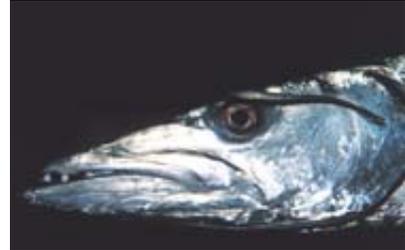
Highly magnified view of cell chromosomes.

chronic - long term or frequently recurring

chronobiology - the field of biology concerned with the timing of biological events, especially repetitive or cyclic phenomena in individual organisms.

chronology - the age-depth relationship in ice, sediment, or another deposit. Ages are usually measured for discrete samples, and the ages of intermediate samples are interpolated between samples with measured ages

ciguatera - a food poisoning of humans caused by eating some species of tropical fishes whose flesh is contaminated with toxins obtained through the food chain



Ciguatera food poisoning may be contracted by eating the flesh of a contaminated barracuda.

ciguatoxin - a toxin found in flesh of marine animals, especially some fishes, at some times, in some localities. It is probably of algal origin and causes paresthesia, gastrointestinal symptoms, neuromuscular blockade, and respiratory paralysis due to interference with membrane function



Barracuda (*Sphyraena sp.*) are often the culprits in ciguatera food poisoning, caused by ciguatoxin. (Photo: Copyright Corel Corporation)

cilia - short, motile, generally microscopic, hairlike projections found on many protists and larvae of some invertebrates. Cilia are used for locomotion, the generation of a current, or filter feeding; A cilium is made up of microtubules and has basically the same internal structure as a flagellum. Movement is caused by the interactions of the microtubules. In higher animals, cilia are found projecting from cells that line certain tubes and passages, such as the tracheae (windpipe) of mammals

ciliary - relating to any cilia or hairlike processes; can relate to muscles concerned with visual focusing

ciliated epithelium - any epithelium having motile cilia on the free surface



Pseudostratified ciliated columnar epithelium - the ciliated epithelium that lines the trachea (windpipe) of mammals. (Photo courtesy of Dr. Franklin S. Carman III, donated from URL: <http://tooldoc.wncc.edu>)

Ciliophora - a group of protists bearing cilia



The stalked ciliate, *Stentor*. (Photo: Jon Houseman/BIODIDAC)

cinclide - one of many blister-like openings in the lower part of the body column of some anemones, through which the animal expels long, thread-like acontia

circadian - being, having, characterized by, or occurring in approximately 24 hour periods or cycles

circadian rhythm - the regular recurrence, in cycles of about 24 hours, of biological processes or activities

circumesophageal nerve ring - anterior concentration of nervous tissue in several invertebrate groups, such as mollusks, annelid worms, sipunculids (peanut worms), and echiurans (spoon worms or innkeeper worms)

cirrus - a slender, flexible appendage or part of an organism, usually having a tactile function

cistron - a DNA sequence that codes for a specific polypeptide; an alternate name for a gene

CITES (Convention on International Trade in Endangered Species) - the 'Washington' Convention on International Trade in Endangered Species of Wild Fauna and Flora, more commonly known as CITES, aims to protect certain plants and animals by regulating and monitoring their international trade to prevent it reaching unsustainable levels. There are more than 150 Parties to the Convention. The CITES Secretariat is administered by the United Nations Environment Programme (UNEP). CITES regulates international trade in over 30,000 species, of which approximately 25,000 are plants

citric acid cycle - see: Krebs cycle

clade - a group of species with a common evolutionary ancestry

cladistics - the systematic classification of groups of organisms on the basis of the order of their assumed divergence from ancestral species

cladogenesis - the evolutionary process whereby one species evolves into two or more species

cladogram - a tree-like diagram, resulting from a cladistic analysis, which depicts a hypothetical branching sequence of lineages leading to the taxa under consideration. The points of branching within a cladogram are called nodes. All taxa occur at the endpoints of the cladogram

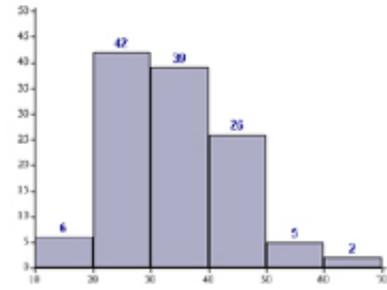
clasper - a rod-like modification of the pelvic fin of a male elasmobranch that is used to transfer sperm into the female during mating



NOAA scientist measuring the length of a ray's clasper.

class - in taxonomy, a category just beneath the phylum and above the order; a group of related orders

class interval - one of the ranges into which data in a frequency distribution table (or histogram) are binned. The ends of a class interval are called class limits, and the middle of an interval is called a class mark. In plotting a histogram, begin by dividing the range of all values into non-overlapping class intervals, in such a way that every piece of data is contained in some class interval



A histogram in which the population of data are grouped into non-overlapping class intervals.

classification - a system of nested hierarchical categories used to efficiently store information about biological diversity

clathrate - resembling an open latticework

clavate - club-shaped

Clean Water Act (CWA) - an act passed by the U.S. Congress to control water pollution. Growing public awareness and concern for controlling water pollution led to enactment of the Federal Water Pollution Control Act Amendments of 1972. As amended in 1977, this law became commonly known as the Clean Water Act. The Act established the basic structure for regulating discharges of pollutants into the waters of the United States. It gave EPA the authority to implement pollution control programs such as setting wastewater standards for industry. The Clean Water Act also continued requirements to set water quality standards for all contaminants in surface waters. The Act made it unlawful for any person to discharge any pollutant from a point source into navigable waters, unless a permit was obtained under its provisions. It also funded the construction of sewage treatment plants under the construction grants program and recognized the need for planning to address the critical problems posed by nonpoint source pollution

cleaning behavior - mutualistic behavior in which larger animals, usually fishes, permit smaller animals, usually other species of fishes or invertebrates, to clean them of external parasites



Pederson's Cleaning Shrimp (*Periclimenes pedersoni*) on a reef in the Virgin Islands. This small (to 1 inch) shrimp favors habitat and a

steady food supply offered by Ringed and Giant Caribbean anemones.

cleaning station - a site visited by fishes where, in a mutually symbiotic relationship, cleaning shrimp or fish remove parasites from their bodies

cleavage - the early mitotic cellular divisions of the fertilized egg (zygote)



A four-cell stage of a cleaving sea urchin embryo. (Photo: Copyright Dr. Leland Johnson, Augustana College, Illinois)

CLEO (Coral Literature, Education & Outreach) - the CLEO project is designed to provide easy access to gray literature and pre-1990's literature on the coral reef environments near the Coral Reef Early Warning System (CREWS) monitoring stations to support education, research and management objectives. The Education modules leverage techniques developed at NOAA/AOML in the Explorer of the Seas, Coral Health and Monitoring and CREWS programs under which knowledge transfer of oceanographic instrumentation and coral reef processes have been developed. Education modules for middle school students engage the students in oceanographic instrumentation, classroom experiments and use of data, and the live Coral Cam observations

climate - long-term characteristics of weather

climate change - the long-term fluctuations in temperature, precipitation, wind, and all other aspects of the Earth's climate. It is also defined by the United Nations Convention on Climate Change as "change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods"

climate variability - changes (variability/trends) in the long-term characteristics of weather

climate-induced bleaching - coral bleaching as a result of changing climate patterns, e.g., temperature

climax - the final stage in ecological succession that is able to persist in the absence of environmental change

cline - the gradual variation, in a character of a species, in geographical space

cloaca - the common passage for fecal, urinary and reproductive discharge in most lower vertebrates

CLOD (Coralline Lethal Orange Disease) - a disease which infects coralline algae

clone - an individual genetically identical to the parent organism, created by the splitting off or budding of cells from the parent organism

clone cells - a group of genetically identical cells all descended from a single common ancestral cell by mitosis in eukaryotes, or by binary fission in prokaryotes. Clone cells also include populations of recombinant DNA molecules all carrying the same inserted sequence of bases

cloned DNA - exact copies of DNA segments prepared by using recombinant DNA technology

cloning - the process of asexual reproduction in an otherwise multicellular organism

cloning vector - DNA molecule originating from a virus, a plasmid, or the cell of a higher organism into which another DNA fragment of appropriate size can be integrated without loss of the vector's capacity for self-replication; vectors introduce foreign DNA into host cells, where the DNA can be reproduced in large quantities. Examples are plasmids, cosmids, and yeast artificial chromosomes; vectors are often recombinant molecules containing DNA sequences from several sources

closed circuit scuba - a diving apparatus which allows divers to re-breathe exhaled air after removal of carbon dioxide and addition of supplemental oxygen. It is not generally used by recreational scuba divers

closed circulatory system - a circulatory system in which blood flows through blood vessels at all times. Blood flows from arteries to capillaries and through veins, but the tissues surrounding the vessels are not directly bathed by blood. Some invertebrates and all vertebrates have closed circulatory systems

cnida - an organelle located in cnidocytes that is capable of eversion

Cnidaria - a multicellular animal phylum, with a tissue grade of construction, that contains the stony (hard) corals, anemones, sea fans, sea pens, hydroids, and jellyfish



An Atlantic coast cnidarian, a dahlia sea anemone (*Tealia sp.*) (Photo: Andy Bruckner)

cnidocyte - a stinging cell of jellyfish, hydroids, sea anemones and corals. The cnidocyte contains the eversible cnida. The most common type of cnidocyte is the stinging structure known as the nematocyst. Nematocysts are located throughout the epidermis, but are especially abundant on the tentacles

cnidosac - a sac located in a ceras of a nudibranch gastropod which contains undischarged nematocysts (obtained through feeding upon cnidarians) passed from the slug's digestive system. When a predator attacks the nudibranch, the nematocysts may discharge as a defensive mechanism



Section through the ceras of *Aeolidiopsis ransoni* showing the cnidosac with three nematocysts. (Photo: Dr. Bill Rudman)

co-management - the sharing of authority, responsibility, and benefits between government and local communities in the management of natural resources

coacervate - an aggregate of colloidal droplets held together by electrostatic forces. Coacervate droplets may contain a mixture of organic compounds. One theory of the evolution of life is that the formation of coacervates in the primeval soup was a step towards the development of cells

coalesce - to come together so as to form one whole; to fuse

coastal area - the areas of land and sea bordering the shoreline and extending seaward through the breaker zone. Coastal areas throughout the world are under enormous environmental stress, which is caused by a wide range of factors, including pollution and the destruction and deterioration of marine habitats



Rainbow over Hawaii, HI coast
(Photo: Dr. James P. McVey, NOAA
Sea Grant Program)

coastal flooding - flooding that occurs from storms where water is driven onto land from an adjacent body of water



A coastal storm leaves flooded
streets in its wake. (Photo: U.S.
Army Corps of Engineers)

coastal reef - a coral reef occurring near and parallel to a coastline

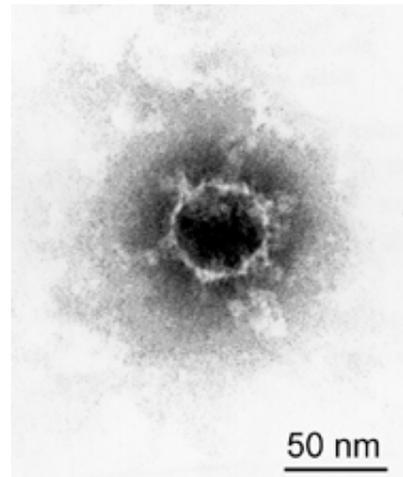
coastal zone - coastal waters and adjacent lands that exert a measurable influence on the uses of the oceans and their living and nonliving resources



Spectacular Oregon coastline. (Photo: Rear Admiral Harley D. Nygren, NOAA Corps)

Coastal Zone Management Act - passed in 1972, the CZMA provides for management of shoreline areas that may include coral reefs

coat protein - the coating protein that encloses the nucleic acid core of a viral particle; the capsid



A single coat protein (capsid) of a cytopovirus surrounded by a loose polyhedrin matrix. (Photo: Dr. Hans Ackermann, Medical Faculty, Laval University, Quebec, Canada)

coccus - a bacterium with a spherical shape



Coccus bacteria. (Photo: Robert W. Bowker, Glendale Community College Glendale, AZ)

COD (Chemical Oxygen Demand) - a measure of the chemically oxidizable material in water which provides an approximation of the amount of organic and reducing material present. The determined value may correlate with biochemical oxygen demand (BOD) or with carbonaceous organic pollution from sewage or industrial wastes

Code - in taxonomy, the International Code of Zoological Nomenclature. An authoritative document containing a system of rules and recommendations to be followed in giving a scientific name to an animal or animal group

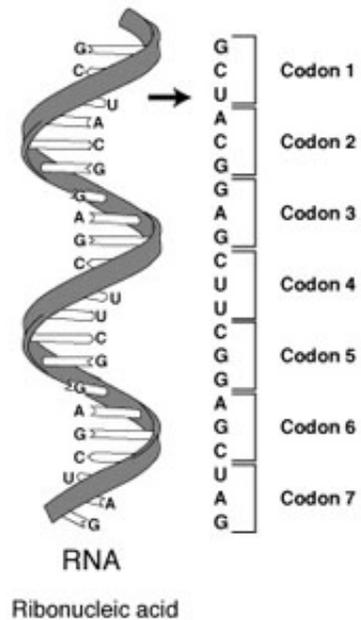
coding - the specification of a peptide sequence by the code contained in DNA molecules

coding region - a sequence of DNA, bounded by start and stop codons, which consists of a series of nucleotide bases that gives rise to mRNA (messenger RNA) that will be translated into the specific amino acids of the protein product

coding sequence - that portion of a gene which directly specifies the amino acid sequence of its protein product

coding strand - the strand of duplex DNA which contains the same base sequence (after substituting Uracil for Thymine) found in the mRNA molecule resulting from transcription of that segment of DNA., known as the sense strand. The mRNA molecule is transcribed from the other strand, known as the template or antisense strand

codon - three bases in a DNA or RNA sequence which specify a single amino acid



RNA codons. A = adenine; C = cytosine; G = guanine; U = uracil.
(Diagram: NIH/Human Genome Project)

coefficient - a number expressing the amount of some change or effect under certain conditions

coefficient of faunal similarity (CFS) - The CFS compares the fauna of one area with that of another. $CFS = \frac{2C}{(a+b)}$, where C = the number of species in common between two areas, a = the number of species in the first area, and b = the number of species in the second area. The higher the CFS, the greater the resemblance

coefficient of variation - in statistics, it refers to the standard deviation of a distribution divided by the distribution's mean, providing a standardized measure of the variation in a distribution, which does not increase simply because the mean itself increases or because the units of measurement change

Coelenterata - an older name for the phylum Cnidaria

coelenteron - the gastrovascular (digestive) cavity of a cnidarian or ctenophore

coelobite - an organism that lives in pores and spaces within a reef

coeloblastula - a larval form associated with oviparous development, with a cytologically undifferentiated central region, and an even distribution of small flagella. Coeloblastulae are found in sponges, brachiopods and other invertebrate groups

coelom - an internal fluid-filled body cavity within a coelomate organism. It lies between the gut and the outer body wall, and is lined entirely with tissue (peritoneum) derived from the mesoderm. Most internal organs are located within the coelom. The structure and development of the coelom is an important taxonomic character for recognizing major groups of animals

coelozoic - living in the lumen of a hollow organ, such as the intestine, gall bladder, urinary tract, etc

coenecium - a branching tubular network inhabited by pterobranch (Hemichordata) colonies that is secreted from glands in the oral shields of the zooids

coenenchyme - all of the mesenchymal tissue, perforated with channels, that is common to all polyps of a colonial cnidarian

coenosarc - the living tissue of a cnidarian polyp, consisting of the outer, nonciliated epidermis and the inner, ciliated gastrodermis with the thin, acellular mesoglea in between. The coenosarc connects the coral polyps of a coral colony. It spreads along the surface of the calcareous exoskeleton

coenosteum - the common surface of corallum between calices

coenosteum pit - the point of insertion or commencement of septa in some corals

coenzyme - an organic nonprotein molecule that binds with the protein molecule to form the active enzyme

coevolution - a change in the genetic composition of one species (or infraspecific group) in response to a genetic change in another, i.e. two or more species evolving, each in response to the other

cofactor - a nonprotein substance required for certain enzymes to function. Cofactors can be co-enzymes or metallic ions

cohort - individuals all of the same age

coliform bacteria - bacteria whose presence in water is an indicator of pollution and of potentially dangerous contamination



A coliform-caused fish kill. Fecal coliforms originate from sewer overflows, septic tank seepage and animal defecation. They are indicators of fecal contamination which could also contain bacteria and viruses responsible for cholera and typhoid infections, hepatitis and gastroenteritis. (Photo: Pine River Shire Environmental Services, Australia)

collagen - the protein substance of the collagenous fibers (white fibers) of skin, tendon, bone, cartilage and all other connective tissue. Collagen also serves as skeletal support in some sponges

collagenous - producing or containing collagen

collagenous fiber - white connective tissue fiber that occurs in bundles. They possess a high tensile strength and make up the principal element of irregular connective tissue, tendons, and aponeuroses, and occur in the matrix of cartilage and bone tissue

collection - an assemblage of specimens compiled and maintained for purposes of study and/or display

collenchyme - in cnidarians, mesenchyme with sparse cellular components

collencytes - a contractile, collagen-secreting amoebocyte in sponges

colloblast - a cell that discharges a sticky filament upon contact with a prey organism. Colloblasts are found in the tentacles of ctenophores (comb jellies). As the tentacles are dragged through the water, the colloblasts discharge and capture prey



Colloblast discharge organ of ctenophorans (comb jellies). (Image: Livingstone, Copyright BIODIDAC)

colloid - a stable suspension of particles that, though larger than in a true solution, do not settle out

colonial coral - a coral composed of many individuals

colonization - a movement of individuals or propagules of a species to a new territory

colonized hardbottom - a substrate formed by the deposition of calcium carbonate by reef building and other organisms. Habitats within this category have some colonization by live coral

colony - a group of the same kind of animals, plants, or one-celled organisms living or growing together

columella - any small column-like structure in various plants and animals, often forming the central axis of development for the organism as a whole, or an anatomical structure; the thickened axial pillar around which the whorls of gastropods are constructed; the central axis of a corallite; the central structure of the calyx formed by fusion of the septa



The columella inside a *Strombus* oyster drill. (Photo: Jesuit Dallas Museum)

columnar - column-shaped

columnar colony - a coral colony formed into one or more columns

comb row - a longitudinal line of ctenes on the epidermis of ctenophores (comb jellies)

CoML (Census of marine Life) - a global network of researchers in more than 45 nations engaged in a ten-year initiative to assess and explain the diversity, distribution, and abundance of marine life in the oceans—past, present, and to explain how it changes over time

commensal - having benefit for one member of a two-species association but neither positive nor negative effect on the other

commercial extinction - the decline in the population of a wild species, used as a resource, to a level where it is no longer profitable to harvest the species

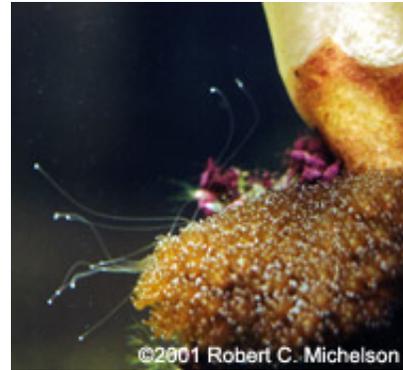
communication network - telecommunications infrastructure that transfers data from observing systems to data centers, and then to end users

community - a naturally occurring assemblage of organisms that live in the same environment and are mutually sustaining and interdependent; a group of populations that interact in time and space

compact branching - a growth pattern where the coral branches are close together

compensation depth - the depth in the ocean at which the difference between the oxygen produced by algae through photosynthesis and that consumed by them through respiration is zero, i.e., net oxygen production is zero

competition - a biological interaction that can limit population growth. Competition occurs when two or more populations vie for the same limited resource



Sweeper tentacles from a *Galaxia* colony. The stinging cells kill neighboring "non-self" corals in the competition for space. Mesenterial filaments which dissolve neighboring non-self corals are another means of competitive tactics by scleractinian corals. (Photo: Copyright 2001 Robert C. Michelson)

competitive exclusion - the principle that when the populations of two species compete for resources, one will use the resources more efficiently, therefore outcompete and eventually eliminate the other population

competitive release - the expansion of a species' ecological niche, associated with the lack of competition with other species

complement - the complement of a nucleic acid sequence replaces each base by its complementary base: adenine (A) by thymine (T), cytosine (C) by guanine (G), and vice versa. In RNA, adenine is paired not with thymine but with uracil (U)

complementarity - the relationship between the two strands of a double helix of DNA. Thymine in one strand pairs with adenine in the other strand, and cytosine in one strand pairs with guanine in the other strand

complementary base pair - the specific matching of purine and pyrimidine base pairs in nucleic acids. This matching occurs because the structure of one base precisely fits with, and bonds to, another specific base. In DNA, adenine and thymine are complementary and form a base pair, as do cytosine and guanine. In pairing between DNA and RNA, adenine and uracil are complementary, and cytosine and guanine are complementary

complementary nucleotide - a member of the pairs adenine-thymine, adenine-uracil, and guanine-cytosine that have the ability to hydrogen bond to one another

complementary resources - a pair of resources for which consumption by the consumer of one resource reduces its requirement for the other

complete protein - a protein that has all of the essential amino acids and in the correct proportions

compound - a material made up of two or more elements combined in a fixed ratio

compound chromatophore - a chromatophore that contains more than one kind of pigment

compound eye - the eye of arthropods, most highly developed in insects and crustaceans. It consists of a group of functionally related visual elements (ommatidia), each having its own refractive system and each forming a portion of an image

compressed - a body shape which is flattened laterally, bringing the right and left sides closer together, e.g., a butterfly fish or a flounder



The compressed body shape of a garibaldi. (Photo: Copyright Corel Corporation)

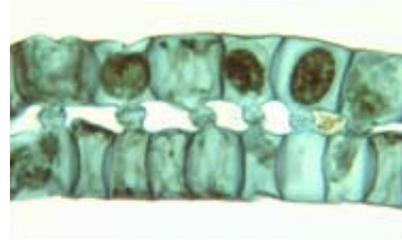
compressed air - air compressed to a pressure higher than the surrounding atmospheric pressure (ambient pressure)

confidence interval - the probability, based on statistics, that a number will be between an upper and lower limit

congenor - a member of the same genus

conjugated protein - a protein complex combining amino acids with other substances

conjugation - a process of sexual reproduction whereby two cells come in contact and exchange genetic material. In prokaryotes and unicellular algae, the transfer is a one-way process. The union of two bacterial cells, during which chromosomal material is transferred from the donor to the recipient cell. Conjugation in protozoans is a two-way process, genetic material is passed between each conjugant



Spirogyra is a filamentous green alga. Certain filaments in a loose parallel bundle of *Spirogyra* assume the female role, and others the male. The cells of adjacent filaments develop tubular extensions which grow towards one another and eventually fuse to form a continuous tube between the cells. Meanwhile the contents of each cell have formed a round sphere. The spheres from the male filament squeeze their way down the connecting tubes to fuse with a sphere of the female cell in the other filament. The result of this sexual union is the formation of a zygote (zygospore) within the chambers of the female filament. After a dormant period, the zygotes undergo meiosis and germinate, resulting in new filaments. (Photo: Wappinger Schools)

Conservation - under the NOAA Coral Reef Conservation program, the term 'conservation' means the use of methods and procedures necessary to preserve or sustain corals and associated species as diverse, viable, and self-perpetuating coral reef ecosystems, including all activities associated with resource management, such as assessment, conservation, protection, restoration, sustainable use, and management of habitat; mapping; habitat monitoring; assistance in the development of management strategies for marine protected areas and marine resources consistent with the National Marine Sanctuaries Act (16 U.S.C. 1431 et seq.) and the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1801 et seq.); law enforcement; conflict resolution initiatives; community outreach and education; and that promote safe and ecologically sound navigation

conservation - the political/social/economic process by which the environment is protected and resources are used wisely

conservation biology - a multidisciplinary science that deals with the conservation of genes, species, populations, communities, and ecosystems that make up the Earth's biodiversity. Its goals are to investigate human impacts of biodiversity and to develop approaches to prevent extinction of species through stewardship of entire biological communities

consexual - of the same sex

conspecific - of the same species

consumer - an organism which must consume other organisms (living or dead) in order to satisfy its energy needs

contaminant - an undesirable substance not normally present, or an usually high concentration of a naturally occurring substance in the environment; a substance in water that might adversely affect the health and welfare of the biota

Content Standard for Digital Geospatial Metadata - provides a common set of terminology and definitions for the documentation of digital geospatial data. The standard establishes the names of data elements and compound elements (groups of data elements) to be used for these purposes, the definitions of these compound elements and data elements, and information about the values that are to be provided for the data elements

continental margin - the water-covered edges of continents consisting of the continental shelf, the continental slope, and the continental rise

continental rise - the enormous wedge of sediment deposited at the base of the continental slope

continental shelf - the shallow, near-horizontal sea floor extending from the coast to the upper continental slope

continental slope - the sloping sea bottom of the continental margin that begins at a depth of about 100 to 150 m at the shelf edge and ends at the top of the continental rise or in a deep-sea trench

contour - on a map or chart, a line connecting points of equal surface value

contour interval - the difference in surface values between contours

controlled environment - the environment in which parameters, such as light, temperature, salinity, etc., are fully controlled

controlled experiment - a scientific experiment, in which results from an experimental group with variable conditions, is compared with a control group with nonvariable conditions

convection current - a movement of air or water caused by changes in density or thermal gradients

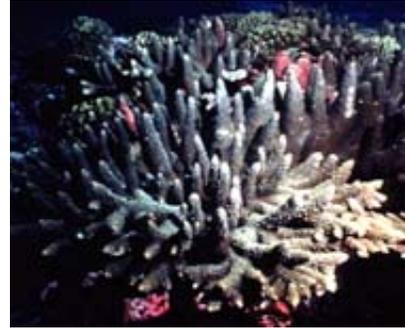
convergence - come together and meet at a point

convergent evolution - the development of superficially similar structures in unrelated organisms, e.g., the wings of insects and birds

copepodid - postnaupliar developmental stages of copepods

coprophagous - pertains to feeding on fecal matter

coral - a general term used to describe a group of cnidarians; indicates the presence of skeletal material that is embedded in the living tissue or encloses the animal altogether



Finger coral (*Porites compressa*) in Hawaii (Photo: M. White)

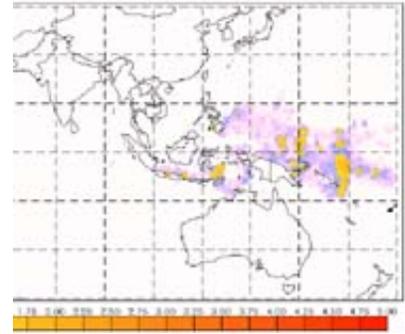
coral assemblage - a group of corals

coral bleaching - the process in which a coral polyp, under environmental stress, expels its symbiotic zooxanthellae from its body. The affected coral colony appears whitened



Bleached *Acropora* coral in Florida Keys (Photo: Larry Benvenuti)

coral bleaching hotspot - a region of sea surface temperature (SST) that exceeds the climatological maximum for a region by 1 deg C or more. These conditions may cause sufficient stress to coral reefs to result in coral bleaching



Section of a graphic depicting areas of elevated ocean temperatures that may result in coral bleaching events.

Coral Bleaching HotSpot monitoring program - a NOAA program that uses satellite and in situ monitoring stations to monitor high sea surface temperature events and to analyze conditions that may lead to coral bleaching

coral growth line - a minute growth line on the outer surfaces of corals that have a calcified outer wall. The carbonate is produced by zooxanthellae which create a series of diurnal growth increments

Coral Parks Program (CPP) - a global initiative that supports existing Coral Parks, assists in the establishment on new Coral Parks, and engages divers and the dive industry in coral reef protection. CPP is an initiative of The Coral Reef Alliance, a non-profit organization dedicated to keeping coral reefs alive around the world

coral product - any living or dead specimens, parts, or derivatives, or any product containing specimens, parts, or derivatives, of any species of coral in the cnidarian Orders: Antipatharia (black corals), Scleractinia (stony corals), Gorgonacea (horny corals), Stolonifera (organpipe corals and others), Alcyonacea (soft corals), and Coenothecalia (blue coral), of the Class Anthozoa; and all species of the Order Hydrocorallina (fire corals and hydrocorals) of the Class Hydrozoa

coral reef - a wave-resistant structure resulting from cementation processes and the skeletal construction of hermatypic corals, calcareous algae, and other calcium carbonate-secreting organisms

Coral Reef Alliance (CORAL) - CORAL promotes coral reef conservation around the world by working with the dive industry, governments, local communities and other organizations to protect and manage coral reefs, establish marine parks, fund conservation efforts, and raise public awareness with the mission to keep coral reefs alive for future generation

coral reef bleaching monitoring product - near real-time information derived from data either from satellite images or in situ monitoring stations at coral reef areas to help improve and sustain coral reef health throughout the world

Coral Reef Watch - see CRW (Coral Reef Watch) Program

coral rock - products used in the aquarium trade. Coral rock is consolidated material, greater than 3 cm in diameter, formed of fragments of dead coral and which may also contain cemented sand, coralline algae and other sedimentary rocks. 'Live rock' describes pieces of coral rock to which are attached live specimens of invertebrate species and coralline algae



Coral rock for sale in the marine aquarium trade. (Photo: Shell Horizons, Inc.)

Coral Stress Index - an index that indicates the relative accumulated thermal stress experienced by a given coral reef

Corallimorpharia - an order of the subclass Zoantharia (Hexacorallia) of the phylum Cnidaria. They are mostly solitary species (some are colonial) that resemble true corals, but lack a calcareous skeleton

coralline algae - algae that form solid calcium carbonate accretions



Coralline algae remove calcium from water. This calcium carbonate gives them a coral-like look. As they die, they turn white. (Photo: Nancy Sefton)

corallite - a coral cup; the skeleton of an individual polyp

corallivore - an organism that eats coral



Parrotfish are often corallivorous, scraping the coral polyps with beaklike jaws.

corallum - a complete coral colony; a coral head

CORDIO (Coral Reef Degradation in the Indian Ocean) - CORDIO is an international program created to respond to the degradation of coral reefs throughout the Indian Ocean. In the western Indian Ocean region coral reefs are key ecosystems that support large sectors of the countries' populations and economies, through artisanal fisheries, tourism and large-scale investments. Projects within CORDIO focus on determining a) the biophysical impacts of coral degradation as a result of bleaching and other disturbances, and the long term prospects for recovery, b) the socio-economic impacts of coral mortality and options for mitigating these through management and development of alternative livelihoods, and c) the prospects of restoration and rehabilitation of reefs to accelerate the ecological and economic recovery.

COREMO 2 - a data entry and analysis program developed by the southern Indian Ocean Global Coral Reef Monitoring Program (GCRMN) node. It is based on ARMDDES (AIMS Reef Monitoring Data Entry System) but has been extensively modified from COREMO to suit the needs of the GCRMN

correlate - to show a relationship between entities

correlation - a relation between a variable and one or more related variables

correlation coefficient - a measure of the relationship between variables

correlogram - a graph illustrating the auto-correlations between members of a time series (vertical axis) for different separations in time (horizontal axis)

corrugated - having a surface with alternating parallel ridges and grooves

cortex - the outer portion (layer) of an organ

CoRViL (Coral Reef Virtual Laboratory) - a joint venture of the National Oceanic and Atmospheric Administration (NOAA), the Great Barrier Reef Marine Park Authority (GBRMPA), and the Australian Institute of Marine Science (AIMS). This venture will provide an automated, cooperative exchange of electronic data, computer processing power and remote sensing tools for the purpose of monitoring the coral reef environment on the Great Barrier Reef. It is anticipated that this effort will eventually provide a model for monitoring physical processes at other sensitive coral reef areas throughout the world

corymbose - describes coral colonies with horizontal interlocking branches and short upright branches

cosmid - a DNA vector that allows the insertion of long fragments of DNA (up to 50 kbases)

cosmopolitan - having a global distribution

cosmopolitan distribution - worldwide distribution within habitat limits

cost-benefit analysis - an assessment of the short-term and long-term costs (losses) and benefits (gains) that arise from an economic decision. If the calculated benefits exceed the calculated costs, the decision to buy an economic good or provide a public good is considered profitable

costa - the extension of the septa outside the calyx into the coenosteum

Coulter counter - an instrument that measures particle size distribution from the change in electrical conductivity as particles flow through a small opening



A Coulter counter is an instrument used to measure the distribution of particle size.

counter shading - protective body coloration where the dorsal surface (above) is dark and the ventral surface (below) is lighter



Counter shading in a white shark. The darker dorsal surface and lighter ventral surface allows the shark to blend in with the environment when viewed from above or below. (Photo: NOAA)

covalence - the number of pairs of electrons an atom can share with other atoms

covalent bond - a bond between two or more atoms that is provided by electrons that travel between the atoms' nuclei, holding them together but keeping them a stable distance apart

craterform - massive shape with a broad base and a large, central depression

creel survey - a survey of anglers in a particular area to discover the types and numbers of fish caught

CREIOS (Coral Reef Ecosystems Integrated Observing System) - The Coral Reef Ecosystem Integrated Observing System (CREIOS) will provide a diverse suite of long-term ecological and environmental observations and information products over a broad range of spatial and temporal scales. The CREIOS goal is to understand the condition and health of, and processes influencing, coral reef ecosystems, to assist stakeholders in making improved and timely ecosystem-based management decisions to conserve coral reefs

crenulate - a shape in which the edge is slightly scalloped

crepuscular - most active at low light levels during dusk and dawn



The large eyes of a squirrelfish hint about its crepuscular behavior, allowing it to be active and feed

during periods of diminished light.
(Photo: Copyright Corel Corporation)

CREWS (Coral Reef Early Warning System) - *in situ* NOAA meteorological and oceanographic monitoring sites that collect data continuously which are transmitted hourly via satellite to a data archival site. An automated system (hardware and software) that monitors select oceanographic and meteorological parameters and produces specialized alerts when conditions may result in environmental stresses conducive of coral bleaching. NOAA plans to expand the CREWS from the Florida Keys/ Bahamian sites to many remote coral reef sites throughout the world



A CREWS station on site.

criterion - a standard rule or test on which a judgment or decision can be based.

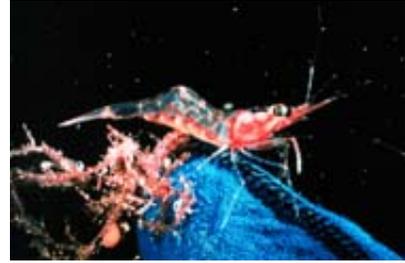
critical depth - the depth in seawater below which carbon loss through respiration by phytoplankton exceeds carbon gain through photosynthesis; no net phytoplankton production occurs

critical value - in statistics, the value of a test statistic at or beyond which the null hypothesis is rejected

cross - in genetics, the mating of two individuals or populations

crossing over - in genetics, the breaking during meiosis of one maternal and one paternal chromosome, the exchange of corresponding sections of DNA, and the rejoining of the chromosomes. This process can result in an exchange of alleles between chromosomes

Crustacea - a subphylum of Arthropoda that includes shrimp, mantis shrimp, lobsters, crabs, water fleas, copepods, crayfish and wood lice. There are almost 40,000 described species of crustaceans. The Crustacea are mainly aquatic, but include some semi-terrestrial and terrestrial groups



A marine shrimp (Crustacea).

crustose - grows flat along the substrate; crust-like

crustose coralline algae - crustose coralline algae are red algae of the division Rhodophyta. They are very important members of a reef community in which they cement and bind the reef together. They are particularly common in high wave energy areas but can also be found throughout all reef zones. Crustose corallines resemble pink or purple pavement. Morphology can range from smooth and flat, to rough and knobby, or even leafy



Crustose coralline algae are very common on reefs. (Photo: <http://www.botany.hawaii.edu>)

CRW (Coral Reef Watch) program - formed in 2000, NOAA's CRW maximizes NESDIS's coral reef resources by joining and building on existing NESDIS coral reef strengths under a more coordinated program. It seeks to develop a long-term coral reef monitoring system with the ability to predict coral bleaching episodes in all major U.S. coral reef areas

cryptic - protective camouflage coloration where the individual resembles its background

cryptic - pertaining to concealment, usually in reference to color pattern or behavior (e.g., hiding in reef crevices)



The viper moray is a cryptic fish, concealing itself in crevices and holes in the coral reef. (Photo: Dr. Anthony Picciolo)

cryptobiosis - a suspension of life processes when conditions become unfavorable. In these resistant states some animals, such as nematodes, rotifers and tardigrades, as can survive extreme drying, heat, or cold, and then return to "life" when favorable conditions return

cryptogenic - of obscure or unknown origin

cryptogenic species - species whose endemic or alien status is unclear. For many species, data are lacking on their original geographic distribution, and it cannot be determined whether they are native or introduced into a particular location

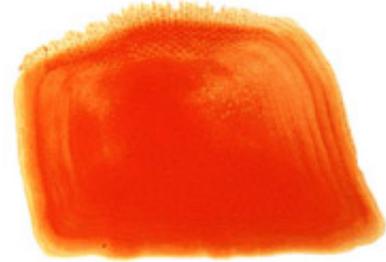
ctene - the locomotor structure of ctenophores (comb jellies) made up of cilia arranged into flattened plates. The ctenes are arranged into eight longitudinal bands, from the aboral to the oral surface



Light refracts off the ctenes of the comb-jelly *Mertensia ovum* producing stripes of rainbow color. (Photo: Kevin Raskoff, MBARI.)

ctenidium - a comb-like structure; the respiratory organ of a mollusk (ctenidial gill)

ctenoid - comb-shaped; with a comb-like margin



Rick Gillis, Ph.D

A ctenoid scale of a bony fish. It is thought that the combed edge helps to reduce hydrodynamic drag during swimming. (Photo: Rick Gillis, Ph.D., Biology Dept., University of Wisconsin-La Crosse)

ctenophore - a member of the animal phylum Ctenophora. A small phylum (about 50 species) whose members, known as comb jellies and sea walnuts, superficially resemble jelly fishes. These planktonic organisms are thought to have evolved from a medusoid cnidarian

cue - in animal behavior, a signal from one animal which acts as a stimulus to elicit a behavioral response in another. The cue may be visual, acoustic, or chemical

culture - a population of plant or animal cells or microorganisms that is grown under controlled conditions

culture medium - a substance which contains nutrients and a favorable environment for the *in vitro* growth of microorganisms and cells

curvilinear relationship - a situation that is best represented by something other than a straight line

cutaneous - pertaining to the skin

cuticle - an extracellular, protective external body covering, secreted by the epidermis, of some invertebrate animals, usually composed of fibrous material, such as chitin or collagen; the waxy layer of epidermal cells of plant parts, such as leaves, stems, and fruit

cyanide fishing - a destructive fishing technique in which sodium cyanide or some other cyanide compound is used to stun and capture coral reef fishes for the aquarium and live food trade

cyanobacteria - photosynthetic aquatic bacteria, often called blue-green algae, but have no relationship to algae. Cyanobacteria get their name from the bluish pigment phycoerythrin, which they use to capture light for photosynthesis. They also contain chlorophyll a, the same photosynthetic pigment found in the chloroplasts of plants. Not all "blue-green" bacteria are blue; some common forms are red or pink, resulting from the pigment phycoerythrin



A bloom caused by cyanobacteria (-blue-green algae+).

cycloid - having a smooth-edged margin

cyclosystem - a system of very small tubules that links the polyps of calcareous colonial hydrozoans

cydippid larva - a larva of ctenophores

cystid - the exoskeleton and body wall of the stationary trunk of bryozoans

cytogenetics - the science that links the study of inheritance (genetics) with that of cells (cytology) and is concerned mainly with the study of the structure, and function of chromosomes

cytokinesis - the division of the cytoplasm of a cell during cell division

cytology - the study of the structure and function of cells

cytoplasm - the protoplasm of a cell exclusive of that of the nucleus. It consists of a continuous aqueous solution (cytosol) and the organelles and inclusions suspended in it. The cytoplasm is the site of most of the chemical activities of the cell

cytoplasmic genes - DNA-containing bodies in the cell but external to the nucleus

cytoplasmic inheritance - inheritance via genes found in cytoplasmic organelles, e.g., mitochondria, rather than the nuclear genes; inheritance via the maternal lineage; extrachromosomal inheritance

cytosine - one of the four nitrogenous bases in DNA that make up the letters ATGC. Cytosine is the "C". The others are adenine, guanine, and thymine. Cytosine always pairs with guanine

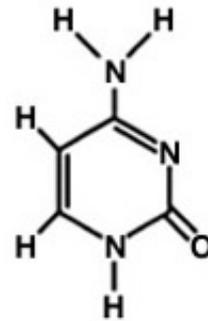


Diagram of the chemical structure of cytosine, one of the four nitrogenous bases in DNA.

cytoskeleton - the network of microtubules, microfilaments, and larger filaments that provides a eukaryotic cell with its structural support, shape, and its capacity to move and arrange its organelles within the cell

cytosol - the fluid, less structured part of the cytoplasm of a cell, excluding organelles and membranous structures; the portion of the cytoplasm which remains after removal of particulate components

cytotoxic - able to cause cell death

CZCS (Coastal Zone Color Scanner) - a scanning radiometer with six spectral channels centered at 0.443, 0.520, 0.550, 0.670, 0.750 and 11.5 micrometers and selected to allow measurement of ocean color and temperature, suspended sediment and chlorophyll concentrations, and ocean pollutants

dactylozoid - a colonial hydrozoan polyp that possesses a large, nematocyst-bearing fishing tentacle, and functions in defense and in food capture

Dalton's Law - the total pressure exerted by a mixture of gases is the sum of the pressures that would be exerted by each of the gases if it alone were present and occupied the total volume

dark-field microscope - a microscope that has a special condenser and objective with a diaphragm that scatters light from the observed object. The object appears bright on a dark background

dark-spots disease - a coral disease characterized by darkly pigmented areas of tissue on stony corals. -At present, there is no known pathogen. The coral tissue remains intact, although at times lesions and coral tissue death are observed in the centers of the pigmented areas. Tissue loss is minimal, if present. This disease is widespread throughout the Caribbean. -For additional information and illustrations, see: http://www.coral.noaa.gov/coral_disease/dark_spots.shtml



Dark spots disease infecting *Stephanocoenia intersepta*. (Photo: NOAA; image copyrighted)

Darwin Mounds - two areas of hundreds of sand and cold-water coral mounds at depths of about 1,000 m, in the northeast corner of the Rockall Trough, approximately 185 km northwest of the northwest tip of Scotland. The Darwin Mounds cover an area of approximately 100 sq. km. The tops of the mounds are covered with *Lophelia pertusa* corals and coral rubble

data - multiple facts (usually but not necessarily empirical) used as a basis for inference, testing, models, etc.; the word is plural (sing. datum) and takes a plural verb

data management - the act, process, or means by which data are managed. This includes the planning, collection, compilation, archival, safe-guarding, listing, organization, extraction, retrieval, manipulation, and dissemination of data

data mining - an information extraction activity whose goal is to discover hidden facts contained in databases. Using a combination of machine learning, pattern recognition, statistical analysis, modeling techniques and database technology, data mining finds patterns and subtle relationships in data and infers rules that allow the prediction of future results

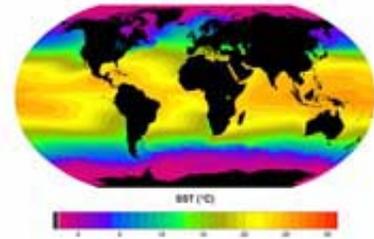
data warehouse - a database, frequently very large, that can access vast arrays of heterogeneous data, stored within a single logical data repository, that are accessible to different querying and manipulation methods. While the warehouse can be distributed over several computers and may contain several databases and information from numerous sources in a variety of formats, it should be accessible through a server. Thus, access to the warehouse is transparent to the user, who can use simple commands to retrieve and analyze all the information. The data warehouse also contains data about how the warehouse is organized, where the information can be found, and any connections between data. Frequently used for decision support within an organization, the data warehouse also allows the organization to organize its data, coordinate updates, and see relationships between information gathered from different parts of the organization

database - a structured file of information or a set of logically related data stored and retrieved using computer-based means

database management system (DBMS) - a set of computer programs for organizing the information in a database. A DBMS supports the structuring of the database in a standard format and provides tools for data input, verification, storage, retrieval, query, and manipulation

daughter cell - one of the two cells formed by the division of a parent cell

Day/Night SST - observations of sea surface temperature obtained during both daytime and nighttime orbits from the Advanced Very High Resolution Radiometer (AVHRR) on NOAA's polar satellite



1985-2000 average sea surface temperature from AVHRR Pathfinder.

decadal - refers to a climatic process that re-occurs every decade or once every few decades

decapod crustacean - a members of the Order Decapoda, Class Malacostraca, Superclass Crustacea, Phylum Arthropoda; has five pairs of thoracic legs. Examples are shrimps, lobsters, crabs, and hermit crabs



A spider crab is a decapod crustacean.

decibel - a logarithmic scale used to denote the intensity (loudness), of a sound relative to the threshold of human hearing. A step of 10 dB is a 10-fold increase in intensity or sound energy

decomposer - a heterotrophic organism that breaks down dead biological matter and uses some of the products and releases others for use by consumer organisms

decomposition - the breakdown of organic matter by bacteria and fungi

decompression - a change from one ambient pressure to a lower ambient pressure as the scuba diver ascends. Decompression also occurs in a decompression chamber. Decompression results in a reduction of gas pressures within the body

decompression chamber - a hyperbaric steel enclosure used to treat victims of decompression sickness (the "bends") in which the air pressure is first gradually increased and then gradually decreased. This shrinks the nitrogen bubbles and allows the nitrogen to safely diffuse out of the victim's tissues



A NOAA decompression chamber.

decompression dive - any dive where the scuba diver is exposed to a higher pressure than when the dive began. Decompression occurs as the diver ascends

decompression diving - scuba diving that requires in-water stops during ascent to the surface to allow off-gassing of nitrogen

decompression sickness (the bends) - a dangerous and potentially lethal condition of divers precipitated by rapid changes in ambient atmospheric pressure, mostly in rapid ascent from underwater, but can also result from flying in an aircraft too soon after a dive. It occurs because at high pressures (such as SCUBA divers experience while underwater) the blood can contain more dissolved nitrogen than at lower pressures. When the diver ascends too rapidly, the blood can no longer contain this dissolved nitrogen and tiny gas bubbles begin to form in the blood. Symptoms include: body pain (mainly in the joints), headache, confusion, itchy skin rash, visual disturbances, weakness or paralysis, dizziness, or vertigo. Treatment involves the administration of oxygen and placing the patient into a decompression chamber until the nitrogen bubbles shrink and safely diffuse from the tissues

decompression stop - a specified time spent at a specific depth as a scuba diver ascends from a dive for purposes of releasing nitrogen gas from the tissues (nitrogen off-gassing)



These NOAA divers are making a decompression stop to allow nitrogen to escape from their tissues. (Photo:

deductive reasoning - an inference in which the conclusion about particulars follows necessarily from general theory. In science, deductive reasoning would involve stating an hypothesis first, and then trying to find facts that reject the hypothesis

deep fore reef - the deepest seaward part of a coral reef; a vertical cliff beginning at a depth of about 60 m

deep scattering layer - a thin sound-reflecting layer of zooplankton and nekton that ascends toward the surface at night and descends each day (diurnal vertical migration) in response to changing levels of light

deep-sea corals - stony, soft, gorgonian, black, and horny corals that inhabit the colder deep waters of continental shelves and offshore canyons, ranging from 50 -1000m+ depths. They lack zooxanthellae and may build reef-like structures or occur solitarily



Lophelia pertusa, a deep-sea stony coral.

definitive host - in a parasite's life cycle, it is the host organism in which the parasite reproduces sexually

deforestation - the removal of trees from a habitat dominated by forest

degeneracy - in relation to the genetic code, more than one codon can code for the same amino acid

Degree Heating Week (DHW) - the NOAA satellite-derived Degree Heating Week (DHW) is an experimental product designed to indicate the accumulated thermal stress that coral reefs experience. A DHW is equivalent to one week of sea surface temperature 1 deg C above the expected summertime maximum. For example, 2 DHWs indicate one week of 2 deg C above the expected summertime maximum

Degree Heating Week accumulation - accumulated thermal stress that coral reefs experience over a typical 12-week period

degrees of freedom - in statistics, the number of independent comparisons that can be made between the members of a sample; in a contingency table it is one less than the number of row categories multiplied by one less than the number of column categories. The number of degrees of freedom is defined as the number of observations that can be chosen freely, i.e., an estimate of the number of independent categories in a particular statistical test or experiment

delayed fertilization - when fertilization of an egg does not occur immediately following introduction of spermatozoa into the female reproductive tract, but may be delayed for weeks or months

delta notation - the absolute abundance of an isotope is difficult to measure with accuracy. Therefore, we compare isotopic ratios in a sample with those in a standard resulting in the delta-notation: $d(x) = \left[\frac{R_x - R_{st}}{R_{st}} \right] \times 1000$, where $d(x)$ is the delta-value of a sample, R_x and R_{st} are the isotopic ratios in sample (R_x) & standard (R_{st}). The d -value is the relative difference in the isotopic ratio of the sample and the standard. It is expressed in part per mille (‰); that is why the right-hand side of the equation is multiplied by 1000 (1000). Carbon and oxygen data from carbonates are usually referred to the PDB standard (a belemnite, *Belemnitella americana*, from the Late Cretaceous PeeDee Formation in South Carolina)

deme - a local interbreeding population of a species

demersal - pertains to an organism that is essentially bottom living but may feed and swim in the water column

demography - the rate of growth and the age structure of populations, and the processes that determine these properties

denaturation - the inducing of structural alterations that disrupt the biological activity of a molecule. It often refers to breaking hydrogen bonds between base pairs (by heat) in double-stranded nucleic acid molecules to produce single-stranded polynucleotides, or altering the secondary and tertiary structure of a protein, destroying its activity

dendriform - having a structure that resembles a tree or shrub

dendrite - a sensory branch of a neuron that carries a nervous impulse to the cell body

dendritic - branched like a tree



Black coral is dendritic in shape.
(Photo: Waikiki Aquarium)

dendrogram - a branching tree-like diagram used to represent phylogenetic paths of evolution

denitrification - the formation of gaseous nitrogen and/or nitrogen oxides from nitrate or nitrite by denitrifying bacteria during anaerobic respiration

denitrify - to remove nitrogen from any substance or chemical compound

denitrifying bacteria - anaerobic bacteria in soil or water that use the nitrate ion as a substitute for molecular oxygen during their metabolism. The nitrate is reduced to nitrogen gas (N_2), which is lost to the environment during the process

deoxyribonucleic triphosphates - unreactive nucleotides that closely resemble the nucleotides that make up DNA. They are 'dummy' nucleotides that act as placeholders when DNA is sequenced

depauperate - an area poor in species richness and/or biodiversity; an impoverished habitat

dependent variable - the variable being measured

deposit - material left in a new position by a natural transporting agent, such as water, wind, ice, or gravity, or by human activity

deposit feeder - an animal that feeds on nutrients in the sediments

depressed - a body shape which is flattened dorso-ventrally, e.g., a ray, skate, monkfish

derived character - in evolution, an advanced trait which only appears in some members of a taxonomic group. For example, a derived character for some mammals would be the loss of the tail, which occurs in the great apes and man. Another derived character is the presence of feathers in birds. Scales are the ancestral feature. Derived characters are also called apomorphies

designated Use - classification specified in water quality standards for each waterbody or segment describing the level of protection from perturbation afforded by the regulatory programs. The designated aquatic life uses established by the state or authorized tribes set forth the goals for restoration and/or baseline conditions for maintenance and prevention from future degradation of the aquatic life in specific waterbodies

determinate cleavage - cleavage resulting in blastomeres each capable of developing only into a particular embryonic structure, not into a complete organism

detritus - the particulate decomposition or disintegration products of plankton, including dead cells, cell fragments, fecal pellets, shells, and skeletons, and sometimes mineral particles in coastal waters



Low tide along South Carolina shoreline with bits of sea shells and other detritus (Photo: Richard B. Mieremet, NOAA)

detrivore - an animal that eats detritus

deuterostome - one of two distinct evolutionary lines of coelomates, consisting of the echinoderms and chordates and characterized by radial cleavage of the early embryo. The cleaving cells are indeterminate (if early embryonic cells are separated, each one develops into a complete organism). The anus develops from the blastopore

development - the chronological series of changes, from a lower to a higher state of organization, which multicellular organisms undergo from the fertilized egg (zygote) to maturity

deviation - in statistics, the difference between an actual observation and the mean of all observations

dextral - right, as opposed to sinistral, or left

diadromous species - a species which undertakes a spawning migration from ocean to river or vice versa

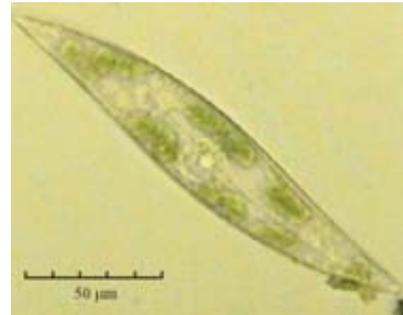
diagenesis - all of the changes that occur to a deposited sediment during its conversion to rock; includes changes that result from chemical, physical as well as biological processes

diagnostic characters - in taxonomy, the characters, or most important characters, which distinguish a taxon from other similar or closely related taxa

diapause - a state of arrested development or growth, accompanied by greatly decreased metabolism

diastema - a space; a gap

diatom - a unicellular alga that consists of two interlocking valves composed of silica



A living diatom (*Pleurosigma angulatum*) from Arctic seas.

diatomaceous - pertaining to diatoms or their fossil remains

dichotomous key - a tool to help identify taxa. It is made up of pairs of choices. Each choice is between statements describing specific traits of the taxa under consideration. Only one statement will be true for each choice. Each choice points to another set of choices until finally only one choice remains

diel - pertaining to the day-night cycle

diffusion - the movement of particles from an area of higher concentration to an area of lower concentration

digestion - the breakdown, by hydrolysis, of complex ingested nutrient compounds (carbohydrates, fats, proteins) into their building blocks, i.e., the conversion of food, in the alimentary canal, into soluble and diffusible products, capable of being absorbed into the circulating fluid and the cells

dimorphism - having two different distinct forms of individuals within the same species or two different distinct forms of parts within the same organism. It could refer to different colors or color patterns, sizes, anatomical parts, etc. Sexual dimorphism is a common case, where the two sexes have different shapes, sizes, etc.

dioecious - having separate sexes. Individuals within the species contain only one or the other of male and female reproductive systems

diphycercal - a caudal fin shape which is primitively symmetrical and pointed, and with the vertebral column or notochord extending to the tip, as found in primitive fishes, such as lampreys and chimaeras

diploid - the condition in which a cell contains a nucleus with two complete sets of chromosomes, one set inherited from each parent. The diploid condition is often abbreviated as $2n$. Most plants and animals are diploid. The term also represents the number of chromosomes in most cells except the gametes, which are haploid in chromosome number

directional selection - a type of natural selection that removes individuals from one end of a phenotypic distribution and thus causes a shift in the distribution. The frequency of an allele is changed in a constant direction, either toward or away from fixation for that allele. Directional selection occurs when individuals at one phenotypic extreme have an advantage over individuals with more common phenotypes

disaccharide - a sugar (carbohydrate) formed by the covalent bonding of two monosaccharides. Table sugar, sucrose, is a disaccharide

discoidal - disc-shaped; flat and round shape

discrimination - differential response to different stimuli

disease - any impairment of an organism's vital functions or systems, including interruption, cessation, proliferation, or other malfunction



Coral with yellow band disease, which results in serious losses of coral tissue.

disease vector - an organism which transmits infective organisms from one host to another

disjunct distribution - the discontinuous or separated geographical distribution of a species or other taxonomic unit

dispersal - the spread of a species to a new location. In many organisms, this happens at a particular stage in the life cycle, and is often critical for the species' survival. Organisms may disperse as spores, seeds, eggs, larvae, juveniles, or adults

displacement behavior - a behavioral response that is appropriate for one situation appears in another situation, for which it is inappropriate

disruptive coloration - a color pattern that breaks up the outline of an organism



The color pattern of the juvenile spotted drum, *Equetus punctatus*, is an example of disruptive coloration. (Photo: Dr. Tom Doeppner, Brown University)

dissociation - the temporary or reversible chemical process in which a molecule or ion is broken down into smaller molecules or ions

dissolved oxygen - the concentration of oxygen dissolved in water, expressed in mg/l or as percent saturation, where saturation is the maximum amount of oxygen that can theoretically be dissolved in water at a given temperature and pressure

distal - the direction away from the midline of the body; the opposite of proximal

distinct - clearly defined and easily recognized

disulfide bond - a chemical bond between the sulfur atoms of two different amino acids in a protein

diurnal - active during the day light hours

dive computer - a small electronic sensor and calculator, carried by the scuba diver, that calculates and displays the basic information needed during a dive, i.e., depth, time, decompression status and tank pressure. By constantly monitoring depth and bottom time, dive computers automatically recalculate the diver's no-decompression status, giving longer dive times while still keeping the diver within a safe envelope of no-decompression time. Computers also monitor ascent rates, logs dives, and measures time intervals between dives

dive computer algorithm - a suite of equations that compute nitrogen uptake and elimination in tissues from changes in the diver's depth and elapsed time underwater

dive table - dive tables present dive times for specific depths, adherence to which, the scuba diver can avoid contracting decompression sickness (the bends). The theory behind dive tables is based on our understanding of how nitrogen is taken up on compression (descent) and given off on decompression (ascent). The first dive tables were devised by John S. Haldane in the period 1906-1908

The PADI (Professional Association of Diving Instructors) recreational dive planner (dive table) has three tables. Table 1 gives the maximum amount of time the diver can stay at a certain depth on the first dive, and it also indicates how much nitrogen the diver has in in the tissues after a dive. Table 2 is concerned with the diver's surface interval time (how long a diver must remain at the surface before the next dive), and Table 3 allows the diver to determine safe diving limits on the next dive. (Photo: PADI)

divergent evolution - the evolution from one species of organism into a number of different species. As the original population increases in size, it spreads out from its center of origin to exploit other habitats and ecological niches. In time, this results in a number of populations, each adapted to its particular habitat. Eventually these populations, genetically may differ from each other sufficiently to become new species. Divergent evolution has also been termed "adaptive radiation"

diversity index - a mathematical index of species diversity within a community

diverticulum - a blind sac branching off a cavity or canal

diving bell - a hollow, usually inverted vessel, such as one used for diving deep in a body of water. It is open on the bottom and supplied with air under pressure. During the *Monitor* 2001 Expedition, navy divers utilized a 12-person, two-chamber saturation system with a two-person closed diving bell. The system can operate as deep as 1,500 ft—considerably deeper than the *Monitor*, which rests on the sea floor at a depth of 235 ft. Saturation systems are often used in deep-water situations (below 200 ft) in order to reduce the time lost to decompression during the slow ascent to the surface required for preventing decompression sickness



The SAT system diving bell is raised to the surface after an eight hour dive on the wreck of the USS *Monitor*. The bell is the divers' "taxi" between their topside saturation living quarters and their work site, some 240 ft below the surface. (Photo: official U.S. Navy photo by Photographer's Mate Chief Petty Officer (DV/SW) Andrew McKaskle)

division - in botanical nomenclature, "division" is used instead of "phylum", and is equal in taxonomic status to the phylum

DNA (deoxyribosenucleic acid) - also termed deoxyribonucleic acid. The molecule that encodes genetic information in the cells. It resembles a double helix held together by weak bonds of four nucleotides (adenine, guanine, cytosine, and thymine) that are repeated ad infinitum in various sequences. These sequences combine into genes that govern the production of proteins. The DNA located within the nuclear membrane of eukaryotic cells is sometimes referred to as nDNA



Graphic of DNA shows the spiral double helix structure of the molecule.

DNA annealing - the reformation of double stranded DNA from thermally denatured DNA. The rate of reassociation depends upon the degree of repetition and is slowest for unique sequences

DNA chip - a small piece of glass or silicon that has small pieces of DNA arrayed on its surface

DNA hybridization - the process of joining two complementary strands of DNA, or one each of DNA and RNA, to form a double-stranded molecule; a technique in which single stranded nucleic acids are allowed to interact so that complexes or hybrids are formed by molecules with sufficiently similar, complementary sequences. By this means the degree of sequence identity can be assessed and specific sequences detected

DNA library - a collection of cloned DNA fragments that collectively represent the genome of an organism

DNA marker - segments of chromosomal DNA known to be linked with heritable traits or diseases. Although the markers themselves do not produce the conditions, they exist in concert with the genes responsible and are passed on with them

DNA polymerase - an enzyme that replicates DNA. DNA polymerase is the basis of PCR (polymerase chain reaction)

DNA probe - in genomics, the DNA affixed to a microarray; a small piece of nucleic acid that has been labeled with a radioactive isotope, dye, or enzyme that is used to locate a particular nucleotide sequence or gene on a DNA molecule

DNA replication - DNA replication or DNA synthesis is the process of copying the double-stranded DNA prior to cell division. The two resulting double strands are identical (occasionally errors (mutation) in replication can result in a less than perfect copy) and each of them consists of one original and one newly synthesized strand

DO (dissolved oxygen) - the concentration of free oxygen dissolved in water and readily available to aerobic organisms. DO is usually expressed in milligrams per liter, parts per million, or percent of saturation

DOC (dissolved organic carbon) - a measure of the organic compounds that are dissolved in water

doliolaria larva - the larval stage of sea cucumbers immediately following the auricularia stage. It is cylindrical in shape and possesses five transverse bands of cilia

dome shaped - a form that resembles half of a sphere

dominant species - a species which make up a large proportion of a community in terms of its biomass or numbers of individuals

doppler shift - the change in the tone of a sound caused by the sound source moving away or towards the listener

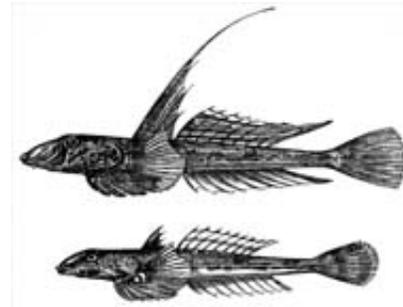
dormancy - a period of suspended growth and metabolic activity. Many plants, seeds, spores, cysts, and some invertebrates become dormant during unfavorable conditions

dorsal - refers to the upper or back surface of an animal



The upper or back surface of this queen angelfish is the dorsal surface, as opposed to the opposite belly surface, which is the ventral surface. (Photo: Chris Huss, Florida Keys National Marine Sanctuary)

dorsal fin - in fishes, one or more fins situated on the midline of the back, having spines or rays, sometimes both; excludes the adipose fin found in some fishes, such as catfishes and salmon



Dragonets, such as *Callionymus lyra*, exhibit strong sexual dimorphism in the dorsal fin (male [top] and female [bottom]). (Image: NOAA)

dorsoventral - an axis extending from the dorsal to ventral surface of an animal body

dot grid - a technique used to analyze a photograph of a quadrat (photo-quadrat), in which a grid of random dots is placed over an image of the photo-quadrat. It assumes that the proportion of dots that lies on a substrate is equal to the proportional area of the substrate

double helix - the normal structural configuration of DNA consisting of two helices winding about the same axis. The structure of DNA was first proposed by Watson and Crick (1953) with two interlocking helices joined by hydrogen bonds between paired bases

downstream - in the direction of the water movement

downwelling - a downward current of surface water in the ocean, usually caused by differences in the density of seawater

dredge - a metal collar with an attached collecting bag that is dragged along the bottom to obtain samples of rock, sediment, or benthic organisms

dredging - a method for deepening streams, swamps or coastal waters by scraping and removing solids from the bottom. The resulting mud is usually deposited in marshes in a process called filling. Dredging and filling can disturb natural ecological cycles. For example, dredging can destroy coral reefs and other aquatic life; filling can destroy the feeding and breeding grounds for many fish and invertebrate species

drift net - a fishing net, often miles in extent, arranged to drift with the tide or current and buoyed-up by floats or attached to a boat



A marine turtle is caught in a drift net. (Photo: NOAA)

drop root - an adventitious root in mangroves that originates from the branches, and roots in the surface-sediments

dry weight - the moisture-free weight of a biological sample obtained by drying at high (oven-drying) or low (freeze-drying) temperatures for an time sufficient to remove all water

dsRNA (double stranded RNA) - long double-stranded RNAs (dsRNAs; typically >200 nt) can be used to silence the expression of target genes in a variety of organisms and cell types

duplex DNA - double-stranded DNA

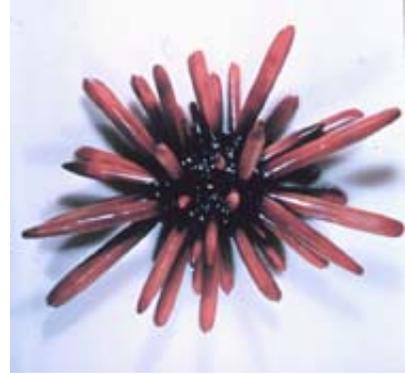
EANx (Enriched Air Nitrox) - a breathing gas mixture for scuba divers which has a percentage of oxygen greater than 21 percent as is found in normal air. This mixture allows longer bottom times at limited depths

ebb tide - that period of tide between a high water and the succeeding low water; falling tide

ecdysone - a molting hormone of arthropods. It stimulates growth and ecdysis (molting)

Ecdysozoa - the ecdyzoans comprise one of the major and largest protostome groups within the animal kingdom. It includes both the arthropods and the nematodes, as well as lesser groups such as rotifers, cephalorhynchs (which include priapulids, kinorhynchs, and loriciferans), and onychophorans. Ecdysozoans build a cuticle, an outer layer of organic material that functions as a lightweight flexible exoskeleton. The name Ecdysozoa refers to the fact that many members of this group regularly shed their cuticle, a process called ecdysis

Echinodermata - an animal phylum that contains starfishes, sea cucumbers, sand dollars, brittlestars, basket stars, sea lilies, feather stars, and sea urchins. Adults exhibit pentamerous radial symmetry, secondarily derived from a bilateral ancestor. They are not at all related to the other radiate phyla, such as the Cnidaria



A pencil urchin of the phylum Echinodermata.

echinopluteus larva - a larval form of some echinoderms



Free-swimming echinopluteus sea urchin (*Echinocardium cordatum*) larva feeds on microplankton captured with its ciliated arms. (Photo: Jan Parmentier)

Echiura - an animal phylum that contains the echiurans or spoonworms. Some species inhabit coral crevices. Echiurans are deposit feeders

echolocation - the sonar-like ability used by bats, dolphins, some whales, and two groups of cave-dwelling birds to detect objects in their environment. Using echolocation, the animal emits high-frequency sounds that reflect off of an object and return to the ears or other sensory receptors

ecological isolation - a form of reproductive isolation in which two closely-related species are separated by what is often a slight difference in the niches they occupy

ecology - the study of the interrelationships between organisms and their environment, including the biotic and abiotic components

ecosystem - an ecological community considered together with the non-living factors of its environment as a unit

ecosystem restoration - actions taken to modify an ecosystem for the purpose of re-establishing and maintaining desired ecological structures and processes



Two divers work to reattach a large fragment of elkhorn coral, *Acropora palmata*, at Mona Island, Puerto Rico. The coral in the background has been attached to the reef framework using stainless steel wires. The wire binds the coral fragment to the living coral where it is expected to reattach to the live coral. (Photo: Erik Zobrist, NOAA Restoration Center)

ecotone - a transitional area between two adjacent ecological communities

ecotourism - travel undertaken to experience sites or regions of unique natural or ecological quality, or the provision of services to facilitate such travel

ecotype - a genetically differentiated subpopulation that is restricted to a specific habitat

ecto- - a prefix meaning 'outside'

ectoderm - the outer germ layer of cells in an embryo that gives rise to the outer layer of skin (epidermis) and neural tissue

ectodermis - the outer cellular covering of a polyp

ectoparasite - a parasite which lives on the surface of its host



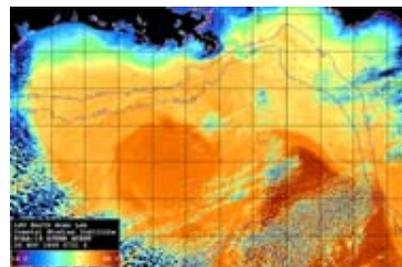
A marine ectoparasite lodged in a fish's mouth. (Photo: NOAA Ocean Explorer)

ectoplasm - the clear, nongranular portion of the cell cytoplasm just inside the cell membrane

Ectoprocta - an animal phylum synonymous with the phylum Bryozoa, the "moss animals"

ectothermic - having an internal body temperature that is dependent on the surrounding temperature. Most aquatic animals are ectotherms; also called poikilothermal or "cold blooded"

eddy - a circular movement of water formed on the side of a main current



AVHRR image of eddy in the Gulf of Mexico. (Image: NOAA-14 Polar Orbiting Satellite/LSU Earth Scan Lab, Coastal Studies Institute)

edge effect - habitat conditions created at or near the more-or-less well-defined boundary between ecosystems (ecotone). Typically there is an increased richness of organisms resulting from the mixing of two communities where they join

eelgrass - a common seagrass (*Zostera marina*) distributed from Greenland to Florida that serves as an important habitat for fishes and shellfish. Unfortunately, approximately 90 percent of all eelgrass throughout its range along the Atlantic coast has been destroyed



Eel grass meadows. (Photo: NOAA)

effluent - a discharge of pollutants into the environment, partially or completely treated or in its natural state. Generally used in regard to discharges into waters; in contrast to an emission, which is generally used in regard to discharges of pollutants into the air

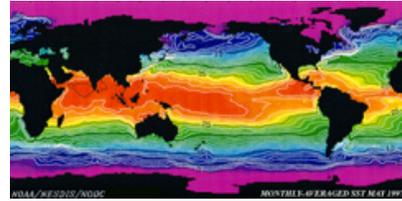
effort - the amount of time and fishing power used to harvest fish. Fishing power includes gear size, boat size, and horsepower

egestion - the elimination of undigested food materials from an organism

egg - a female sex cell or gamete with the haploid number of chromosomes. It may be fertilized by a sperm cell to produce a zygote with the diploid number of chromosomes for that particular species. The eggs of some species may develop into multicellular individuals without being fertilized by a sperm cell. This is the process of parthenogenesis

Ekman layer - the thin horizontal layer of water riding on top of the ocean that is affected by wind

El Niño - an irregular variation of ocean current that from January to March flows off the west coast of South America, carrying warm, low-salinity, nutrient-poor water to the south. It is associated with the Southern Oscillation. These two effects are known as the El Niño Southern Oscillation (ENSO). El Niño usually occurs during the Christmas season when the equatorial counter current strengthens and flows eastward to overlies the cold, nutrient-rich waters of the Peru current. It does not usually extend farther than a few degrees south of the equator, but occasionally it does penetrate beyond 12 deg S, displacing the relatively cold Peru Current. The effects of this phenomenon are generally short-lived, and fishing is only slightly disrupted. Occasionally, the effects are major and prolonged



Graphic of sea surface temperatures show El Niño, May 1997.

elasmobranch - a member of the Subclass Elasmobranchii of cartilaginous fishes. These include sharks, rays, and skates



The manta ray is a large, graceful, mostly plankton-feeding elasmobranch. They also feed on small fishes. (Photo: Jackie Reid/ Flower Garden Banks National Marine Sanctuary)

elastic - capable of returning to an initial form or shape after deformation; resilient

electromagnetic radiation - energy that travels through space in the form of waves. The highest frequencies in the spectrum of electromagnetic radiation are gamma-rays; the lowest frequencies are radio waves. All electromagnetic radiation travels at the speed of light. Shorter wavelength radiation (eg, ultraviolet) carries more energy and is likely to be more harmful to living tissue

electromagnetic receptor - a neurological receptor that responds to light, electricity, and magnetism. Photoreceptors respond to light and electroreceptors detect electrical energy

electron microscope - a microscope which beams electrons, instead of light beams, at and through the object of interest. This type of microscope provides the greatest resolution of extremely small details in the nanometer size range. Magnification may be up to x300,000

electrophoresis - a technique for separating different types of molecules based on their patterns of movement in an electrical field

electroporation - the creation of reversible small holes in a cell wall or membrane through which foreign DNA can pass. This DNA can then integrate into the cell's genome

electroreceptor - a receptor organ that senses changes in an electrical current in the surrounding water, for example, the ampullae of Lorenzini in sharks

ELISA (enzyme-linked immunosorbent assay) - a rapid test where an antibody or antigen is linked to an enzyme as a means of detecting a match between the antibody and antigen; a technique for detecting specific proteins by using antibodies linked to enzymes

emarginate - a notched margin, but not so deeply as to be forked. As an example, a trout possesses an emarginate caudal fin



The caudal fin of this trout has an emarginate shape. (Image: U.S. Fish and Wildlife Service)

embayment - an indentation in the shoreline that forms a bay

embryo - the stage of early growth and differentiation of tissues and the formation of primitive organs and organ systems of a multicellular organism, from fertilization until birth or hatching. In seed plants, it is the young sporophyte that resulted from the union of the egg and one of the two tube nuclei

emigration - the movement of individuals out of a population or from one area to another

empirical - based on experience or observations, as opposed to theory or conjecture

emulsion - a suspension of small globules of one liquid in a second liquid with which the first will not mix

encrustation - a crustlike deposit or growth over a substratum

encrusting colony - a thin colony which adheres closely and is attached to the substrate



Encrusting tunicates at Gray's Reef off Sapelo Island, Georgia (Photo: Karen Angle).

Endangered Species Act (ESA) - an Act of Congress passed in 1966 that establishes a federal program to protect species whose survival is threatened by habitat destruction, overutilization, disease, etc.

endangered taxa - taxa in danger of extinction and whose survival is unlikely if causal factors continue operating. Included are taxa whose numbers have been drastically reduced to a critical level or whole habitats have been so drastically impaired that they are deemed to be in immediate danger of extinction. Also included are those that possibly are already extinct, in so far as they have not been seen in the wild in the past 50 years

endemic species - a species whose distribution is restricted to a particular area

endo- - a prefix meaning 'inside'

endobenthic - refers to meiofaunal-sized organisms that move within the sediments

endocrine gland - a gland that manufactures hormones and secretes them directly into the circulatory system to act at distant sites in the body

endocrine system - the system of ductless glands in animals that secrete hormones

endocytosis - uptake of material into a cell by the formation of a membrane-bound vesicle

endoderm - the inner germ layer of diploblastic and triploblastic embryos that gives rise to internal tissues such as the gut and gut derivatives, e.g., air bladder, lungs, and the lining of the digestive tract

endogenous - having its origin, or produced within the organism or one of its parts

endogenous rhythm - a metabolic or behavioral rhythm that originates within the organism and persists regardless of external conditions

endolithic - growing within a rock or any other hard inorganic substratum

endolithic algae - algae which burrow into calcareous rocks or corals

endonuclease - a nuclease that cleaves nucleic acids at specific internal sites

endoparasite - a parasite which lives in the internal organs of its host

endophytic - living within the tissues of a host plant or alga

endopinacocyte - in sponges, a pinacocyte lining the incurrent and excurrent canals

endopinacoderm - in sponges, a surface lined with endopinacocytes

endoplasm - the granular portion of the cell cytoplasm between the ectoplasm and nuclear membrane

endoskeleton - skeleton, or support structure, which is on the inside of the organism's body. All vertebrates possess an endoskeleton that is made of either bone and/or cartilage



Endoskeleton of a 35-ton, 13-m gray whale on the floor of the Santa Cruz Basin.

endosymbiont - an organism which lives within the body of another organism as part of a symbiotic relationship. The relationship may be mutualistic or commensalistic; also called an 'endobiont'

endosymbiotic - being symbiotic and living within the body of an individual of the associated species

endothecal dissepiment - one of many horizontal partitions across the corallite within the corallite wall

endothermic - an animal that is able to maintain a body temperature that varies only within narrow limits by means of internal mechanisms. Most birds and mammals are considered endothermic; also called homeothermal or "warm blooded"



Whale fat (blubber) aids these humpback whales in maintaining a relatively constant body temperature. (Photo: Dave Matilla, NOAA/NOS National Marine Sanctuaries)

endothermic reaction - a reaction which absorbs heat

endozoic - living inside an animal

energy flow - the movement of energy through a community via feeding webs

enrichment - the addition of nitrogen, phosphorus and carbon compounds or other nutrients into a lake or other waterway that greatly increases the growth potential for algae and other aquatic plants. Most frequently, enrichment results from the inflow of sewage effluent or from agricultural runoff

ENSO (El Niño Southern Oscillation) - see El Niño and Southern Oscillation

enterocoelous - the mesoderm and coelom initially develop as pouches off of the primitive digestive tract (archenteron) of an embryo. Enterocoelous development of the coelom occurs in deuterostomes

enteron - the alimentary canal or the gut of an embryo. Some structures of the enteron may not be completely developed or differentiated in early embryonic growth

entrainment - the synchronisation of one biological rhythm to another or to a zeitgeber cycle, e.g. circadian rhythms are often entrained to the light-dark cycle; also, the process of small organisms being captured in the cooling water of a power plant

entropy - the measure of the disorder or randomness of energy and matter in a system

environment - everything external to the organism

environmental impact assessment - detailed studies which predict the effects of a development project on the environment. They also provide plans for the mitigation of adverse impacts

environmental stress - severe environmental effects on the natural ecosystem



A catastrophic environmental stress- the 1989 grounding of the *Exxon Valdez*, which spilled an estimated 11 million gallons of crude oil over 1,300 miles of coastline.

environmentalism - advocacy for, or work toward, protecting the natural environment from destruction by human activities

enzootic - an infectious disease constantly present in an animal population but having low incidence

enzyme - an organic catalyst

ephyra larva - a jellyfish (Scyphozoa) larval stage that develops into the adult medusa or jellyfish



Ephyra larva of the jellyfish *Aurelia*. (Photo: Rick Gillis, Ph.D., Biology Dept., University of Wisconsin-La Crosse)

epibenthic (epifaunal or epifloral) - refers to organisms living on the surface of the substrate

epibiont - an organism that lives on the outside of another organism

epidemic - the widespread outbreak of a disease, or a large number of cases of a disease in a single community or relatively small area

epidemic spawning - the simultaneous shedding of gametes by a large number of individuals



Star coral shedding gametes in an epidemic spawning event.

epidermis - the outer epithelial layer of the body

epifauna - animals that live upon or are associated with substratum features

epilithic - growing on rock or stone. Epilithic organisms live attached to rocks

epiphyte - microalgal organism living on a surface (e.g., on a seaweed frond); a plant living on the surface of another plant

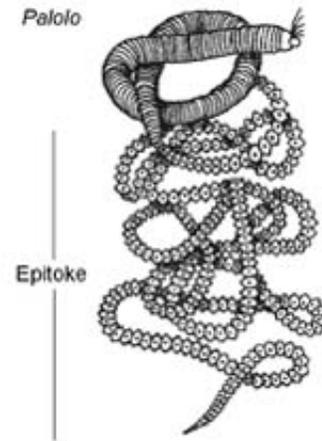
epistasis - the prevention or masking of the expression of an allele at one locus by an allele at another locus

epistome - the flap over the mouth of some lophophorates

epitheca - a layer of calcium carbonate that grows outside corallite walls

epithelium - a tissue layer of cells which lines body cavities and tubules, or covers surfaces. The cells may be ciliated or non-ciliated, and may be squamous (flat, scale-shaped), cuboidal (cube-shaped), or columnar (column-shaped) in shape. The cells may occur in a single layer, or may be multi-layered (stratified)

epitoky - a mode of reproduction unique to polychaete worms in which the worm undergoes a partial or entire transition into a pelagic, sexually reproductive form, known as an epitoke. In many cases, epitoky involves loss or degeneration of digestive structures and enhancement of swimming, sensory, and reproductive structures. The epitoke is considered a delicacy in some islands of the South Pacific.



Palolo (Eunice viridis) are polychaete worms that are about 12 inches long and live in burrows dug into the coral pavement on the outer reef flat. The worm is composed of two distinct sections. The front section is the basic segmented polychaete with eyes, mouth, etc., followed by a string of segments, called the "epitoke," that contain reproductive gametes. (Image: www.nps.gov)

epizoite - an animal that lives on the surface of another organism

epizootic - a temporal pattern of disease occurrence in an animal population in which the disease occurs with a frequency clearly in excess of the expected frequency in that population during a given time interval; an outbreak (epidemic) of disease in an animal population

epoch - a division of geologic time next shorter than a period. Example: the Pleistocene epoch is in the Quaternary period

equilibrium - the state in which the action of multiple forces produces a steady balance, resulting in no change over time

equinox - either of the two times during a year when the sun crosses the celestial equator and the length of day and night are equal

era - a division of geologic time next smaller than the eon and larger than a period. Example: The Paleozoic era is in the Phanerozoic eon and includes, among others, the Devonian period

erosion - the wearing away of the land surface naturally by wind or water, but is often intensified by human's land-clearing practices. The runoff is harmful to coral reefs

errant - motile or free swimming



The polychaete *Nereis sp.* is an errant species of worm. (Photo: U.S. Geological Survey)

ERSST (Extended Reconstruction of SST) data set - a globally complete reconstruction of of sea surface temperatures (SST) based on *in situ* measurements and satellite data produced at a monthly, 2 degree resolution

erythrophore - a chromatophore which contains reddish pigments found in carotenoids and pteridines

essential amino acid - an amino acid that cannot be synthesized by animals and therefore has to be ingested with food

essential fish habitat - under the Magnuson-Stevens Fishery Conservation and Management Act, those waters and substrates that fishes require to spawn, breed, feed, or grow to maturity



This tangle of red mangrove roots in the Jobos Bay, Puerto Rico National Estuarine Research Reserve is an essential fish habitat, serving as a both a nursery area and protection for many marine animals. (Photo: NOAA)

EST (expressed sequence tag) - a small part of the active part of a gene, made from cDNA which can be used to fish the rest of the gene out of the chromosome by matching base pairs with part of the gene. The EST can be radioactively labeled in order to locate it in a larger segment of DNA

establishment - the subsequent growth and/or reproduction of a colonized species in a new territory

ester - a chemical compound formed by the reaction of an organic or inorganic acid with an alcohol, with the elimination of water

esthetasc - a sensory seta covered by cuticle projecting from most antennules and antennae in crustaceans

esthete - a light sensitive organ in a minute vertical canal in the upper layer of the shell plate of a chiton

estimate - the best guess arrived at after considering all the information given in a problem

ethogram - an inventory or catalog of all of the behavioral patterns of an organism or a species

etiology - the science that is concerned with origins and causes of disease

eukaryotic - descriptive of organisms with cells having a distinct nucleus with nDNA, and intracellular membranes. This includes all protists, fungi, plants and animals. The organisms are termed eucaryotes

eumetazoa - all multicellular animals excluding the sponges

euphotic depth - the depth to which significant phytoplankton photosynthesis can take place. It is typically taken to be the depth at which PAR falls to 1 percent of its value just below the surface

euphotic zone - the layer of the ocean that receives sufficient sunlight for photosynthesis. The depth to which 1% of incident light penetrates (1% is the minimum amount of light required for photosynthesis)

euryhaline - pertaining to an aquatic organism that can withstand a broad salinity range

euryphagous - describes an organism which gains its nourishment from a large variety of foods

eurythermal - pertaining to an aquatic organism that can withstand a broad temperature range

eutrophic - a situation in which the increased availability of nutrients such as nitrate and phosphate stimulates the growth of plants such that the oxygen content is depleted and carbon sequestered



Eutrophic conditions can result in large fish kills, as many fish die from reduced levels of oxygen in the water.

event - in probability, an event is an occurrence or the possibility of an occurrence that is being investigated

everted - turned inside out

evo-devo (evolutionary developmental biology) - a relatively new approach in biology that seeks to explain the causes biodiversity. It attempts to integrate every area of biology from molecular genetics through embryology, molecular and population genetics, comparative morphology, paleontology, molecular evolution, ecology and functional morphology. It offers both an account of developmental processes and also new integrative frameworks for analyzing interactions between development and evolution. A major challenge lies in integrating these approaches to understand the evolution of biodiversity at a mechanistic level. The "evo-devo" community needs access to genomic information on a wide range of organisms

evolutionary tree - a lineage designed to show the evolutionary history of relationships among groups of organisms

Exclusive Economic Zone (EEZ) - the sovereign waters of a nation, recognized internationally under the United Nations Convention on the Law of the SEA as extending out 200 nautical miles from shore. Within the U.S. the EEZ typically is between three and 200 miles from shore

excretion - a physiological process, originating in cells, that removes waste materials produced by the body

excurrent canal - in sponges, an excurrent canal discharges water received from the apopyle, into the spongocoel (atrium). The water then passes through the osculum or oscula to the outside

Executive Order 13089 - on June 11, 1998, President Clinton issued Executive Order 13089 directing all agencies to increase their efforts to protect our nation's coral reef resources. The executive order calls for the establishment of a U.S. Coral Reef Task Force, cochaired by the Secretaries of the Interior and of Commerce. The Task Force will develop and implement a comprehensive program of inventory, monitoring, and research to map and identify the major causes and consequences of degradation of coral reef ecosystems

Executive Order 13158 - on May 26, 2000, President Clinton signed Executive Order 13158 on Marine Protected Areas (MPAs) to strengthen the protection of U.S. ocean and coastal resources. This significant milestone in ocean conservation directs the Departments of Commerce and the Interior, and other federal agencies, to strengthen and expand a national system of MPAs by working closely with state, territorial, local, tribal, and other stakeholders

exhalant system - in sponges, part of the aquiferous system between the apopyle and the osculum

exocrine gland - a gland that secretes its product through a duct

exogenous - having its origin external to the organism or ecosystem

exon - a nucleotide sequence (of DNA or RNA) in a gene that codes for part or all of the gene product or for some control function. In eukaryotes, exons are separated by non-coding sequences called introns; that part of the gene (a section of DNA) that is transcribed into messenger RNA and encodes a protein

exopinacoderm - the unicellular external surface of a sponge (ectosome composed of pinacocytes)

exoskeleton - an external skeleton or supportive covering of an animal formed from the ectoderm, as for example, the shell coverings of a crustacean, the calcium carbonate secretions of stony corals, or the bony plates of an armadillo

exothermic reaction - a reaction that gives off heat

exotic species - a non-native species that is introduced into an area; also referred to as alien or invasive species

expected value - in statistics, the mean value calculated for a statistic over an infinite number of samples

explanate coral colony - a colony that spreads horizontally as the branches fuse into a solid or near solid plate

exponent - an expression of the number of times that a base is used as a factor

exponential growth - growth in the size of a population in which the rate of growth increases as the size of the population increases; change in a population growth rate that is proportional to the size of the population

exposure suit - a full or partial garment that is worn by scuba divers for protection against heat loss. Water conducts heat away from the body about 20 times faster than air. In addition to providing warmth, exposure suits also serve to protect from minor scrapes, stings and abrasions. There are three kinds of exposure suits: *wet suits*, which allows water to seep in between the insulated rubber covering and the skin. They come in a variety of thicknesses suitable for insulation in water as cold as 50 degrees F; *body suits*, made from Lycra or nylon. They provide full length abrasion protection, but only minimal insulation; and *dry suits* which are water-tight garments that keeps the divers body warm by providing insulation with a layer of gas, such as air. It is used for diving in waters that are too cold for comfortable wet suit protection, usually below 65 degrees F



Arctic diver with rebreather and heated dry suit prepares to descend into the ice. (Photo: NOAA/OAR/ National Undersea Research Program)

extant - of a taxon: having living representatives; of a specimen: still in existence

extant species - species which are now living

exteroreceptor - a neurological receptor that receives information from the environment external to the organism

extinct - of a taxon: having no living representatives.

extinct species - species for which there are no living representatives

extinction - the evolutionary termination of a species caused by the failure to reproduce and the death of all remaining members of the species; the natural failure to adapt to environmental change



Manatees are threatened with extinction from both habitat destruction and direct effects from human encroachment, such as serious wounds from boat propellers.

extinction coefficient - a coefficient measuring the rate of extinction, or diminution, with distance of transmitted light in sea water

extirpated species - a species that has been destroyed or removed completely from a particular area, region, or habitat

extra-embryonic membrane - membranes possessed by amniote (reptiles, birds, and mammals) embryos that allow these classes of vertebrates to be free of aquatic habitats for reproduction, and in their evolution, occupy terrestrial habitats. The membranes are the amnion, yolk sac, allantois and chorion

extracellular digestion - a form of digestion that takes place within the lumen of the digestive system. The resulting nutrient molecules are transferred into the blood or body fluids through the process of absorption

extratentacular budding - an asexual form of reproduction where daughter corallites grow from the outside wall of the parent corallites

extreme environment - an environment characterized by extremes in growth conditions, including temperature, salinity, pH, among others



Crowded life in an extreme environment—*Riftia* tubeworms, mussels, and scavenging crabs found at a hydrothermal vent site in the Pacific Ocean. Most hydrothermal vents are found at an average depth of about 2,100 meters (7,000 ft) in areas of seafloor spreading along the Mid-Ocean Ridge system. (Photo courtesy of C. Van Dover.)

extremophile - a microorganism that lives at extreme levels of pH, temperature, pressure or salinity

extrinsic - not forming an essential part of a thing; arising or originating from the outside

extrinsic factor - a biotic or abiotic factor acting on an organism or population from outside the organism or population. These are the physical and chemical features of the environment, as well as other organisms

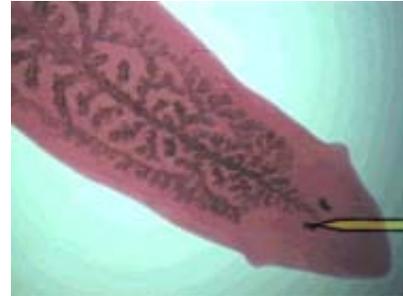
exumbrella - the upper surface of the bell of a medusa or jellyfish



The rounded upper surface of this jellyfish is the exumbrella.



eyespot - any light-sensing structure in some primitive organisms that consists of a pigmented area and light sensitive cells; also called an ocellus



Eyespots of a free-living flatworm, *Planaria dugesia*.



facultative - able to exist under more than one set of environmental conditions. For example, a facultative parasite may exist either as a parasite or as a saprotroph (gaining nutrients from dead organic matter)

facultative mutualism - mutualism in which one or both species in the association may survive and maintain populations in the absence of the other species

Fagatele Bay National Marine Sanctuary - Fagatele Bay, located on Tutuila, the largest island of American Samoa, was designated as a National Marine Sanctuary in 1986. It is the smallest and most remote of all the national marine sanctuaries encompassing only 163 acres (.25 sq. mi.). Fagatele is the only true tropical coral reef in the National Marine Sanctuaries Program



Fagatele Bay, a National Marine sanctuary in American Samoa. (Photo: NOAA)



Fahrenheit temperature scale - a thermometric scale on which the freezing point of water is at 32 degrees F (Fahrenheit) above the 0 degree (F) mark on the scale, and the boiling point of water is at 212 degrees F

falcate - scythe-shaped



Falcate-shaped dorsal fin of an *Orca Whale*. (Photo: Robyn Angliss, NOAA/NMML)

falciform - curved like a long, narrow scythe

falcalate - a shape that is curved and sharp-pointed, like a claw

family - a taxonomic group containing one or more genera

farctate - a filled or solid structure, as opposed to one that is tubular or hollow

faro - a rhomboid-shaped, steep-sided, continental shelf atoll

fat - a triglyceride (lipid) that is usually solid at room temperature

fatty acid - any of a class of saturated aliphatic monocarboxylic acids that form part of a lipid molecule; a product of fat hydrolysis

fauna - the entire group of animals found in an area

feces - egested undigested food wastes

fecundity - the productiveness or potential productiveness of an organism, measured in the number of viable offspring it may produce; the number of eggs an animal produces each reproductive cycle; the potential reproductive capacity of an organism or population

Federal Geographic Data Committee (FGDC) - coordinates the development of the National Spatial Data Infrastructure (NSDI). The NSDI encompasses policies, standards, and procedures for organizations to cooperatively produce and share geographic data. The 17 federal agencies that make up the FGDC are developing the NSDI in cooperation with organizations from state, local and tribal governments, the academic community, and the private sector

fermentation - the anaerobic breakdown by microorganisms of complex organic substances, especially carbohydrates, to CO₂ and alcohol; fermentation is also used to describe the process by which various chemical or pharmaceutical compounds can be made in large tanks, called fermenters, that contain microorganisms or plant or animal cells, and the nutrients they require to live and grow

fertilization - the process where a spermatozoan (sperm cell) penetrates the cell membrane of an egg cell and the nuclei of the sperm and egg cells join together and their chromosomes combine to form a diploid zygote

fibropapillomatosis - a fibroepithelial tumor, probably caused by a herpes-type virus, found in juvenile, subadult, and adult sea turtles, causing them to be emaciated, weak, depressed, and anemic. Affected turtles may have flotation problems resulting from fibrous tumors in the lungs. Fibrous tumors are also found in visceral sites, such as liver, lung, kidney and gastrointestinal tract.

filamentous - slender and/or threadlike

filial - an offspring generation

filiform - thread-shaped

filiform tentacle - a long, thin tentacle of a hydrozoan polyp, usually concentrated toward the base

filter feeder - an organism that feeds by capturing particles suspended in the water column. A synonym of suspension feeder.

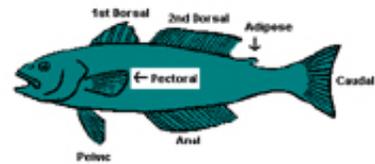
fimbriate - a structure that is fringed at the margin



The papillae of this scorpion fish

possess a fimbriate appearance.

fin - organ of locomotion and balance in fishes and some other aquatic animals; in fishes, fins are of two types: paired (pectoral and pelvic fins) and unpaired or median (dorsal, adipose, anal, and caudal fins and finlets). Fins of bony fishes contain hard spines and/or soft rays, which may be jointed and branched. The spines and rays are covered by integument. Counts of spines and rays are used as diagnostic characters in fish taxonomy; a membranous, finlike, swimming organ, as in pteropod (having the anterior lobes of the foot modified so as to form a pair of winglike swimming organs), and heteropod (where the foot developed into a median fin) mollusks



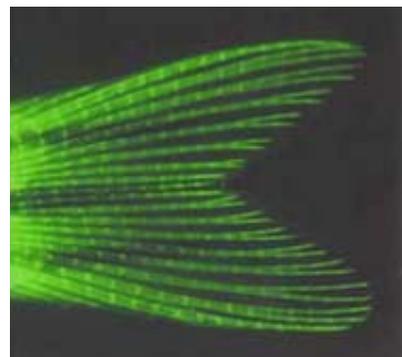
Drawing of a bony fish that shows the locations of the median and paired fins. (Graphic: Cristi A. Cave, Stream Biology and Ecology)

fin (scuba) - a rubber or plastic shoe-like device attached to the feet to increase surface area for greater thrust while swimming; they may be open heeled or full-footed. Scuba divers prefer the open heel style, usually worn with booties



Open heel SCUBA fins with mask and snorkel. This type of adjustable-strap fin is worn over neoprene booties.

fin ray - a slender, rod-shaped structure that supports the membranes of the fins of fishes. There are two types of rays, soft rays and spines. Soft rays are jointed, often branched, and flexible near their tips. Spines are unjointed, unbranched, and usually sharp at the tip and stiff along the shaft



Caudal fin of a fish. The fin is stained with the vital dye calcein which colors calcium/calcified bone matrix. Note

the soft segmented fin rays. (Photo: Dr. M. Kathy Lovine, Washington University, St. Louis, MO)

fingerling - a young or small fish

finlet - one of several small non-retractable fins located dorsally and ventrally between the second dorsal and anal fins and the caudal fin of scombroids (mackerals, tuna) and some other fishes, e.g., sauries and snake mackerals. Finlets appear to have a hydrodynamic function in fishes that have been studied for this character



A series of small finlets between the dorsal and anal fins and the tail of a bluefin tuna. (Photo: NOAA)

fire coral - a species of hydroid (*Millepora sp.*) that frequently is brownish to orange-yellow in color and forms encrusting colonies that can assume the shape of its support structure. Their nematocysts release a virulent toxin which causes painful welts on human skin. Fire corals are not true corals (see Hydrozoa)



Fire coral in the Flower Garden Banks National Marine Sanctuary (Photo: Jackie Reid)

first stage regulator - attached to the scuba tank, the first stage regulator reduces the high tank pressure to an intermediate pressure of 100 to 150 psi above the surrounding water pressure



The first stage regulator is attached to the scuba tank. (Photo: NOAA/ National Undersea Research Program)

FISH (fluorescence *in situ* hybridization) - hybridization of cloned DNA to intact chromosomes, where the cloned DNA has been labelled with a fluorescent dye. This is the major method of physical mapping of cloned DNA fragments on chromosomes

fish census - the collection of data over time concerning the species of fishes in an area, their relative abundances, and population densities

fish kill - the sudden death of fishes due to the introduction of pollutants, toxic blooms, or the reduction of the dissolved oxygen concentration

Fishery Conservation and Management Act - the federal law that created the regional councils and is the federal government's basis for fisheries management in the EEZ. Also known as the Magnuson Act after a chief sponsor, Senator Warren Magnuson of Washington State

fishery management council - a regional, quasi-governmental group with authority to manage fisheries in federal waters, generally from three to 200 miles offshore

fissure - a deep and narrow depression cutting across the reef front with origins relating to jointing planes in the reef limestone or non-limestone bedrock

fistula - an abnormal passage between two organs or between an organ and the outside of the body. Fistulae are caused by ulceration, congenital malformation, or when damaged tissues come into contact with each other and join together while healing

fistule - in sponges, a tubular structure on the upper surface, upon which the osculum is situated. A fistule is frequently found on species that burrow into mud or excavate coral

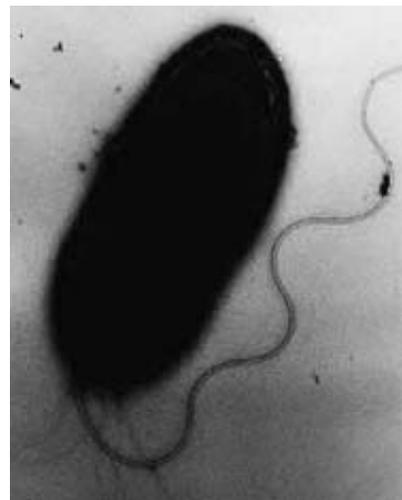
five prime and three prime ends (5' and 3' ends) - a double stranded DNA (the double helix) always has an orientation or directionality. Because of this directionality, the nucleotides along one strand are heading in one direction (e.g. the 'ascending strand') and the others are heading the other (e.g. the 'descending strand'). For reasons of chemical nomenclature, the asymmetric termini of each strand are called the 5' and 3' ends (pronounced "five prime" and "three prime"). Nucleotide sequences are read by enzymes in the "5' to 3' direction". In a vertically oriented double helix, the 3' strand is said to be ascending while the 5' strand is said to be descending

fixed action pattern - in ethology or animal behavior, a complex behavioral response which once released by a key stimulus, runs to completion

flabellate - fan-shaped

flagellated chamber - in sponges, an internal cavity that is lined with choanocytes

flagellum - a whip-like appendage used for locomotion in sperm cells and some bacteria, fungi, and protists

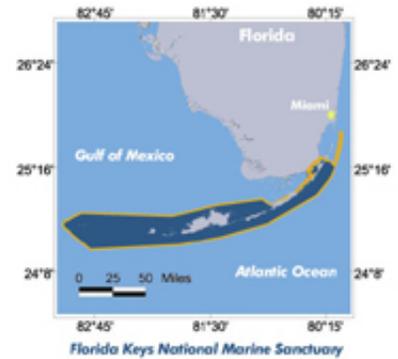


A bacterium with a whip-like flagellum. (Photo: U.S. National Institutes of Health)

flaring corallite - a corallite with expanding, trumpet-like curves to the outer corallite wall

flora - the entire group of plants found in an area

Florida Keys National Marine Sanctuary - the Florida Keys National Marine Sanctuary was designated as a national marine sanctuary in November of 1990. The Florida reef tract is the most extensive living coral reef system in North American waters and the third largest barrier reef system in the world. The sanctuary extends 220 miles in a northeast to southwest arc between the southern tip of Key Biscayne, south of Miami, to beyond, but not including the Dry Tortugas Islands



The Florida Keys National Marine Sanctuary. (Graphic: NOAA)

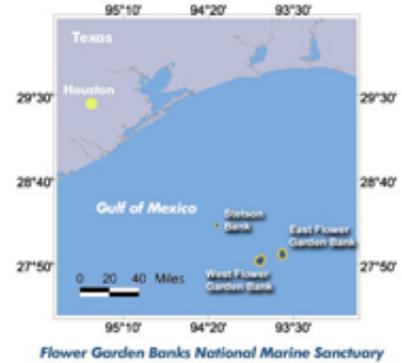
flotsam - wreckage or discarded material, e.g. garbage, found floating on the surface of the ocean or washed up on the beach



Seahorses caught in flotsam off the Colombian/Panamanian coast. (Photo: NOAA)

flow cytometry - a technique used to sort cells or other biological materials by means of flow through apertures of defined size or by laser sorting

Flower Garden Banks National Marine Sanctuary - the Flower Garden Banks National Marine Sanctuary was designated as a national marine sanctuary on January 17, 1992. The sanctuary is located about 110 miles off the coasts of Texas and Louisiana, and harbors the northernmost coral reefs in the United States and serves as a regional reservoir of shallow water Caribbean reef fishes and invertebrates. The coral reefs rise to within 66 feet of the surface. The area containing both the East and West Banks is 41.7 square nautical miles in size and contains 350 acres of reef crest. In October 1996, Congress expanded the sanctuary by adding a small third bank, Stetson Bank, located about 70 nautical miles south of Galveston, Texas. Environmental conditions at Stetson Bank do not support the establishment and growth of coral reefs



Graphic depicting location of the Flower Garden Banks National Marine Sanctuary in the Gulf of Mexico.

fluorescence - the emission of light from a substance caused by exposure to radiation from an external source

fluorescent pigment - a pigment that absorbs light at one wavelength and emits it at a different wavelength. The emitted light usually has a lower energy than the light absorbed by the pigment

flux - the rate of flow of energy or particles across a given surface

foliaceous - leaf-like; also foliose



Foliaceous coral. (Photo: NOAA)

foliose coral - a coral whose skeletal form approximates that of a broad, flattened plate

food chain / food web - all the interactions of predator and prey, included along with the exchange of nutrients into and out of the ecosystem. These interactions connect the various members of an ecosystem, and describe how energy is converted and passes from one organism to another

food pyramid - pyramid-shaped diagram which shows feeding relationships within a food chain, e.g. that herbivores are smaller, more numerous and faster breeding than the predators that feed on them

foot - in mollusks, the structure found on the animal's ventral side, that consists primarily of muscle, and is modified for locomotion, food gathering, and digging

forage - to search for food

forage fishes - small fishes which occur in large numbers and serve as food for predatory fishes

foramen - an opening in a structure

Foraminifera - planktonic and benthic protozoan protists that have a test (shell) composed of calcium carbonate



These foraminiferans have a test composed of calcium carbonate.
(Photo: Rick Gillis, Ph.D., Biology Dept., University of Wisconsin-La Crosse)

fore reef - the portion of a reef seaward of reef crest. A synonym of reef slope

fore reef escarpment - a slope or cliff seaward of the fore reef terrace, at a depth of about 25-30m

fore reef slope - a sand covered, gradual or sharply descending slope; the next-to-deepest part of the fore reef

fore reef terrace - the uppermost portion of the fore reef; a flat plain beginning at the base of the buttress or mixed zone, at a depth of about 60 m

formal metadata - metadata that follows an FGDC approved standard

fossa - a hole or cavity in the coral skeleton

foveolate corallite - a corallite of some species which is located at the base of a funnel-shaped depression

FRA (Fish Replenishment Area) - a designated area, within a Fisheries Management Area (FMA), where certain specified fish harvesting activities are prohibited

fractal - the smallest part of a mathematical set of numbers which when repeated or scaled will maintain the primary permutation; an object which is self-similar at all scales. Regardless of scale the same level of detail and appearance is present

fragmentation - a type of asexual reproduction common in branching corals. Branches break off from the parental colony to establish other colonies nearby

framework - a rigid, wave resistant calcareous structure constructed by sessile organisms such as sponges, corals, and bryozoans, in a high energy environment

free radical - an atom or group of atoms possessing an unpaired electron; free radicals are highly reactive and bind with other molecules, thus disrupting normal cellular processes and causing cellular damage (oxidative stress)

free-living coral - a coral which is not attached to a substrate

French Frigate Shoals - an open atoll in the Northwest Hawaiian Islands (NWHI) that consists of a large, crescent-shaped reef surrounding numerous small, sandy islets. While the land area is only one-fourth square kilometer (67 acres), the total coral reef area of the shoals is over 938 square kilometers (232,000 acres). The reef system associated with French Frigate Shoals supports the greatest variety of coral species in the NWHI, with 41 species of stony corals documented. It also supports more than 600 species of invertebrates, many of which are endemic to the area, over 150 species of algae, and many species of fishes. Hundreds of green sea turtles travel to the shoals for safe nesting. The many small islets of French Frigate Shoals also provide refuge to the largest sub-population of endangered Hawaiian monk seals



Sponges in French Frigate Shoals reef. (Photo: NOAA)

frequency - the number of items occurring in a given category

frequency distribution - a graphical, tabular, or mathematical representation of the manner in which the frequencies of a continuous or discrete random variable are distributed over the range of its possible value

frequency of recombination - the number of crossover events observed between two linked loci expressed as a proportion of the total number of meioses sampled

fringing reef - a shelf reef that grows close to shore. Some develop around oceanic islands. A synonym of shore reef



A fringing reef off a South Pacific Island.

frond - a leaf-like thallus, such as the body of a kelp

Fungi - the Kingdom of usually multicellular, heterotrophic eukaryotes that have multinucleated cells enclosed within cell walls. Nutrition is obtained by decomposing dead and dying organisms and absorbing the decomposition products



Fungi growing in an Oregon woodland. (Photo: Carol Baldwin, NOAA/OMAO)

fungicide - a chemical compound used to retard or prevent the growth of fungi

funnel organ - a structure, common in several phyla, that leads from the coelom to the outside and may be used for waste elimination and/or reproduction (Annelida, Brachiopoda, and other small phyla); the modified tubular opening of the mantle cavity in cephalopods used in generating a stream of water for use in locomotion

furcate - to divide into branches; to fork

fusiform - a shape that is tapered at both ends; spindle-shaped; torpedo-shaped, like a mackerel

G1 - phase in the cell cycle between the completion of cell division and the initiation of DNA synthesis

G2 - phase in the cell cycle between the completion of DNA synthesis and the next cell division

gall - an abnormal outgrowth caused by infection or irritation by certain fungi or bacteria

game species - species of animals that are hunted or fished, for purposes of sport, recreation, and food capture

gamete - a sex cell, e.g., a spermatozoan or egg cell, produced by sexually reproducing organisms

gamete bundle - in coral sexual reproduction, the polyps of many species release bundles of eggs and sperm cells, called gamete bundles, that float to the sea surface. The layers surrounding the egg and sperm bundles soon rupture, releasing the gametes at the surface, where fertilization occurs

gametocyte - a reproductive cell capable of dividing by meiosis to produce gametes, e.g., a spermatocyte or oocyte

gametogenesis - the development and maturation of gametes (sex cells) through meiosis. The process is termed 'spermatogenesis' in the development of sperm cells and 'oogenesis' in the development of egg cells

gametophyte - a life cycle stage in certain algae that produces male and female reproductive organs

gamma ray - an electromagnetic wave or photon emitted from the nucleus

ganglion - a structure containing an aggregation of cell bodies of nerve cells (neurons)

gap analysis - a Geographic Information System (GIS) methodology to identify the distribution of biodiversity over large spatial areas. It was developed in 1988 by the U.S. Geological Survey in an effort to ensure that regions rich in species diversity are conserved with the hope that this will eliminate the need to list species as threatened or endangered in the future. The gap analysis approach uses maps of vegetation and predicted animal distributions to locate centers of species richness outside areas currently managed for biodiversity protection. These are considered the "gaps" of gap analysis. Thus far, its use primarily has been in the terrestrial sphere

gap phases - the phases of the cell cycle known as G1 and G2, during which relatively less obvious cellular activity is visible

gas chromatograph/mass spectrometer (GC/MS) - an instrument that identifies the molecular composition and concentrations of various chemicals in water and soil samples

gas chromatography - a method of separating chemical components of a mixture, which involves the passage of a gaseous sample through a column having a fixed adsorbent phase

gas laws - laws that predict how gases will behave with changes in temperature, pressure, and volume

gastric - pertaining to the stomach

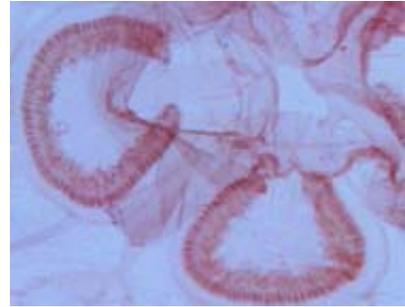
gastric filaments - in scyphozoan medusae, a fringe of short, threadlike filaments whose secretory cells secrete digestive enzymes. They are located on the floor of each gastric pouch

gastric mill - the grinding apparatus in the cardiac stomach of crustaceans. It is formed by three chitinous teeth that project into the stomach; the thick-walled muscular pouch below the crop in many birds and reptiles, used for grinding food



Gastric mill and teeth within the stomach of a grooved tanner crab (*Chionoecetes tanneri*). (Photo: NOAA)

gastric pouch - in scyphozoans (jellyfish), one of four sacs in which food is digested. Each pouch contains a conspicuous horseshoe-shaped gonad on its floor



Gastric pouch region of the jellyfish, *Aurelia*. The horseshoe-shaped structure is a gonad. (Photo: John Houseman, BIODIDAC)

gastrodermis - the epithelial lining of the gastrovascular (digestive) cavity of cnidarians and ctenophores (comb jellies)

gastrolith - A deposit of calcium salts made in the stomach of many crustaceans during the period between molts. It may be used to store calcium needed in the new exoskeleton

Gastropoda - a class of the phylum Mollusca that includes snails, sea slugs, nudibranchs, limpets, and cone shells. There are approximately 30,000 living species described. Many species are inhabitants of coral reefs and nearby seagrass beds

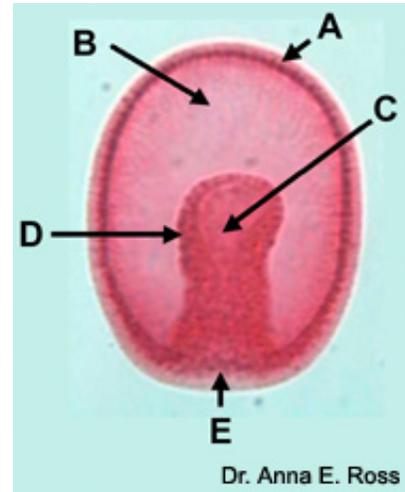


A sea slug of the Class Gastropoda, Phylum Mollusca.

gastrovascular cavity - the internal digestive cavity of cnidarians and ctenophores that is lined with the gastrodermis

gastrozoid - a polyp in hydrozoans and other colonial cnidarians which is specialized for feeding

gastrula - the embryonic stage of an animal that has cells differentiated into germ layers. Sequentially, It follows the blastula stage



An echinoderm gastrula. It was formed by the invagination of blastomeres at the vegetal pole area of the blastula to produce the archenteron, which will become the digestive system. The opening into the archenteron is the blastopore, which will become the anus of the adult. The cavity of the archenteron is the gastrocoel. The roof of the archenteron, which forms the mesoderm, will expand and pinch off mesodermal vesicles with an internal cavity that will become the coelom (see: mesoderm). A - ectoderm; B - blastocoel; C - archenteron; D - endoderm; E - blastopore. (Photo: Dr. Anna E. Ross, Christian Brothers University, TN)

gastrulation - during embryonic development of most animals, a complex and coordinated series of cellular movements occurs at the end of cleavage. The details of these movements vary among species, but usually result in the formation of of an embryonic stage termed the gastrula. The gastrula has two primary germ layers, the ectoderm and endoderm in diploblastic animals, and three primary germ layers with the development of the mesoderm in triploblastic animals



An early gastrula. The cells at the vegetal hemisphere have begun to

invaginate into the blastocoel, forming the archenteron. (Photo: Dr. Anna E. Ross, Christian Brothers University, TN)

Gause's principle - the principle that "no two species can coexist indefinitely on the same limiting resource." Also called Gause's Law, or the 'competitive exclusion principle'

gb (gigabase pairs) - one billion (10^9) pairs of nucleotide bases in DNA

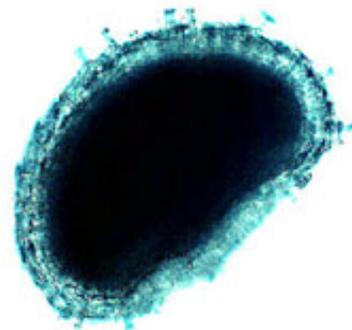
GBIF (Global Biodiversity Information Facility) - an international non-profit organization that provides free and universal access to data regarding the world's biodiversity. A wide range of countries and organizations participate in GBIF and have made their data available through the GBIF web site (<http://www.gbif.org>)

GCRMN (Global Coral Reef Monitoring Network) - a global network whose aim is to improve management and sustainable conservation of coral reefs for people by assessing the status and trends in the reefs and how people use and value the resources. It does this by providing many people with the capacity to assess their own resources, within a global network, and to spread the word on reef status and trends

gel - a jelly-like substance formed by the coagulation of a colloidal liquid; a cytoplasmic phase

gel electrophoresis - a process for separating molecules by forcing them to migrate through a gel under the influence of an electric field

gemmule - an asexual, spore-like reproductive unit in sponges, capable of overwintering and developing into an adult sponge the following summer



Rick Gillis, Ph.D

A sponge gemmule. Calcareous spicules projecting from the covering of the gemmule provide additional protection. (Photo credit: Rick Gillis, Ph.D., Biology Dept., University of Wisconsin-La Crosse)

gene - the functional and physical unit of heredity passed from parent to offspring. Genes are pieces of DNA, and most genes contain the information for making a specific protein

gene array - a regular pattern of DNA fragments, or oligonucleotides, spotted onto a solid support and used as a diagnostic tool to measure many individual gene expression levels simultaneously

gene expression - the conversion of information from gene to protein via transcription and translation

gene flow - the movement of genes through or between populations as the result of out-crossing and natural selection

gene frequency - the relative occurrence of a gene in a given population, usually expressed as a percentage

gene index - a listing of the number, type, label and sequence of all the genes identified within the genome of a given organism

gene locus - the specific place on a chromosome where a gene is located

gene mapping - determination of the relative locations of genes on a chromosome

gene pool - the sum total of genes, with all their variations, possessed by a particular species at a particular time

gene product - the product, either RNA or protein, that results from expression of a gene. The amount of gene product reflects the activity of the gene

gene silencing - the interruption or suppression of the expression of a gene at the levels of transcription or translation

gene splicing - a cell process by which a gene is cut into different parts, exons and introns. The exons are the coding region and are put back together to make the gene that is transcribed and translated into a protein

gene therapy - an approach to preventing and/or treating disease by replacing, removing or introducing genes or otherwise manipulating genetic material. In some cases, the material can be injected with a genetic vaccination. In other cases the material is introduced through harmless bioengineered viruses that carry the therapeutic gene to the cell. Globules known as liposomes can also be used to carry therapeutic genes to specific cells

gene-based medicine - instead of solely replacing defective genes, gene-based medicine is the application of nucleic acids (DNA, RNA) containing genetic information as therapeutic reagents in general. Nucleic acids are used to add a therapeutically beneficial function to cells, delete pathological functions from cells, or utilize cells for the production of therapeutic proteins. This can be either a transient or a permanent effect

generalist - an organism which can survive under a wide variety of environmental conditions, and does not specialize to exist under any particular set of circumstances

generation - offspring from the same parental group going through their life cycle together

genetic code - the chemical code by which genetic information in DNA is translated into biological function. A set of three nucleotides (codons), the building blocks of DNA, signifies one amino acid. Amino acids are the building blocks of proteins

genetic disease - a disease that has its origin in changes to the genetic material. Genetic diseases usually refer to diseases that are inherited in a Mendelian fashion, although non-inherited forms may also result from genic (DNA) mutation

genetic distance - a measure of the genetic similarity between any pair of populations. Such distance may be based on phenotypic traits, allele frequencies or DNA sequences

genetic diversity - the variety of different types of genes or alleles in a species or population

genetic drift - random changes in the frequency of alleles in a population. In small populations, it can lead to the elimination of a particular allele by chance alone. It is thought to be one cause of speciation when a group of organisms is separated from its parent population

genetic engineering - the technique of selectively removing, modifying, or adding genes to a DNA molecule by use of recombinant DNA or other specific molecular gene transfer or exchange techniques. These techniques produce endogenous proteins with properties different from those of the normal, or to produce entirely different proteins altogether. Organisms modified by genetic engineering are sometimes referred to as transgenic, bioengineered, or genetically modified

genetic map position - the location of a gene on a genetic map, deduced from recombination frequencies

genetic marker - a DNA sequence used to "mark" or track a particular location (locus) on a particular chromosome

genetic mutation - a permanent structural alteration in DNA. In most cases, DNA changes either have no effect or cause harm, but occasionally a mutation can improve an organism's chance of surviving and passing the beneficial change on to its descendants

genetically modified organism - an organism that has been modified by the application of recombinant DNA technology

genital bursa - an invagination at the base of an arm of a brittle star. Each bursa is a pouch lined with ciliated epidermis and is the primary respiratory surface for the organs of the perivisceral coelom. The epidermal cilia generate a ventilating current. The bursae have the gonads on the coelomic side of their wall

genome - all the DNA contained in an organism or a cell, which includes both the chromosomes within the nucleus and the DNA in mitochondria

genome size - the size of a genome (all the genetic material in the chromosomes of a particular organism) is generally given as its total number of base pairs

genomic library - a collection of clones made from a set of randomly generated overlapping DNA fragments that represent the entire genome of an organism

genomics - the comprehensive analysis of all the genes of an organism; molecular characterization of all the genes and gene products of a species, including the study of gene sequences, gene mapping, and gene function; genomics usually involves high speed sequencing of the DNA and computer searches for sequences that code for genes. Genomics allow researchers to identify specific genes responsible for specific proteins with specific functions in an organism

genotype - the genetic constitution of an individual or group. In taxonomy, the genotype is the type species of a genus

genus - a taxonomic group containing one or more species

geo-referenced data - refers to data with geographic location information included, such as latitude and longitude

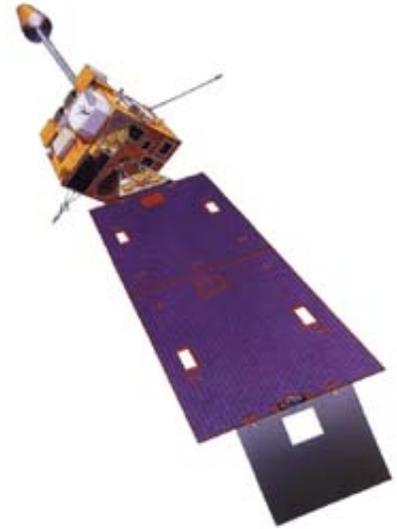
geochemistry - the study of the chemical elements, their isotopes, and related processes with respect to the abundance and distribution of materials within the Earth's waters, crust, and atmosphere

geographical isolation - a form of reproductive isolation in which members of a population become separated from another population by geographical barriers that prevent the interchange of genes between the separated populations

geoid - the hypothetical surface of the Earth that coincides everywhere with the mean sea level

geologic time scale - a relative time scale based upon fossil content. Geological time is divided into eons, eras, periods, and epochs

geostationary satellite - satellite whose orbit around the equator equals that of the Earth's rotation, making it possible for them to view the same disc of Earth's surface below continuously



Artist's rendition of GOES I/M, geostationary satellites whose mission includes data collection and broadcasting, and environmental sensing. (Image: NASA/Goddard Space Flight Center)

geostrophic current - a flow that sustains a balance between Coriolis deflection and a pressure gradient

Geotiff - a file format that embeds image registration information directly into a raster file; an industry-neutral raster file format widely used and recognized by all of the major GIS software vendors. ESRI began support for Geotiff at version 7.0 of ARC/INFO and version 3.0 of ArcView. Geotiff represents an effort by over 160 different remote sensing, GIS, cartographic, and surveying related companies and organizations to establish a TIFF-based interchange format for georeferenced raster imagery

germ layers - distinct layers of cells, produced during the early embryonic developmental process of gastrulation, which gives rise to all cells, tissues, organs, and organ systems of the organism's body. The three types of germ layers are the ectoderm, endoderm, and mesoderm. Diploblastic organisms (e.g. cnidarians) have two layers, ectoderm and endoderm; triploblastic organisms (all higher animal groups) have mesoderm between these two layers

gestation period - the period of development of the young in viviparous animals, from the time of zygote formation (fertilization) until birth

GIF (Graphics Interchange Format) - a bit-mapped digital image graphics file format suitable for efficiently importing image data into computer files or for transmitting or displaying the formatted image on a computer monitor or printing it out. GIF supports color and various resolutions. It also includes data compression, making it especially effective for scanned photos

gill - a highly vascularized respiratory organ with a large surface area in aquatic animals. Gills are in direct contact with the surrounding water for gas exchange



The gill cover (operculum) of this fish is lifted to expose the gills, which are the respiratory organs of fishes and many other aquatic animals.

gill arch - one of several curved bony or cartilaginous structures located on either side of the pharynx that support the gills of fishes and amphibians. Each gill arch is made up of an upper and a lower limb that are joined posteriorly. The gill filaments and gill rakers are attached to the gill arches

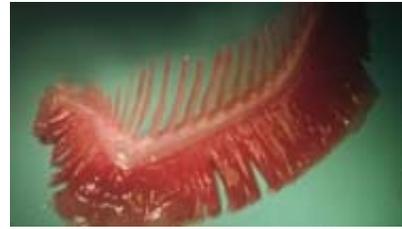
gill filament - a fingerlike projection from a gill arch through which respiratory gases enter and leave the blood

gill net - a net primarily designed to catch fish by entanglement in a mesh that consists of a single sheet of webbing which hangs between cork line and lead line, and which is fished from the surface of the water



A fisherman setting out a gill net.
(Photo: NOAA)

gill raker - one of a series of knob- or comb-like projections on the front edge of the gill arch. Gill rakers aid in the fish's feeding. Their shape and number are a good indication of the diet of the fish. Fishes which eat large prey, such as other fishes, have short, widely spaced gill rakers that prevent the prey item from escaping between the gills. Fishes which eat smaller prey have longer, thinner and more numerous gill rakers. Species which feed on plankton have the longest, thinnest and most numerous gill rakers. Gill rakers also protect and clean the gill fillaments. Counts of gill rakers are used as taxonomic characters



Gill arch of an almaco jack (*Seriola rivoliana*) showing the gill rakers and gill filaments. (Photo: NOAA)

gill tuft - a fluffy cluster of gill filaments

GIS (Geographic Information System) - a system that allows automatic location of information suitable for mapping. Usually involves a software system that takes geographic position data and other data (e.g., type of bottom sediment) in order to create a map. Data on processes (e.g., current speed) can be incorporated to make a geographic model of flow

gland - a group of cells or a single cell in animals or plants that is specialized to secrete a specific substance

global change - a transformation which occurs on a worldwide scale (for example, an increase in CO₂ in the atmosphere) or exhibits sufficient cumulative effects to have worldwide impact (for example, local species extinction resulting in global loss of biodiversity)

global warming - an increase in temperature that occurs globally

globular - globe-shaped; having the form of a sphere, or nearly so



The porcupine fish, when threatened, swallows water and takes on a globular shape. (Photo: Copyright Corel Corporation)

glucose - a monosaccharide, $C_6H_{12}O_6$, that is the end product of carbohydrate metabolism and is the chief source of energy for living organisms

glutinous - sticky

gnathic - pertaining to the jaw

Gnathostomata - the group of vertebrates that possess jaws; includes fishes, amphibians, reptiles, birds, and mammals

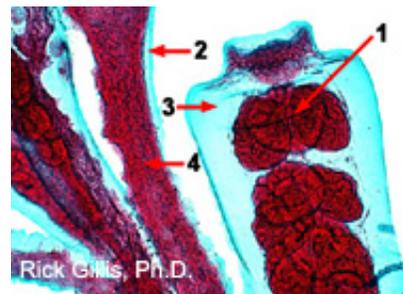
GOES (Geostationary Operational Environmental Satellite) - a class of satellite operated by NOAA, positioned in a nearly stationary orbit over the equator at an altitude of about 22,500 miles. GOES-8 is currently the operational "east" spacecraft at 75 degrees West longitude, while GOES-10 is the "west" spacecraft located at 135 degrees West. GOES-11 is in standby at 110 degrees West



Image developed by NASA from GOES data-Hurricane Floyd at the U. S. coast on September 15, 1999 (Hal Pierce, NASA Goddard Space Flight Center)

gonads - the primary sex organs of an animal. In males they are the testes, and in females, the ovaries

gonangium - a reproductive polyp of a colonial hydrozoan. It consists of a stalk containing medusa buds surrounded by a thin membrane, the gonotheca



A gonangium of the hydrozoan *Obelia*. 1= medusa bud; 2= perisarc; 3=gonotheca; 4= coenosarc. (Photo: Rick Gillis, Ph.D., Biology Dept., University of Wisconsin-La Crosse)

gonochoric - having separate sexes. Individuals within the species contain only one or the other of male and female reproductive systems

gonoduct - any duct that generally transfers eggs or sperm cells

gonophore - a sexual zooid produced as a medusa bud upon a hydroid, sometimes becoming a free hydromedusa and sometimes remaining attached

gonopodium - a term given to the anal fin (or the anterior portion of it) of a male fish when it is modified to function as a copulatory organ, e.g., in guppies

gonopore - an opening between the reproductive system and the outside environment; the genital pore of many invertebrates

gonotheca - a thin membrane covering the body of a gonangium, the reproductive polyp of a colonial hydrozoan

gonozooid - a reproductive polyp of a colonial hydrozoan

gorgonian - an anthozoan of the subclass Octocorallia, commonly called sea fans and sea whips



A sea fan, *Gorgonia ventalina*, in the Florida Keys.

gorgonin - a fibrous protein in the mesoglea which provides skeletal support for sea fans and other members of the Order Gorgonacea

GPS (Global Positioning System) - a network of satellites and receiving devices used to compute accurate geographical positions on the Earth. A GPS is used in navigation, and its precision supports cadastral surveying



Portable GPS unit utilized in surveying.

gradient analysis - an intuitive method to portray variation along a single or multiple environmental gradients. The plots display species or community abundance in response to a known environmental gradient, i.e., the analysis of species composition along a gradient of environmental conditions

Gram's stain - a method for differential staining of bacteria; Gram-positive cells stain purple-black and Gram-negative cells stain pink; useful in bacterial taxonomy and identification

gravid - pregnant; heavy with young; full of ripe eggs or distended by such fullness



Gravid green crab with egg mass on the abdomen. (Photo: Gary Weber)

Gray's Reef National Marine Sanctuary - Gray's Reef comprises one of the largest nearshore sandstone reefs in the southeastern United States. It is located 32 kilometers (17.5 nautical miles) off Sapelo Island, Georgia. Designated in 1981, the Gray's Reef National Marine Sanctuary boundaries protect 17 square miles of open ocean. Sandstone outcroppings and ledges up to ten feet in height separate the sandy, flat-bottomed troughs in a reef that combines temperate and tropical flora and fauna. The rocky platform, some 60 to 70 feet below the surface, is covered by a carpet of attached organisms and is known locally as a "live bottom habitat." Gray's reef is not a coral reef. It is a consolidation of marine and terrestrial sediments (sand, shell, and mud) which was laid down as loose aggregate between 6 and 2 million years ago



A reef scene showing biodiversity at Gray's Reef. (Photo: NOAA)

grazer - an animal which feeds on plants



Sea urchins are important grazers on coral reefs. Their diet, however, is not totally restricted to plants and algae.

green algae - green algae belong to the Division Chlorophycota. These algae contain photosynthetic pigments similar to those in higher plants (chlorophylls a and b, as well as secondary pigments: carotenes, lutein, and zeaxanthin) and have a green color. Green algae include unicellular forms, filamentous forms, and leaf-like thalluses.



The green alga *Caulerpa taxifolia* with feather-like branches. The leaf is 5-65 cm in length. (Photo: NOAA)

greenhouse effect - the heating that occurs when gases such as carbon dioxide trap heat escaping from the Earth and radiate it back to the surface

greenhouse gases - atmospheric gases, primarily carbon dioxide, methane, and nitrous oxide restricting some heat-energy from escaping directly back into space

gross photosynthetic rate - the total rate of CO₂ fixation with no allowance for the CO₂ simultaneously lost during respiration

gross primary production - the total amount or weight of organic matter created by photosynthesis over a defined time period (total product of photosynthesis)

ground truthing - measurements conducted on the ground or at sea to calibrate, compare or verify observations made from satellites or aircraft

grounding - a ship's striking a shoal or reef

growth band - a band formed yearly on coral by the secretion of CaCO₃; one yearly growth band contains two smaller bands representing winter growth and summer growth

growth factor - any of various chemicals, particularly polypeptides, that have a variety of important roles in the stimulation of new cell growth and cell maintenance. They bind to the cell surface on receptors. Specific growth factors can cause new cell proliferation

growth rate - the increase in mass per unit of time

growth - an increase in cell size or cell number, or both

guanine - one of the four nitrogenous bases in DNA and RNA that make up the letters ATGC, guanine is the "G". The others are adenine, cytosine, and thymine. Guanine always pairs with cytosine

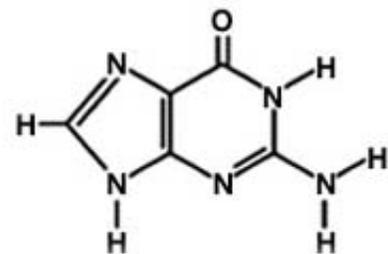


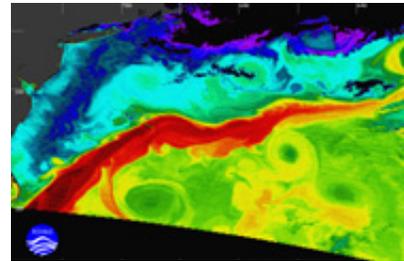
Diagram of the chemical structure of guanine, one of the four nitrogenous bases in DNA.

guild - a group of species that use the same resources in a similar way; an ecological association based on similar roles in a community rather than evolutionary descent, as for example, filter feeders or browsers

gular - of, relating to, or located on the throat

gulf - a portion of an ocean or sea that extends into the land; a partially land-locked sea, e. g., the Gulf of Oman

Gulf Stream - the warm ocean current of the North Atlantic. It originates in the westward equatorial current and is deflected northward by the coast of South America into the Gulf of Mexico and then follows the coast of North America to Nantucket, where it is deflected eastward toward northern Europe



Sea surface temperature image of the Gulf Stream, derived from infrared measurements of the Moderate-resolution Imaging Spectroradiometer (MODIS), May 8, 2000. (Image produced from 11- and 12-micron bands by Bob Evans, Peter Minnett, and co-workers, University of Miami)

gustation - pertains to the sense of taste

gut - the digestive tube formed between the mouth and anus in which food is digested and nutrients absorbed; it consists of the mouth, pharynx, esophagus, stomach, intestine, and anus, though some animals do not have all these regions

guyot - a flat-topped submarine mountain

gynogenetic - containing genetic material derived from the female parent only

gyre - a large water-circulation system of geostrophic currents rotating clockwise in the Northern Hemisphere or counterclockwise in the Southern Hemisphere

habitat - the place or environment where a particular organism, population, or species lives

habitat complexity - the areal extent and number and diversity of habitat types and distinct ecological zones within a specified area

habitat distribution - the structure and spatial characterization of all habitat types in a specified area

habitat diversity - the number of different types of habitats within a given area

habituation - in animal behavior, the temporary waning or disappearance of an innate response when it is elicited many times in succession

half-life - the time required for a radioactive substance to lose half of its nuclei

halocline - the boundary where there is a marked change in salinity between surface fresh water and underlying saltwater in a stratified coastal environment

halophile - an organism which lives in an environment of high salt concentration. Halophiles have special adaptations to permit them to survive under these conditions

halophyte - a plant that grows in soils that have a high content of various salts



A black mangrove is an example of a halophyte, a plant that thrives in a saline environment.

haploid - a haploid cell contains a nucleus with a single complete set of chromosomes. The haploid condition is often abbreviated as n . Most fungi, protists, and algae are haploid, as are some insects, bryophytes, and the gametes of all organisms

haplotype - a set of closely linked genes that tends to be inherited together as a unit; a particular set of alleles at linked loci that are found together on a single homolog

hapteron - a single branch within a holdfast

hard bottom - a substrate formed by the deposition of calcium carbonate by reef building corals and other organisms or existing as bedrock or volcanic rock usually of minimal relief

hard coral - a coral in the anthozoan order Scleractinia. Also known as the stony corals, these organisms possess a hard external calcareous skeleton. A synonym of **stony coral**



Skeleton of a hard coral colony.

hard coral forms - may be conveniently summarized as: encrusting (lichen-like); branched (staghorn-like); massive (rock-like); sub-massive (pillar-like); tabulate (table-like); foliose (scroll-like); and solitary

Hardy-Weinberg Law - the frequency of a given genotype will reach equilibrium in a randomly mating population and will stay constant over many generations in the absence of selection pressures

Hawaiian Archipelago - the Hawaiian Archipelago consists of eight large islands and 124 small islands, reefs, and shoals. It stretches for over 2,400 km from 19 degrees - 28 degrees N to 155 degrees -178 degrees E. It can be divided into two distinct regions: the Northwestern Hawaiian Islands (NWHI), primarily uninhabited atolls, islands, and banks accounting for the majority of U.S. reefs, and the Main Hawaiian Islands (MHI) largely made up of populated, high, volcanic islands with non-structural reef communities, fringing reefs, and two barrier reefs

heat shock proteins (HSPs) - a group of proteins that are present in the cells of all living organisms. They are induced when a cell is exposed to various types of environmental stresses, e.g., heat, cold and oxygen deprivation. Heat shock proteins are also present in cells under normal conditions, assisting in other cellular protein functions and behavior. They also trigger immune responses through both intracellular and extracellular activities; also called stress proteins

heavy metal - a metal having a specific gravity of 5.0 or greater. Heavy metals are generally toxic to organisms in relatively low concentrations, and tend to accumulate in the food web. Examples include arsenic, cadmium, chromium, lead, and mercury

heliox - a breathing gas mixture for scuba divers that contains only oxygen and helium, used for deep diving to remove the narcotic effect of nitrogen

helix - a structure with a spiral shape

heme - a complex red organic pigment containing iron and other atoms to which oxygen binds

hemichordate - any of various worm-like marine animals belonging to the phylum Hemichordata, having a primitive notochord and gill slits



An acorn worm in the phylum Hemichordata. (Photo: BIODIDAC)

hemocoel - the extensive spaces of an arthropod's body through which the hemolymph (blood) circulates

hemocyanin - a bluish, copper-containing respiratory pigment with an oxygen-carrying function similar to that of hemoglobin that is present in the blood of certain mollusks and arthropods

hemoglobin - the iron-containing protein (pigment) found in red blood cells of vertebrates. Hemoglobin transports oxygen from the respiratory surface (gills, lungs) to the body's tissues. It is red when oxidized

hemolymph - the circulating and tissue-bathing fluid of the arthropod open circulatory system. It is composed of cells and plasma and often loosely termed as blood

Henry's Law - the amount of gas that will dissolve in a liquid at a given temperature is almost directly proportional to the partial pressure of that gas

herbivore - an animal that feeds on plants

heredity - the transfer of genetic information from parent cells to progeny

hermaphrodite - an animal or plant which is equipped with both male and female reproductive organs

hermatypic coral - a reef-building coral with zooxanthellae in its tissues

herpetology - the scientific study of amphibians and reptiles



Herpetologists study the biology of amphibians and reptiles, such as this Indopacific sea snake, *Laticauda colubrina*. This species lays its eggs on land. Other species are livebearers and give birth to their young in the ocean. (Photo: Sohan Shetty)

heterocercal - a caudal fin where the upper lobe is larger than the lower lobe. Most sharks have heterocercal caudal fins

heterochrony - a change in the timing of ontogenetic events between two species. These can be the result of relatively small genetic changes between an ancestor and its descendant species

heterotroph - an organism that cannot manufacture its own food, and therefore requires external sources of energy

heterozooid - a specialized non-feeding bryozoan zooid. Heterozooids include forms specialized for producing and brooding eggs, or, more rarely, spermatozoa. Others are specialized to protect the colony, or have a cleaning function, or strengthen and support the colony

heterozygote - an individual having a heterozygous gene pair. A diploid or polyploid with different alleles at a particular locus

heterozygous gene pair - a gene pair having different alleles in the two chromosome sets of the diploid individual, for example, **Aa**

hexamerous - having six parts, or parts in multiples of six arranged radially, as found in anthozoans in which the tentacles and mesenteries are in multiples of six

hexaxon - in sponges, a spicule with six rays

high tide - the tide at its fullest extent, when the water reaches its highest level



A small island at the mouth of the Amazon River at high tide. See **low tide** for contrast. (Photo: Alessandra and Michael)

high-resolution satellite SST climatology - 9 km monthly or yearly averages of satellite-derived (see AVHRR) sea surface temperatures obtained over periods of 10 years or longer

hinge - the elastic part of a bivalve (Mollusca) shell that unites the valves along the top of the shell

histogram - a bar graph in which the area over each class interval is proportional to the relative frequency of data within this interval

histology - the branch of biology that studies the microscopic structure of animal or plant tissues. The four basic types of animal tissues are: epithelial tissue, nervous tissue, muscular tissue and connective tissue (bone, cartilage, blood, fat, and areolar (fibrous)). The three basic plant tissues are: dermal tissue, ground tissue, and vascular tissue

histone - a type of protein present in the nucleus of eukaryotic cells that helps to compact DNA into tightly packed chromosomes

historical data - data sets from previous studies

hoa - a channel or pass connecting the atoll lagoon with the open ocean

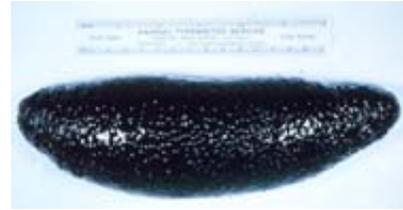
holdfast - a root-like structure for attachment that anchors attached seaweeds and other algae to the substratum

holoblastic cleavage - complete cleavage of the zygote. The cleavage furrows pass all the way through the zygote; typical of isolecithal and mesolecithal eggs

Holocene epoch - an epoch of the Quaternary period dating from the end of the Pleistocene approximately 8,000 years ago until the present

holoplankton - planktonic organisms that spend their entire life cycle in the floating state, as contrasted with organisms, such as fishes, which spend only a portion of their life cycle (eggs, larvae) as members of the planktonic community

holothurian - a sea cucumber in the echinoderm class Holothuroidea



A holothurian (sea cucumber),
Holothuria atra.

holothurin - a toxic substance released by some holothuroids (sea cucumbers)

holotype - in taxonomy, a single specimen designated or indicated the type specimen by the original author at the time of publication of the original description

homeobox - family of genes that regulates activities of other genes (turns genes 'on' and 'off')

homeostasis - the ability to maintain a relatively constant internal environment

homeotic gene - a gene that controls the activity of other genes involved in the development of a body plan

homeotic mutation - a mutation that causes a body part of an organism to develop in an inappropriate position

homing behavior - a type of behavior where the adult organism returns to its place of origin

homocercal - a caudal fin with upper and lower lobes that are approximately equal in size; characteristic of most bony fishes

homolog - in genetics, one member of a chromosome pair. Homologous chromosomes have corresponding DNA sequences and come from separate parents, i.e., one homolog comes from the maternal parent and the other comes from the paternal parent; in evolution, a characteristic that is similar in different species because it evolved from a common ancestor

homologous chromosomes - the pair of chromosomes in a diploid individual that have the same overall genetic content. One member of each homologous pair of chromosomes is inherited from each parent

homology - the relationship of any two characters that have descended from a common ancestor. The term can apply to a morphological structure, a chromosome, an individual gene, or a DNA sequence

homonym - in taxonomy, each of two or more identical but independently proposed names for the same or different taxa. A junior homonym is the later published of two homonyms. A senior homonym is the earlier published of two homonyms

homozygote - an individual having a homozygous gene pair. A diploid or a polyploid with identical alleles at a locus

homozygous gene pair - a diploid gene pair having identical alleles in both copies, for example, **AA** or **aa**

hookah - "hookah" refers to diving where the diver is supplied with breathable air from the surface via an air compressor and an airline (hose). This type of diving is ideal for shallow water commercial applications

horizontal classification - in taxonomy, classification which stresses grouping together taxa in a similar stage of evolution, rather than location on the same phyletic line

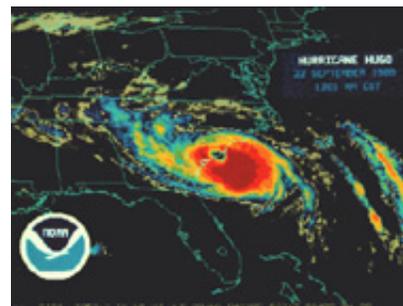
host - an organism which serves as the habitat for a parasite or symbiont. The host may provide nutrition to the parasite or symbiont, or simply a place in which to live

hotspot - an environmentally endangered region that is both rich in species and found nowhere else

HotSpot animation - animations from HotSpot imagery denoting coral reef bleaching events over time

HotSpot charts - charted regions that highlight sea surface temperature (SST) anomalies that are greater than 1 deg C above the maximum monthly climatological SST. See also coral bleaching and coral bleaching hotspot

hurricane - an intense tropical cyclone in which winds tend to spiral inward toward a core of low pressure, with maximum surface wind velocities that equal or exceed 33.5 m/sec (75 mph or 65 knots) for several minutes or longer at some point



Infrared image of Hurricane Hugo making landfall September 22, 1989. (Image: NOAA)

hurricane surge - a rise in the sea surface on an open coast, often resulting from a hurricane



Surge from 1969's Hurricane Carol swamps a yacht club. (Photo: Providence Journal Co., NOAA/NWS Historic Collection)

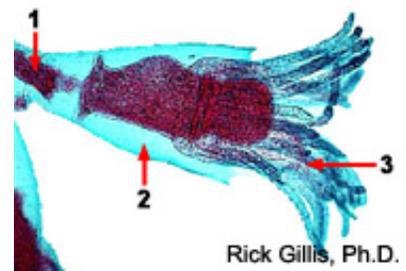
hyaline - translucent or transparent

hybrid - an individual with parents of different species

hybrid name - in taxonomy, names of progeny of two individuals belonging to different taxa. Names given to hybrids are not normally available, as they are individuals, not populations, and hence not taxa

hybridization - the production of offspring (hybrids) from genetically dissimilar parents

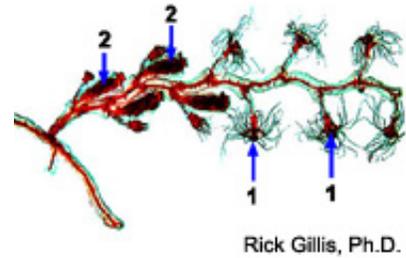
hydranth - a feeding polyp of a colonial hydrozoan. It bears tentacles armed with nematocysts, a mouth and a thin outer covering, the hydrotheca



Hydranth of the hydrozoan, *Obelia*.
1=coenosarc; 2=hydrotheca;
3=tentacles. (Photo: Rick Gillis, Ph.
D., Biology Dept., University of
Wisconsin-La Crosse)

hydrocarbon - an organic molecule, such as methane (CH₄), which consists only of carbon and hydrogen atoms

hydrocaulus - the main stem of a colonial hydrozoan which consists of a cylindrical tube of living tissue (coenosarc) covered by a thin outer membrane (perisarc)



Rick Gillis, Ph.D.

Hydrocaulus of the hydrozoan, *Obelia*. (Photo credit: Rick Gillis, Ph. D., Biology Dept., University of Wisconsin-La Crosse)

hydrogen bond - a relatively weak chemical bond consisting of a hydrogen atom between two electronegative atoms (e.g., oxygen or nitrogen), with one side being a covalent bond and the other being an ionic bond

hydrogen ion - an individual atom of hydrogen which is not attached to a molecule and therefore has a positive (+) charge

hydrological cycle - the movement of water in all of its phases (gas, liquid, solid) from the Earth to the atmosphere and back to the Earth

hydrology - the science dealing with the properties, distribution and circulation of water and snow

hydrolysis - the breaking down of a compound into fragments by the addition of a molecule of water. The hydroxyl group is incorporated in one fragment and the hydrogen atom in the other

hydrophilic - having a strong affinity for water; tending to dissolve in, mix with, or be wetted by water -

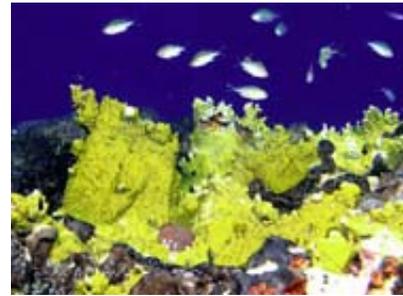
hydrophobic - refers to molecules that do not interact with water and are not soluble in water. Hydrophobic compounds do not dissolve easily in water, and are usually non-polar. Oils and other long hydrocarbons are hydrophobic

hydrostatic skeleton - a type of skeleton found in many soft-bodied invertebrates which consists of a turgid column of liquid within one of the body spaces that provides support or rigidity to the organism or to one of its parts. Hydrostatic skeletons are found in echinoderms (starfish, sea urchins), annelids (worms), nematodes (roundworms), and a number of other wormlike invertebrate phyla

hydrotheca - a thin outer covering of a hydranth, the feeding polyp, of a colonial hydrozoan

hydroxyl group - an [-OH] or alcohol group on a larger molecule. The oxygen is single-bonded to the hydrogen and has one free bond to the rest of the molecule

Hydrozoa - a class within the phylum Cnidaria. The Hydrozoa contains five orders that include: small medusae with no polyp generation; colonial forms with alternating polyp and medusa stages and a chitinous exoskeleton; solitary polyps that lack a medusoid stage; colonial forms with massive aragonite skeletons (e.g., fire coral); and complex colonial forms, with individual polyps specialized for feeding, swimming, prey capture, and reproduction. Some, but not all, float by means of a large pneumatophore, or gas bag



White-tipped mustard-colored fire coral in the Flower Garden Banks.

hyperplasia - abnormal increase in the size/volume of a tissue due to multiplication of cells

hypersaline - referring to water with a salinity higher than that of natural seawater

Hyperspectral AVIRIS (Airborne Visible/Infrared Imaging Spectrometer) - a hyperspectral image is a very high resolution image which was acquired with a hyperspectral scanner. These instruments acquire data in 224 contiguous channels of approximately 10nm bandwidth. They are spanning the visible, near-infrared and mid-infrared portion of the electromagnetic spectrum

hypha - one of the long, branching filaments that forms the mycelium of a fungus

hypobranchial gland - a gland in the mantle cavity of mollusks that secretes mucus

hypolithic - living on lower surfaces of rocks

hyposaline - referring to water with a salinity lower than that of natural seawater

hypostome - in cnidarians, the circular raised area of a hydrozoan polyp that lies between the tentacles and the mouth. The term is also used to describe mouthparts in other phyla

hypothermia - a condition when the body temperature is colder than normal (37 degrees C/98.6 degrees F in humans)

hypothesis - a tentative assumption made for the purpose of empirical scientific testing. A hypothesis becomes a scientific theory when repeated testing and the great body of evidence suggests that the hypothesis has a strong probability of being correct

ichthyology - the scientific study of fishes



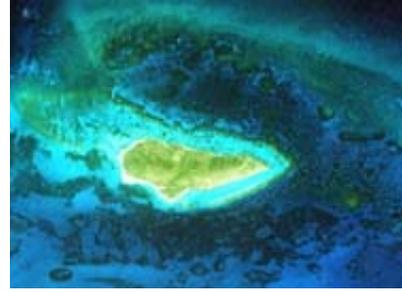
The diver is studying the behavior and ecology of squirrelfishes on a Caribbean coral reef. (Photo: Dr. Anthony R. Picciolo, NOAA)

ICRI (International Coral Reef Initiative) - an environmental partnership and network that brings all the stakeholders together with the objective of sustainable use and conservation of coral reefs for future generations. ICRI is an informal mechanism that allows representatives of over 80 developing countries with coral reefs to sit in equal partnership with major donor countries and development banks, international environmental and development agencies, scientific associations, the private sector and non-governmental organizations (NGOs) to decide on the best strategies to conserve the world's coral reef resources

idiopathic - denotes a disease of unknown cause or origin

IDL (Interactive Data Language) - a commercial array-oriented language with numerical analysis and display features, first released in 1977. It supports interactive reduction, analysis, and visualisation of scientific data

IKONOS satellite - high-resolution (1-2 meter resolution) imaging satellite; the world's first commercial satellite for imagery of this type



Four-meter true color IKONOS image of Buck Island Reef National Monument shows an extensive underwater coral reef ecosystem.

imbricate - with overlapping parts, such as scales

imitation - a behavior that occurs when an animal immediately mimics the actions of another animal while they are in each other's presence

immersed corallite - a corallite that is embedded in the surrounding coenosteum

immune system - a system that provides the organism with a defense against infection. In higher organisms it is afforded by the presence of circulating antibodies and white blood cells. Antibodies are manufactured specifically to deal with the antigens associated with different diseases as they are encountered. White blood cells attack and destroy foreign particles in the blood and other tissues

immunogen - any substance that can elicit an immune response

impact - a change, caused by external sources, in the chemical, physical (including habitat) or biological quality or condition of a habitat or environment

impermeable - having the property of restricting the passage of substances across a membrane

in situ - in the natural or original position

in situ data - measurements made at the actual location of the object or material measured, in contrast to remote sensing

incidental parasite - an accidental parasite

incipient population - a small population that is just beginning to reproduce and become established in an area or community

incisiform tooth - a chisel-shaped tooth used for cutting. Typically, it wider than it is thick

incomplete dominance - in genetics, an interaction between alleles in which both alleles are expressed more or less equally. The expression for a phenotype for a given trait exhibits a blending of the genetic messages from the allele partners controlling that trait. An example may be a cross between a homozygous red trait (AA) and a homozygous white trait (aa), where neither the red (A) nor white (a) trait is dominant. The phenotypic expression of the offspring is pink (Aa), the intermediate phenotype

incomplete protein - a protein which does not supply all the essential amino acids

incurrent canal - in sponges, an inpocket of the epidermis (pinacoderm) which opens into a choanocyte chamber via a small opening, the prosopyle

independent assortment - the random alignment of homologous chromosomes during meiosis. Each member of a pair of homologous chromosomes separates independently of the members of other pairs so the results are random

independent variable - a variable controlled by the experimenter

indeterminate cleavage - cleavage where the fate of the resulting daughter cells is not determined after the initial division of a fertilized egg. If the cells separate, each has the potential to develop into an entire organism and the resulting individuals are genetically identical (identical twins). Indeterminate cleavage is characteristic of deuterostomes

indicator species - any organism that by its presence or absence, its frequency, or its vigor, indicates a particular property of its surrounding environment; a species whose presence is a sign that certain environmental conditions exist

indigenous - native to a particular country or area

Indo-Pacific - a vast region encompassing the tropical Indian and Pacific Oceans from Africa in the west to Hawaii and French Polynesia in the east. This area represents the largest marine biogeographic region in the world

inductive reasoning - the process of observing data, recognizing patterns, and making generalizations from the observations; reasoning from particular facts to a general conclusion

infauna - animals that inhabit the sandy or muddy surface layers of the ocean bottom, i.e., those that live buried or dig into the substrate

inferior - anatomically beneath, lower, or toward the bottom (e.g., the mouth is inferior to the nose)

inflated - swollen or expanded

informatics - the management and analysis of data using advanced computing techniques

information management - the integration of a variety of activities designed to manage information and information resources throughout their life cycle. Activities include planning, budgeting, organizing, directing, training, promoting, and controlling the information and information resources throughout the process of collecting, processing, transmitting, disseminating, and disposing of information; the manipulation, reorganization, analysis, graphing, charting, and presentation of data for specific management and decision-making purposes

infra- - a prefix meaning "below"

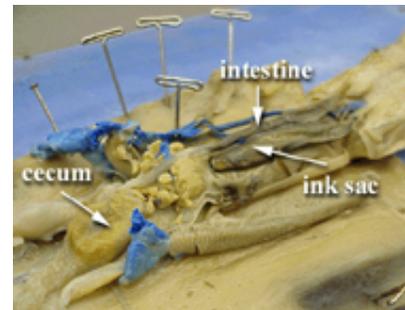
infraspecific name - in taxonomy, a general term for any name below the rank of species. The term includes subspecific and infrasubspecific names

infundibuliform - funnel-shaped

ingestion - the intake of water or food substances by "swallowing" them, taking them into the body cavity or into a cell vacuole

inhalant system - in sponges, part of the aquiferous system between the ostia and prosopyle

ink sac - a diverticulum of the rectum of most cephalopods, where an "inky" melanin solution is stored. The ink is ejected from a duct opening at the base of the siphon. It serves to cloud the water, and enable these animals to escape from predators



Ventral view of a dissected squid revealing the ink sac. (Photo: Biology Dept., Fairfield University, Fairfield, CT)

innate - not established by conditioning or learning; "an unconditioned reflex"; a genetic behavior pattern

innate releasing mechanism - in ethology or animal behavior, an innate system within an animal that responds to a stimulus in the environment to produce a genetic stereotyped behavior; a stimulus-response mechanism

inner cell mass - the cluster of cells inside the mammalian blastocyst. These cells give rise to the embryonic disk of the later embryo and, ultimately, to the fetus

inorganic matter - chemical substances of mineral origin which contain no organically produced carbon

insolation - the amount of solar radiation received on a given body or in a given area

instar - a discreet, in-between molt stage, during the metamorphosis of an arthropod from larva to adult

instinct - an unlearned, genetically coded behavior pattern that is internally motivated and characteristic of the species; the innate capacity of an animal to respond to a given stimulus in a relatively fixed way

insular - relating to, or characteristic of, or situated on an island

integer - a number without a decimal (0, 1, 25, 173, 1032, etc.). Integer values can be less than, equal to, or greater than zero

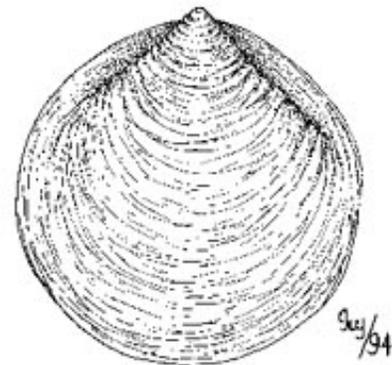
integrated coastal zone management - the process of combining all aspects of the human, physical and biological aspects of the coastal zone within a single management framework

interannual - refers to a climatic process that re-occurs every three to ten years. El Niño is an example of a climatic process that re-occurs every 4-6 years

interface - the common boundary between two substances such as a water and a solid, water and a gas, or two liquids, such as water and oil

interferon - a family of small proteins that stimulate viral resistance in cells

intermediate form - a fossil or modern species that possesses characters definitive of two or more different taxa, or that displays characters morphologically intermediate between two different taxa



Some experts believe that the "living fossil" genus *Neopilina*, an internally

segmented mollusk in the class Monoplacophora, is an evolutionary link between mollusks and other more obviously segmented invertebrates, such as annelid worms. (Graphic: BIODIDAC)

intermediate host - in a parasite's life cycle, it is a host organism in which a parasite undergoes a stage of asexual development

interorbital - the space between the eyes

interoreceptor - a neurological receptor that is located within the organism's body and detects physiological changes, e.g. pH, temperature, chemicals in blood

interradial canal - one of four branched ciliated canals in scyphozoan medusae that originates from the gastric pouches and move materials from the ring canal back toward the stomach and gastric pouches

intersex - an organism which possesses a mixture of male and female characteristics

interspecific - between members of different species

interspecific competition - competition between individuals of different species

interstices - the openings or pore spaces in a rock, soil, and other such material

interstitial - refers to the interstices or pore spaces in rock, soil, or other material subject to filling by water; fluid-filled spaces between cells in tissues

interstitial fauna - animals that live in the spaces within sediment particles (interstitial spaces)

interstitial water - water in the pore spaces of soil or rock

intertidal zone - the region between the highest water line and the mean low tide level



Sea anemones crowd a rocky intertidal zone (Photo: Nancy Sefton)

intolerant organism - an organism (or species) that is not adaptable to human alterations to its environment and thus declines in number where alterations occur

intraspecific - among members of the same species

intraspecific competition - competition between individuals of the same species

intratentacular budding - a type of asexual reproduction where daughter corallites grow from the inside wall of parent corallites, usually by division of the parent corallite

intrinsic - belonging to a thing by its very nature; the essential nature or constitution of a thing; inherent; in and of itself

intromittent organ - a copulatory structure employed by the males of species that practice internal fertilization to transfer sperm cells into the reproductive tube of the female, e.g., the clasper of a shark, skate or ray; penis; modified anal fin (gonopodium) of live-bearer fishes

intron - DNA sequences that interrupt the protein-coding sequence of a gene; introns are transcribed into mRNA but the sequences are eliminated from the RNA before it is used to make protein; junk DNA; in eukaryotic cells, a sequence of DNA that is contained in the gene but does not encode for protein. The presence of introns "splits" the coding region of the gene into segments called exons

invagination - an inward folding of a layer of cells forming an interior pocket



The cells at the vegetal hemisphere of this starfish blastula have begun to push into the blastocoel (invagination), forming a diploblastic embryo with a new cavity, the primitive gut, or archenteron. The cells lining the archenteron are endodermal cells. (Photo: Dr. Anna E. Ross, Christian Brothers University, TN)

inversion - a chromosomal re-arrangement that reverses the order of a linear array of genes on the chromosome

invertebrate - an animal that lacks a vertebral column (backbone)



Feathery invertebrate tube worms in the Caribbean Sea (Photo: Dr. Anthony Picciolo).

ion - a positively or negatively charged atom produced through loss or gain of one or more electrons

ionic bond - a chemical bond in which one atom loses an electron to form a positive ion and the other atom gains an electron to form a negative ion

ionizing radiation - high-energy radiation capable of producing ionization in substances through which it passes, i.e., radiation that has enough energy to eject electrons from electrically neutral atoms, leaving behind charged atoms or ions; examples are alpha particles (helium nuclei), beta particles (electrons), neutrons, and gamma rays (high frequency electromagnetic waves, x-rays)

IOOS (Integrated Ocean Observing System) - a "user-driven" integrated system of observations, data management and communications, and data analysis and modeling that provides data and information required to achieve seven societal goals: 1) Improve predictions of climate change and variability (weather) and their effects on coastal communities and the nation; 2) Improve the safety and efficiency of marine operations; 3) More effectively mitigate the effects of natural hazards; 4) Improve national and homeland security; 5) Reduce public health risks; 6) More effectively protect and restore healthy coastal marine ecosystems; and 7) Enable the sustained use of marine resources

IR (infrared) radiation - earth-emitted radiation over thermal wavelengths: 3-15 micrometers. Used for satellite remote sensing because it can be used to monitor weather and oceanographic conditions 24 hours a day

iridescent - exhibiting rainbow colors



This deep-sea fish called a "green eye" (Chlorophthalmidae) exhibits a beautiful iridescent pattern around its large eyes and head. (Photo: NOAA Ocean Exploration)

iridiophore - a colorless chromatophore which contains purines, mostly guanine in the form of large, nonmotile crystals

isobath - a line on a map or chart that connects all points having the same depth below a water surface

isoenzyme - one of a group of enzymes that are very similar in catalytic properties, but may be differentiated by variations in physical properties, such as isoelectric point or electrophoretic mobility; also called 'isozyme'

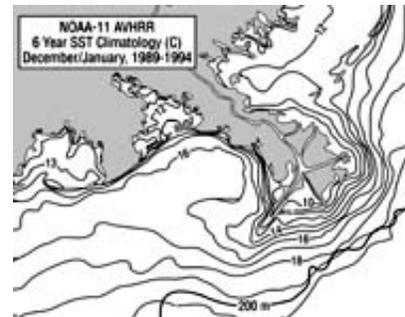
isogamous - having haploid gametes that are similar in size, structure and motility. An isogamete can unite with another to form a zygote

isogenic chromosome - in a diploid organism, a chromosome in which both alleles at every locus are identical on both copies

isohyetal line - a line drawn on a map or chart joining points that receive the same amount of precipitation

isolecithal - an egg cell in which the total amount of yolk is small and the yolk granules are fairly uniformly distributed throughout the cytoplasm, and cleavage completely bisects the cell, e.g., the egg of a starfish. A synonym is "homolecithal"

isoline - a line on a surface connecting points of equal value



Isobars are utilized to depict NOAA-11 AVHRR SST climatology in this diagram.

isometric contraction - a muscular contraction in which tension increases while the length of the muscle remains constant

isometric growth - growth that occurs at the same rate for all parts of an organism so that its shape is consistent throughout development

isotonic contraction - a muscular contraction in which tension is constant while the length of the muscle changes

isotope - one of two or more species of atoms of the same chemical element that have the same atomic number and occupy the same position in the periodic table. They are nearly identical in chemical behavior, but they differ in atomic mass or mass number. Therefore, they behave differently in the mass spectrograph, in radioactive transformations, and in physical properties, and may be separated or detected by means of these differences

isthmus - a narrow strip of land connecting two larger land masses, such as the isthmus of Panama

ITCZ (Intertropical Convergence Zone) - the region near the equator where the trade winds of the Northern and Southern Hemispheres converge

iteroparity - the reproductive condition in which individuals reproduce several times during their lifetime

ITIS (Integrated Taxonomic Information System) - a partnership of U.S., Canadian, and Mexican agencies, other organizations, and taxonomic specialists cooperating on the development of an online, scientifically credible, list of biological names. ITIS is also a participating member of Species 2000, an international project indexing the world's known species

J curve - a J-shaped growth curve that depicts exponential growth

jetty - a structure extending into the ocean to influence the current or tide in order to protect harbors, shores, and banks



A jetty protecting the shore line.
(Photo: NOAA)

joint probability - the probability of two or more things occurring together

JPEG (Joint Photographic Experts Group) - the original name of the committee that wrote the standard. It is a lossy compression technique for color images. Although it can reduce files sizes to about 5% of their normal size, some detail is lost in the compression

jugostegalia - a basket-like structure formed midventrally by overlapping branchiostegals in some families of eels

jugular - pertaining to the throat area



Blennies have their pelvic fins in the jugular position, anterior to the pectoral fins. (Photo: South Florida Water Management District)

junk DNA - a term used to describe the excess DNA which is present in the genome beyond that required to encode proteins. The term is misleading since these regions are likely to be involved in gene regulation, and other not yet known functions; a non-coding sequence of DNA; an intron

juvenile - a young animal that has not reached sexual maturity

karyogamy - a process of fusion of the nuclei of two sex cells or gametes; the second step in syngamy

karyotype - the entire chromosome complement of an individual cell, as seen during the mitotic phase

Kelvin scale - an absolute scale of temperature in which each degree equals one kelvin. Water freezes at 273.15 K and boils at 373.15 K

kenozooid - a small bryozoan heterozooid that strengthens and supports the colony, as well as fill spaces; long, branching, tubular, transparent stolons which extend above the substratum and to which the feeding individuals (autozooids) are attached

key - a small, low coastal island or emergent reef of sand or coral; flat mound of sand and admixed coral fragments built upon a reef flat or just above high tide level. A synonym of **cay**



A number of small keys (cays) in Jobos Bay, Puerto Rico.

key stimulus - in ethology or animal behavior, the stimulus which releases a fixed action pattern

keystone predator - the dominant predator or the top predator that has a major influence on community structure

keystone species - a species that is disproportionately important in the maintenance and balance of its community integrity

kilobase (kb) - a length unit equal to 1000 base pairs of a double-stranded nucleic acid molecule; 1000 pairs of nucleotide bases in DNA

kinetic energy - energy associated with motion

kinetics - the study of acceleration, motion, or rate of change

kinetochore - a structure forming at the centromere during mitosis for binding microtubules; a platelike structure necessary for chromosomal movement during mitosis; it develops on the centromere and links the chromosomes to the mitotic spindle

kingdom - in taxonomy, the highest ranked category in the taxonomic hierarchy. All organisms are classified into one of five kingdoms: Monera (the prokaryotic Kingdom. Includes archaeobacteria, eubacteria and cyanobacteria); Protista (unicellular eukaryotes); Fungi (yeasts and mushrooms); Plantae (plants); and Animalia (animals). Some scientists recognize slightly different classification schemes

knee root - an aerial root of a mangrove that emerges from the ground then loops back in. It is also called a peg root. It is not clear whether knee roots have a role in respiration

knob - a projecting structure on the reef margin or reef front wherein the upper surface flares outward, giving the surface a greater diameter than the basal section

knoll - a small reef within the lagoon or on shallow shelves

knot - The unit of speed used in navigation that is equal to 1 nautical mile (6,076.115 ft or 1,852 m) per hour

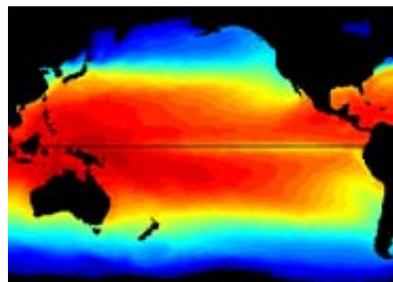
Krebs cycle - a series of enzymatic reactions in mitochondria involving oxidative metabolism of acetyl compounds to produce high-energy phosphate compounds that are the source of cellular energy ; also known as the tricarboxylic acid (TCA) cycle and as the citric acid cycle

Kure Atoll - the most remote of the Northwestern Hawaiian Islands, and the northern-most coral atoll in the world, located at the extreme northwest end of the Hawaiian archipelago. The atoll has almost 80,000 acres of coral reef habitat with 28 species of stony corals so far documented. Kure Atoll is an important pupping and resting area for Hawaiian Monk seals. The island is also a nesting area for smany species of sea birds, and a wintering area for a variety of migratory bird species from North America and Asia



Photos: (Left) The Kure Atoll Reserve Preservation Area includes approximately 17 square nautical miles (57 square kilometers) of submerged coral reef habitats; (Right) An endangered Hawaiian monk seal and her pup. (Photos: NOAA)

La Niña - a phenomenon characterized by unusually cold ocean temperatures in the eastern Equatorial Pacific, compared to El Niño, which is characterized by unusually warm ocean temperatures in the eastern Equatorial Pacific



Graphic showing December 1998 La Niña event.

label - a compound or atom that is either attached to, or incorporated into, a macromolecule and is used to detect the presence of a compound, substance, or macromolecule in a sample; also called a 'tag'

labeled - to mark substances in a way that they can easily be identified. In an organism, substances may be labeled using stable isotopes or harmless radioactive components so that they can be traced, analyzed or measured

labial - pertaining to the lips

labium - any lip-like structure

Lacey Act - the Lacey Act, passed in 1900, and amended several times, makes it unlawful to import, export, transport, sell, buy, or possess fish, wildlife, or plants taken, possessed, transported, or sold in violation of any federal, state, foreign, or Native American tribal law, treaty, or regulation

lacuna - a cavity ("little lake") in a matrix-like substance. For example, cartilage cells (chondrocytes) are located in lacunae in the cartilagenous matrix; bone cells (osteocytes) are located in lacunae in bone matrix

lagoon - a warm, shallow, quiet waterway separated from the open sea by a reef crest



A lagoon in Bora Bora. (Photo: Dr. Anthony Picciolo/NOAA)

lagoon slope - the back reef on a barrier or atoll reef

lanceolate - spear-shaped, tapered at both ends

Landsat satellite - U.S. satellite used to acquire high-resolution (500-800m) remotely sensed multi-spectral images of the earth's land surface and surrounding coastal regions



Artist's rendition of LANDSAT satellite.

lappet - a sensory structure in some jellyfish (Scyphozoa), associated with a rhopalium, which responds to touch (pressure); a fleshy lobe

larva - a sexually immature juvenile stage of an animal's life cycle. However, there are a few exceptions, where the larval form never metamorphoses into the adult stage and is sexually mature (neoteny)



Microscopic photograph of a crab larva (megalops stage) from a plankton collection.

lateral - refers to the side or flank of an animal

lateral line scale - one of a series of scales that bear the pores and tubes of the lateral line system

lateral line system - a series of sense organs that detect pressure or vibrations along the heads and sides of cyclostomes, fishes, and some amphibians. It consists of a network of sensory hair cell clusters (neuromasts) and small water-filled canals that lie immediately beneath the skin and extend along the sides of its body. This network is sensitive to external motion



Note the lateral line of the Caribbean red snapper (*Lutjanus purpureus*) with 49 to 53 scales, which extend onto the base of the caudal fin. (Photo: U.S. Food and Drug Administration)

latitude - the angular distance between an imaginary line around the Earth, or any spherical body, parallel to its equator and the equator itself; an imaginary line around the Earth parallel to the equator

Law of Conservation of Energy - energy can be transferred from one system to another in many forms, however, it can not be created nor destroyed. Thus, the total amount of energy available in the universe is constant

Law of the Minimum - the growth of a population is limited by the resource in shortest supply. Also known as 'Liebig's Law'

least squares - a statistical criterion for the estimation of the goodness of fit in correlation analysis. Least squares methods aim to minimize the sum of squared differences between the observations and the predictions from a model

lecithotrophic larva - a planktonic larva that gains its nutrition from yolk (semi-crystalline phospholipoprotein granules). In most bony fishes, yolk is supplied by the yolk sac, a bag-like ventral extension of the gut containing yolk granules

lectotype - in taxonomy, one of several syntypes, designated by any author after the original publication of a species name as the 'type specimen' for the taxonomic name. Designated only where there was no original holotype

LED (light emitting diode) - a very small light often used in electronic instrumentation

leeward - referring to the side of an island or reef that faces away from the prevailing wind

lek - a polygynous mating system where a number of males aggregate at a particular site during the breeding period and engage in courtship behavior, especially displays. Females attracted to the site "select" males for mating and subsequent fertilization of eggs. Once mated, the females usually go elsewhere to lay their eggs or to complete gestation. Lekking behavior (also called arena behavior) has been observed among cuttlefish, fishes, birds, antelope, and insects. Lekking species tend to stay at a single lek throughout a breeding season and to return to the same lek site from breeding period to breeding period

lenticel - aerial roots (pneumatophores) of mangroves contain spongy tissue connected to the exterior of the root via small pores called lenticels. During low tide, when lenticels are exposed to the atmosphere, oxygen is absorbed from the air and transported to and even diffused out of the roots below ground. This diffusion of oxygen maintains an oxygenated microlayer around the roots that enhances nutrient uptake.

leptocephalus larva - a long, ribbon-like larval form that is characteristic of eels, tarpons, and bonefishes

lepton - a class of subatomic particles that constitute matter which have no measurable size and do not interact with the strong nuclear force. The charged leptons are the electron, the muon, the tau and their antiparticles. Neutral leptons are called neutrinos

lesion - any pathological or traumatic discontinuity of tissue, or loss of function of a part

lethal gene - a mutant form of a gene whose phenotypic effect eventually results in the death of the bearing organism. Death from different lethal genes may occur at any time, from fertilization of the egg to advanced age. Lethal genes may be dominant, incompletely dominant, or recessive; also called a 'lethal allele'

leuconoid - the body form of highest complexity in sponges. The leuconoid form is highly irregular, displays the greatest degree of folding of the body wall, and has lost radial symmetry. The choanocytes line the pockets formed by the convoluted body wall

leucophore - a colorless chromatophore which contains purines, usually guanine, in the form of small, motile crystals in the cell's cytoplasm

library - in genomics, an unordered collection of clones (i.e., cloned DNA from a particular organism) whose relationship to each other can be established by physical mapping

LIDAR (Light Detection And Ranging) - a remote-sensing technique that uses a laser light source to probe the characteristics of a surface target. A laser emission may be directed downward from a low flying aircraft. Information about the target is derived from back-scattered reflectance or fluorescence of the target. Chlorophyll pigments in coral reef organisms (e.g., algae, seagrasses, coral), when excited by shorter (blue or green) wavelength light, emit light at longer (red) wavelengths, i.e., it fluoresces

ligase - an enzyme used to join DNA (DNA ligase) or RNA (RNA ligase) segments together

limnology - the study of the physical, chemical, meteorological and biological aspects of fresh waters

line intercept transect - a linear transect protocol where a tape is secured at each end of the transect with the tape draped over the reef in between. Observations are collected on each species and substrate component and their length under the tape

lineage - a genetically continuous line of evolutionary descent

linear acceleration - the rate of change of velocity in a linear direction (along a straight line) with respect to time

linear reef - a linear coral formation that is oriented parallel to the shore or the shelf edge

linear regression - regression in which the relationship is linear

linear relationship - a situation in which the best-fitting regression line is a straight line

linear transect - a line of specified length laid out within a study site. They are generally positioned parallel to the shore along depth contours. Measurements and observations may be taken along the entire surface beneath the line (line intercept transect) or at specified intervals along the line (point intercept transect)

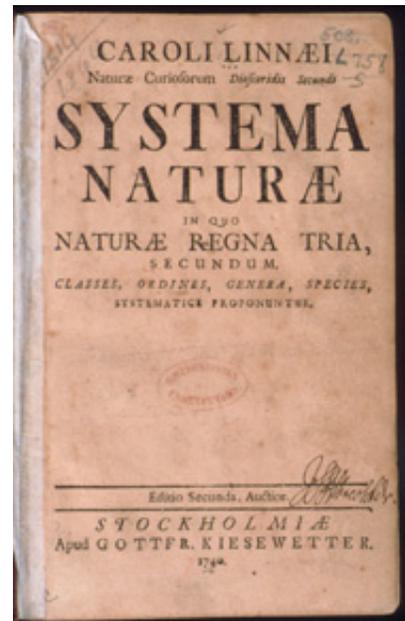


A NOAA scientist laying out a linear transect line.

linkage - the proximity of two or more markers (genes, etc.) on a chromosome; the closer together the markers are, the lower the probability that they will be separated during DNA repair or replication processes, and hence the greater the probability that they will be inherited together

linked genes - genes that are so closely associated on a chromosome that the allelic forms found on a chromosome are inherited together by an offspring at least 80 percent or more of the time

Linnaeus, Carolus - the 18th century Swedish botanist (1707-1778) who established the modern binomial system of biological nomenclature for plants and animals. His non-latinized name was Carl von Linne



In the 18th century, Linnaeus made a great contribution to science by developing systems of classification and nomenclature to organize the explosion of information on plants and animals. The tenth edition (1758-59), of Linnaeus's classic work, *Systema Naturae*, was chosen as the

starting point for zoological nomenclature. (Photo: Smithsonian Institution Libraries)

lionfish - the red lionfish (*Pterois volitans*) is a venomous coral reef fish belonging to the scorpion fish family (Scorpaenidae). Native to the Indian and western Pacific oceans, lionfish are now an invasive species found in the western Atlantic Ocean from southern Florida to New York and Bermuda. They appear to be reproducing along the southeastern U.S. coast; Other common names are turkeyfish, dragonfish, and firefish



The lionfish, *Pterois volitans*, is a recent invasive species in the western Atlantic Ocean. Like some other members of the scorpion fish family, the lionfish is a venomous animal, possessing venom glands at the base of the dorsal, anal and pelvic fin spines. The venom is injected in a potential predator via the spines. The genus *Pterois* contains eight species variously referred to as lionfishes, turkeyfishes, or firefishes. The lionfish is an inhabitant of near and offshore coral and rocky reefs. During the day, it seems to prefer shelter under ledges or in caves or crevices. (Photo: Paula Whitfield, NOAA Beaufort Laboratory)

lipase - an enzyme, secreted by the pancreas and the glands of the small intestine, that breaks down fats into glycerol and fatty acids during digestion

lipid - a group of organic compounds, including the fats, oils, waxes, steroids, and triglycerides, that are insoluble in water but soluble in common organic solvents, and are oily to the touch. Together with carbohydrates and proteins, lipids constitute the principal structural materials of cells

lipopolysaccharide - a compound containing a lipid bound to a polysaccharide

liposome - an artificial, single or multilaminar vesicle, made from a lipid, that is used for the delivery of a variety of biological molecules or molecular complexes to cells, e.g., drug delivery and gene transfer. Liposomes are also used to study membranes and membrane proteins

lithosphere - the outer solid part of the earth, including the crust and uppermost mantle. The lithosphere is about 80-100 km thick, although its thickness is age dependent. The lithosphere below the crust is brittle enough at some locations to produce earthquakes by faulting, such as within a subducted oceanic plate.

Lithothamnion ridge - a synonym for algal ridge. The algal genus *Lithothamnion* is important in maintaining reef integrity by cementing various pieces of calcium carbonate.

littoral - intertidal; between low and high tide levels.



This sea slug is a denizen of northwest U.S. rocky littoral (intertidal) zones.

live rock - calcareous rock which is removed from the vicinity of a coral reef with some of the life forms on it still living. These may include bacteria, coralline algae, sponges, worms, crustaceans and other invertebrates. Live rock is commonly used in reef aquaria because it contains bacteria that can help filter the water through nitrification.



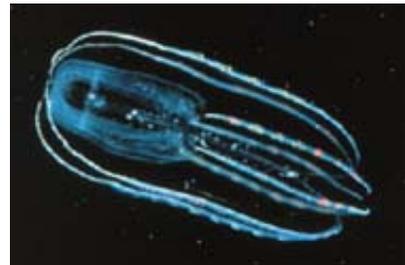
Live rock from Tonga, crated for shipping to an aquarist. (Photo: <http://www.reefscience.com>)

liveaboard - a commercial dive boat with sleeping and eating accommodations. Scuba divers live aboard the boat for several days and usually visit dive locations inaccessible to other divers



A liveaboard dive boat designed and constructed with divers and underwater photographers in mind. A vessel such as this may accommodate up to 20 passengers in private cabins, all with full bathrooms. It is fully air-conditioned with a state-of-the-art dive center, and complete photo and video labs with daily E6 processing. Wide dive platforms provide easy water entries and exits. (Photo: *Belize Aggressor*)

lobate - lobe-shaped



This comb jelly (ctenophore) possesses a lobate shape. (Photo: NOAA)

lobe - a rounded projection

locomotion - the act of moving, or the ability to move, from place to place

locus - the position of a gene, DNA marker, or genetic marker on a chromosome

logarithmic phase - the steepest slope of the growth curve of a culture; the phase of vigorous growth during which cell number doubles every 20-30 minutes; also called 'log or exponential growth phase'

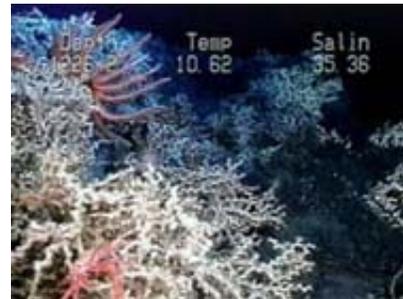
logarithmic scale - a constant ratio scale in which equal distances on the scale represent equal ratios of increase. For example, in a logarithmic scale, the distance between 10 and 100 is the same as the distance between 100 and 1000, or between 1000 and 10,000. Logarithmic scales are used when the range of numbers being represented is large

long term monitoring - the repeated surveying of organisms, populations, communities, or environmental parameters over time to help us understand a variety of natural processes

longitude - an imaginary great circle on the surface of the Earth passing through the north and south poles at right angles to the equator; "all points on the same meridian have the same longitude"

longshore current - a current that flows parallel to the shore just inside the surf zone. It is also called the littoral current

Lophelia reef - a reef formed by *Lophelia pertusa*, a deep-sea coral found in all oceans except the Arctic Ocean



This photo of a *Lophelia* coral garden was taken via a manned submersible on the ocean floor. (Photo: NOAA)

lophocyte - a mobile cell in sponges that produces collagen

lophophorate - an informal taxonomic unit that includes coleomatic metazoans which possess a specialized filter-feeding organ, the lophophore. Almost all lophophorates are marine organisms and all are suspension feeders. Lophophorates are deuterostomes and are typically considered relatively closely related to chordates and echinoderms. There are three lophophorate phyla: Phoronida, Bryozoa and Brachiopoda

lophophore - a feeding organ possessed by lophophorates. It is a disk or horseshoe-shaped structure which surrounds the mouth and bears the tentacles of the Bryozoa (moss animals), Brachiopoda (lamp shells) and Phoronida (horseshoe worms). The tentacles are hollow (coelomic) and covered with cilia which generate water currents that draw food toward the mouth

LORAN (LONG RANGE Navigation) - a navigation system developed in the 1950's based on the time displacement between signals from two or more fixed shore based antennae

lotic - refers to a flowing or running body of fresh water, i. e., streams and rivers



A peaceful lotic environment, the Patuxent River, eastern Maryland, in December 2000. (Photo: Mary Hollinger, NOAA/National Oceanographic Data Center)

low tide - the lowest level of the tide; the minimum height reached by each falling tide



A small island at the mouth of the Amazon River at low tide. See **high tide** for contrast. (Photo: Alessandra and Michael)

lower palmata zone - the part of a reef crest that is seaward of the palmata zone. It consists primarily of elkhorn coral (*Acropora palmata*) at a depth of about 3-6 m in Caribbean reefs



A young *Acropora palmata* colony in St. Croix, U.S. Virgin Islands (Photo: J. Halas)

luciferase - the enzyme which activates luciferin, in the presence of ATP, to produce bioluminescence

luciferin - a compound whose activated form emits light. In the presence of the enzyme luciferase and ATP, luciferin is oxidized to produce oxyluciferin and energy given off as cold light (bioluminescence)

lumen - the interior space of a tubular organ, such as a blood vessel or an intestine

luminous - emitting light.

luminous flux - the rate of flow of light energy

lumisome - in some cnidarians, a small, intracellular membrane-enclosed vesicle which contains all the proteins necessary for bioluminescence

lunate - crescent-shaped



Blue tangs with lunate-shaped caudal fins. (Photo: NOAA)

MAA (mycosporine-like amino acids) - MAAs are a family of compounds which act as nature's sunscreen in the marine environment. Shallow-water environments of tropical coral reefs are characterized by high levels of ultraviolet-A and ultraviolet-B radiation. Corals have developed an efficient defence against the potential damage of long-term solar irradiation, which often includes the production of natural "sunscreen"-type UV-absorbing compounds and related antioxidants. These compounds in shallow-water corals were identified to be a group of mycosporine-like amino acids (MAAs) having absorption maxima in the range 310-360 nm. MAAs are assumed to be produced by the zooxanthellae in coral tissues, since their biosynthesis involves a biochemical pathway not found in invertebrates. The major distribution of MAAs, however, resides within the coral tissues, suggesting that the algal partner of the mutualistic relationship provides UV protection to the whole of the relationship via MAA translocation. MAAs have been identified in a number of taxonomically diverse organisms such as fungi, marine heterotrophic bacteria, cyanobacteria, eukaryotic algae, marine invertebrates, fishes, and a wide variety of other marine organisms

MAC (Marine Aquarium Council) - an international, not-for-profit organization that brings marine aquarium animal collectors, exporters, importers and retailers together with aquarium keepers, public aquariums, conservation organizations, and government agencies. Its mission is to conserve coral reefs and other marine ecosystems by creating standards and certification for those engaged in the collection and care of ornamental marine life from reef to aquarium

macerate - to disintegrate tissues by means of cutting, soaking or enzymatic action to obtain a cell dissociation

macro - a text file containing a sequence of commands that can be executed as one command.

macroalgae - algae that project more than one centimeter above the substratum



Macroalgae are important habitat on temperate and northern reefs.

macrobenthos (macrofauna or macroflora) - benthic organisms (animals or plants) whose shortest dimension is greater than or equal to 0.5 mm

macroevolution - evolution on the grand scale resulting in the origin of higher taxa

macrogamete - the larger of the two gamete types in a heterogametic organism. It is considered as the the female gamete

macromolecule - a large polymer, such as DNA, RNA, protein, lipid or polysaccharide, made up of thousands of atoms

macronutrient - a nutrient, such as a nitrate or phosphate, that is required by plants in relatively large quantities in order to undergo photosynthesis and growth

macrophage - an amoeboid cell capable of moving through tissues, engulfing and destroying dead cells or bacteria. Certain white blood cells are the most aggressive macrophages

madreporite - a perforated platelike structure in most echinoderms that forms the intake for their water vascular systems



The white spot in the middle of the central disc of the starfish is the madreporite, the opening into the echinoderm+s water vascular system.

makatea - a fossil coral reef

malacology - the scientific study of mollusks



A Pacific octopus (Mollusca) photographed during the NOAA Submarine Ring of Fire expedition, 2002. (Photo: NOAA Ocean Explorer)

Malacostraca - a class of arthropods in the subphylum Crustacea. The more than 20,000 described species of Malacostraca can be divided into two groups, the Phyllocarida, and the Eumalacostraca. Phyllocarida contains the oldest crustacean known and includes only one living group. The Eumalacostraca consists of all Malacostracan groups other than the Phyllocarida. Eumalacostracans generally possess a well-developed carapace and a long, muscular abdomen. It is the group that contains most of the animals the general public recognize as crustaceans, such as shrimp, crabs, lobsters

Mammalia - a class of warm blooded animals (mammals) whose common characteristics include the presence of hair, milk-secreting glands, a muscular diaphragm between the abdominal and pleural and mediastinal cavities, a lower jaw composed of a single pair of bones, a middle ear containing three bones, and the presence of only a left systemic arch



Dolphins are among the most recognizable marine mammals; this one floats serenely in the Caribbean Sea. (Photo: Copyright Corel Corporation)

mammalian dive reflex - the physiological responses, including bradycardia and shutdown of the peripheral circulation, which occurs during dives by an air-breathing vertebrate

mammalogy - the scientific study of mammals

mandible - pertains to mouth parts; the lower jaw

mangal - relating to a shoreline ecosystem dominated by mangrove trees, with associated mud flats

mangrove - a general name for several species of halophyte belonging to different families of plants (including trees, shrubs, a palm tree and a ground fern) occurring in intertidal zones of tropical and subtropical sheltered coastlines and exceeding one half meter in height. The term is applied to both the individual and the ecosystem, the latter of which is termed mangal. Mangroves provide protected nursery areas for juvenile reef fishes, crustaceans, and mollusks. They also provide a feeding ground for a multitude of marine species. Many organisms find shelter either in the roots or branches of mangroves. Mangrove branches are nesting areas for several species of coastal birds. The root systems harbor organisms that trap and cycle nutrients, organic materials and other important chemicals. Mangroves also contribute to higher water quality by stabilizing bottom sediments, filtering water and protecting shorelines from erosion. They protect reefs from land runoff sedimentation. Conversely, coral reefs protect mangroves and seagrasses from erosion during heavy storms and strong wave action



Mangrove nursery area, Puerto Rico.

manta tow technique - a technique used to provide a general description of large areas of reef and to gauge broad changes in abundance and distribution of organisms on coral reefs. The technique, widely used in Australia, involves towing a snorkel diver (observer) at a constant speed behind a boat. The observer holds on to a 'manta board' attached to a small boat by a 17-meter length of rope. This person makes a visual assessment of specific variables during each manta tow (2 minutes duration), and records these data when the boat stops, on a data sheet attached to the manta board. The manta tow technique is used to provide a general description of large areas of reef and to gauge broad changes in abundance and distribution of organisms on coral reefs. The advantage of manta tow over other survey techniques is that it enables large areas of reefs to be surveyed quickly and with minimal equipment

mantle - a membranous or muscular structure in mollusks that surrounds the visceral mass and secretes a shell if one is present



A cowrie, *Cypraea sp.*, with partially extended mantle.

mantle cavity - the space between the mantle and the rest of the body parts of a mollusk, which contains several important respiratory and reproductive organs

manubrium - the proboscis of a jellyfish: a tubular structure that connects the mouth to the digestive cavity



The mouth of a jellyfish is at the end of the manubrium, which extends to engulf prey. (Photo: NOAA/Florida Keys National Marine Sanctuaries)

mareogram - a graphic representation of the rise and fall of the sea level, with time as abscissa and height as ordinate, usually used to measured tides; may also show tsunamis; also called 'marigram'

MAREPAC (Marine Resources Pacific Consortium) - MAREPAC is a consortium made up of representatives from nine islands in Micronesia (Marshall Islands, Federated States of Micronesia, Northern Marianas, Guam, Palau, and American Samoa). MAREPAC's mission is to develop regional capabilities, foster collaboration, and disseminate accurate information in support of sound policy development on sustainable use of marine resources of cultural, economic, and scientific value

mariculture - the cultivation of marine organisms under controlled conditions; a synonym for marine aquaculture



Shrimp farms and their waste runoff have resulted in the destruction of coastal habitats and added to pollution in critical estuarine waters.

marine debris - debris composed primarily of plastics, nets, lines, other fishing gear, glass, rubber, metal, wood and cloth. Sources of debris are people on beaches, storm drains, fishing boats, waste treatment sites, and industrial facilities. These materials have damaging effects on coral reefs



Marine debris, such as this plastic bag, can kill coral. (Photo: NOAA)

marine iguana - the marine iguana (*Amblyrhynchus cristatus*) inhabits the Galapagos Islands, an archipelago on the Equator, 800 kilometers west of the Ecuadorian coast. It differs from the mainland iguanas by the shape of the snout and other morphological features. The species probably rafted to the islands many millions of years ago, and developed a new ecological niche. They feed almost exclusively on marine algae and seaweed in the intertidal zone, and some make shallow dives past the breaker zone



A marine iguana from the Galapagos Islands. (Photo: NOAA)

Marine Managed Area (MMA) - see: Marine Protected Area

Marine Protected Area (MPA) - any area of the marine environment that has been reserved by federal, state, territorial, tribal or local laws or regulations to provide lasting protection to part or all of the natural or cultural resources within them. Familiar examples of U.S. MPAs include National parks, wildlife refuges, monuments and marine sanctuaries, fisheries closures, critical habitat, habitat areas of particular concern, state parks, conservation areas, estuarine reserves and preserves, and numerous others. Areas which are not MPAs are areas where access is restricted for reasons other than conservation (such as security zones, shellfish closures, sewage discharge areas, and pipeline and cable corridors), or unprotected areas that are logistically inaccessible due to weather, sea state, etc; MPAs are sometimes called Marine Managed Areas (MMA). However, "marine protected area" is a broad, inclusive term which includes both multi-purpose sites with some restrictions as well as the more restrictive "no take marine reserves."

marine snow - dense concentrations of particulate organic detritus and living organisms whose downward drift appears similar to a snowfall

marker gene - in genetic engineering, an easily identified gene that is inserted into an organism, along with a desired gene. The presence of the marker gene demonstrates that the transformation was successful

marsh - a soft, wet area periodically or continuously flooded to a shallow depth, usually characterized by a particular group of grasses, cattails and other low plants



Coastal marsh in Monterey Bay National Marine Sanctuary, CA.
(Photo: Kip Evans)

marsupium - an abdominal pouch where certain animals carry their young, as in some crustaceans and the brood pouch of the male seahorse

Mascarene Plateau - a submerged volcanic plateau dominating the western Indian Ocean, extending approximately 2,000 km between Seychelles and Mauritius. It covers an area of over 115,000 square kilometers of shallow water with depths ranging from 8 m to 150 m on the plateau, plunging to depths of 4000 m at its edges. It is the major marine ecosystem of the western Indian Ocean

mass extinction - a catastrophic, widespread perturbation where major groups of species become extinct in a relatively short time

mass spawning - spawning events where many different species spawn simultaneously

mass spectrometer - a laboratory instrument that measures the mass-to-charge ratio of individual molecules that have been converted into ions. This information is then used to determine the masses of the molecules

mass spectrometry - an analytical technique where ions are separated according to their ratio of charge to mass. The atomic weight of the particle can be obtained from the mass spectrum produced

massive - having a large compact structure without a definable shape



Scuba divers examine a massive coral colony. (Photo: Australian Institute of Marine Sciences)

massive colony - a coral colony that is solid and typically hemispherical in shape

maternal mRNA - messenger RNA found in oocytes and early embryos that is derived from the maternal genome during oogenesis

maxilla - pertains to mouth parts; the upper jaw

maxilliped - one of the mouth appendages of crustaceans, situated behind the maxillae. Crabs have three pairs, but many of the lower crustaceans have only one pair

maximum sustainable yield - the maximum number of a food or game population that can be harvested without harming the population's ability to grow back; the largest average catch or yield that can continuously be taken from a stock under existing environmental conditions

mean - a statistical measure of central tendency. The sum of a set of observations divided by the number of observations. It is also referred to as 'arithmetic mean' and 'sample mean'

mean high tide - the level to which the water rose on an average day over a previous period of time (years or decades); the average of all the high tides as calculated over a long period of time

mean low tide - the average altitude of all low tides recorded at a given place over a long period of time

mean sea level - the level of the surface of the sea between mean high and mean low tide. It is used as a reference point for measuring elevations

meandroid colony - a massive colony that has corallite mouths aligned in valleys, such that there are no individual polyps

mechanoreceptor - a neurological receptor that responds to mechanical energy, e.g. pressure, touch, and gravity

median - a statistical measure of central tendency. The middle-most value in a set of observations with an equal number of observations lying above and below the median value

medusa - the free swimming stage of some corals, jellyfish, anemones, hydroids and comb jellies, shaped like a bell or umbrella and swims by pulsations of the body



A jellyfish (medusa stage) showing its oral or subumbrella surface. The hanging tentacles bear stinging cells, used for food capture.

medusa bud - one of the buds of a hydroid, destined to develop into a gonophore or medusa. Medusa buds are released from the gonangium through a central opening, the gonopore

megabase (Mb) - unit of DNA or RNA sequence equal to one million (10) pairs of nucleotide bases. Abbreviated Mb

megalops larva - the larval stage in brachyuran crabs that follows the zoea larval stage

megasclere - a large spicule in sponges

meiobenthos (meiofauna or meioflora) - benthic organisms whose shortest dimension is less than 0.5 mm but greater than or equal to 0.1 mm

meiosis - a two-stage type of cell division in sexually reproducing organisms that results in the development of sperm and egg cells. In meiosis, a diploid cell divides to produce four haploid cells, each with half the original chromosome content. In organisms with a diploid life cycle, the products of meiosis are called gametes. In organisms with an alternation of generations, the products of meiosis are called spores

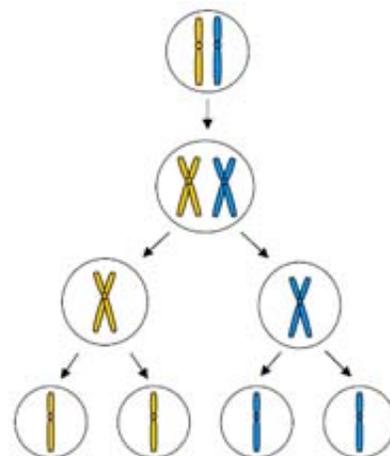


Diagram showing the meiotic division of a diploid cell, which in two divisions, results in the production of four haploid daughter cells. This process is also termed gametogenesis because it results in haploid sperm and egg cells.

Melanesia - a large region of volcanic islands which includes New Guinea, the Solomon Islands, Vanuatu, Fiji, Maluku, the Torres Strait Islands, and New Caledonia. The name "Melanesia" means "black islands", referring to the dark-complexioned inhabitants these islands



Map showing location of Melanesia. (Graphic: Melanesian Cultural Heritage Management Identification Study)

melanophore - a chromatophore which contains black and brown pigments called melanin

membrane filter - a thin microporous material of specific pore size used to filter bacteria, algae, and other very small particles from water

Mendel's Laws of Heredity - the *Law of Segregation* states that each hereditary characteristic is controlled by two 'factors' (alleles), which segregate and pass into separate germ cells (gametes). The *Law of Independent Assortment* states that pairs of 'factors' segregate independently of each other when germ cells are formed

Mendelian inheritance - one method in which genetic traits are passed from parents to offspring. It is named after the Austrian monk, Gregor Mendel, who first studied and recognized the existence of genes and this method of inheritance; a hereditary process explainable in terms of the behavior of chromosomes, e.g., segregation of chromosomes, independent assortment, and homologous exchange of parts



Gregor Mendel (1822-1884), the "father" of the science of genetics.

Mendelian population - a natural, interbreeding unit of sexually reproducing organisms sharing a common gene pool

meroblastic cleavage - incomplete cleavage of the zygote, restricted to the blastodisc, the non-yolky cytoplasm at one end of the egg; typical of teloblastic eggs

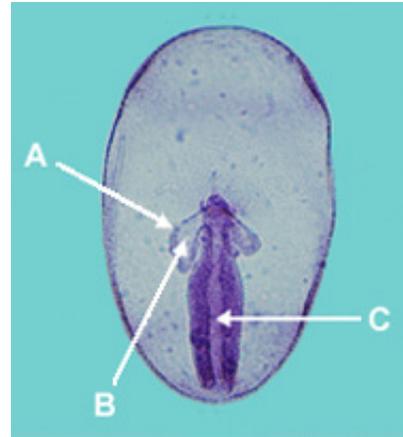
mesenchyme - in cnidarians, a primitive "connective tissue" located between the epidermis and the gastrodermis. If it contains no cell components, it is termed "mesoglea"; undifferentiated cells of an embryo, derived from mesoderm, which give rise to connective tissue and the circulatory and lymphatics systems; amoebocytic cells often embedded in a gelatinous matrix

mesenteric filament - the cord of tissue in sea anemones that runs along the edge of incomplete mesenteries and which bear glandular cells and nematocysts; they are used in digestion and become acontia toward the pedal disc

mesentery - a sheet of tissue that envelops, separates, or supports particular organs or body regions; a vertical sheet of tissue that divides the gastrovascular cavity of sea anemones

meso- - a prefix meaning 'middle'

mesoderm - the middle of the three germ layers of a triploblastic embryo that gives rise to the skeletal and support, muscular, blood vascular, urogenital and reproductive systems, and contributions to some glands



Late gastrula. This photograph is a dorsal view of the embryo, with the anterior being toward the animal pole and the posterior toward the vegetal pole. Note the beginning of the formation of enterocoelic (mesodermal) pouches, from which the mesoderm is derived, on the right and left side of the anterior end of the gastrocoel. A - mesoderm; B - coelom; C - archenteron (Photo: Cell and Developmental Biology Online website (University of Guelph) <http://www.uoguelph.ca/zoology/devobio/>)

mesoglea - the connective tissue layer between the epidermis and gastrodermis of cnidarians and ctenophores (comb jellies)



Inner tissues of this Giant Green Anemone (*Anthopleura xanthogrammica*) are separated by the mesoglea. (Photo: Lisa Eschenbach)

mesohyle - the non-cellular gel layer (also called 'mesenchyme') of sponges. It is located between the epidermis (pinacoderm) and the choanoderm, the cell layer that lines the spongocoel. The mesohyle contains either spicules (supportive needles made of calcium carbonate) or spongin fibers (a flexible skeletal material made from protein); also called mesohyl

mesolamella - a collagenous layer that separates the choanochambers of hexactinellid sponges (glass sponges)

mesolecithal - a moderately telolecithal egg, typical of amphibians

Mesozoic - an era of time during the Phanerozoic eon lasting from 245 million years ago to 66.4 million ago

metabolic gas - a gas which is released by the body as a result of metabolism. Carbon dioxide is an example of a metabolic gas

metabolism - the sum of all the physical and chemical processes by which living organised materials are produced and maintained (anabolism), and also the destructive transformation processes by which energy is made available for the uses of the organism (catabolism)

metabolite - a substance that takes part in the process of metabolism, which involves the breakdown of complex organic constituents of the organism's body with the liberation of energy for use in bodily functioning. The various compounds that take part in, or are formed by, these reactions are called metabolites

metadata - information about data or other information. Metadata or "data about data" describe the content, quality, condition, and other characteristics of data

metagenesis - an alternation of sexual and asexual generations. When metagenesis occurs in cnidarians, the polyp is the asexual generation and the medusa is the sexual generation. A generalized life cycle occurs as follows: medusae produce gametes which unite to form zygotes. Each zygote divides repeatedly and develops into a free-swimming planula larva, which eventually settles and develops into a polyp. Each polyp then asexually produces medusae to complete the life cycle

metamere - in biology, any of the homologous segments lying in a longitudinal series that make up the body of certain animals, such as earthworms and lobsters. A metamere is also called a 'somite'

metamerism - in biology, the division of the body into a series of more or less similar segments (metameres), as in an annelid worm or a lobster



A polychaete worm exhibiting metamerism. (Photo: Rick Gillis, Ph. D., Biology Dept., University of Wisconsin-La Crosse)

metamorphosis - change of body shape, e.g., the change from a larval form to a juvenile or adult form

metanauplius larva - postnaupliar larva of crustaceans with the same general body and limb morphology as the nauplius, but having additional appendages



Crustacean metanauplius larva. (Photo: Dep.de formation des maitres. Physiologie animale, Universite Pierre & Marie Curie, Paris VI.)

metanephridium - a type of excretory tubule in annelid worms. The metanephridium has internal openings called 'nephrostomes' that collect body fluids and conducts them to the outside through external openings, the 'nephridiopores'

metanephros - the final excretory organ that develops in a vertebrate embryo. In birds, reptiles, and mammals it replaces the mesonephros as the functional excretory organ, and develops into the adult kidney

metazoa - multicellular animals having cells differentiated into tissues and organs, and usually a digestive cavity and nervous system

metecdysis - the final stage in arthropod molting in which the new cuticle is hardened

meteorology - the science that deals with atmospheric phenomena, especially weather and weather conditions



Meteorologists often study violent weather. (Photo: NOAA)

meter - a unit of length which constitutes the basis of the Metric System. It is one ten-millionth part of the distance measured on a meridian of the Earth from the equator to the pole. One meter equals 39.37 inches

methane - an odorless gas produced by the decomposition of organic matter

metric system - a decimal system of measures and weights with the meter and the gram as bases

microarray - in genomics, a tool for studying how large numbers of genes interact with each other and how a cell's regulatory networks control vast batteries of genes simultaneously. A robot is used to precisely apply tiny droplets containing functional DNA to glass slides. Researchers then attach fluorescent labels to DNA from the cell they are studying. The labeled probes are allowed to bind to cDNA strands on the slides. The slides are put into a scanning microscope to measure how much of a specific DNA fragment is present

microatoll - a circular colonial corallum up to 1 m height and 4 m diameter. Growth is mainly lateral, as upward growth is limited by aerial exposure

microbe - a nonspecific term for small organisms that can be seen only with the aid of a microscope. The term encompasses viruses, bacteria, yeasts, molds, and protists. The term, however, is used most frequently in reference to bacteria

microbenthos (microfauna or microflora) - benthic organisms whose shortest dimension is less than 0.1 mm

microbiology - the study of organisms that can be seen only with the aid of a microscope

microbiota - organisms which are invisible, or nearly so, to the naked eye

microecology - the study of the interactions between microorganisms and their environment

microenvironment - a specific set of physical, biological, and chemical factors immediately surrounding the organism

microevolution - relatively minor change in the composition of a species' gene pool over time

microfauna - animals which are invisible, or nearly so, to the naked eye

microflora - plants which are invisible, or nearly so, to the naked eye

microhabitat - a smaller part of a habitat that has some internal interactions allowing it to function self-sufficiently within a generally larger habitat, such as a patch reef in a lagoon

micron (μ) - a unit of length equivalent to a micrometer (μm), one-millionth of a meter or 0.00003937 inch

Micronesia - a region situated between the Mariana Trench in the west and the Line Islands in the east. The name "Micronesia" means "tiny islands." the Federated States of Micronesia consists of the states of Yap, Chuuk, Pohnpei, and Kosrae. This region is composed of thousands of small islands, mostly atolls



Map of Micronesia. (Graphic: U.S. CIA)

micronutrient - a nutrient, such as iron, copper, or zinc, that is required in very small amounts by plants in order to photosynthesize and thrive

microsatellites - loci (or regions within DNA sequences) where short sequences of DNA nucleotides are repeated in tandem arrays (the sequences are repeated one right after the other). The lengths of sequences used most often are di-, tri-, or tetra-nucleotides. In the literature they can also be called simple sequence repeats (SSR), short tandem repeats (STR), or variable number tandem repeats (VNTR). Microsatellites are inherited in a Mendelian fashion. They are widely used in the following applications: forensic identification and relatedness testing; diagnosis and identification of diseases; population studies (by looking at the variation of microsatellites in populations, inferences can be made about population structures and differences, genetic drift, genetic bottlenecks and even the date of a last common ancestor); and conservation biology where they can be used to detect sudden changes in population, effects of population fragmentation, and interaction of different populations. Microsatellites are useful in identification of new and incipient populations

microsclere - a small spicule in sponges

microtubule - a long, hollow rod composed of the protein, tubulin. Microtubules make up portions of the cytoskeleton of cells. Microtubules aid in cell support, intracellular transport, and cell proliferation. They are also found in cilia and flagella

microwave - any electromagnetic radiation having a wavelength in the approximate range from one millimeter to one meter, the region between infrared and short-wave radio wavelengths

midlittoral zone - the portion of the intertidal zone that is covered and uncovered by water each day



Tidal pools in the midlittoral zone.
(Photo: Susan Scott)

migration - the large-scale movement of a population for some specific purpose



Humpback whales (*Megaptera novaeangliae*) migrate from near the poles to tropical waters. (Photo: R Wicklund)

millipore filter - a thin membrane composed of cellulose fibers that is used, for example, as a filter in the bacteriological examination of water

milt - the testes of fishes when filled with semen; fish seminal fluid



The testes of this male adult salmon produce milt when ready to spawn. The milt becomes a liquid, containing sperm cells, and exits through the vent opening to fertilize eggs. (Photo: Pacific Streamkeepers Federation)

mimicry - the appearance or characteristics of one organism that copies or "mimics" another in order to gain some advantage; the organism may resemble some other natural object as an aid in concealment

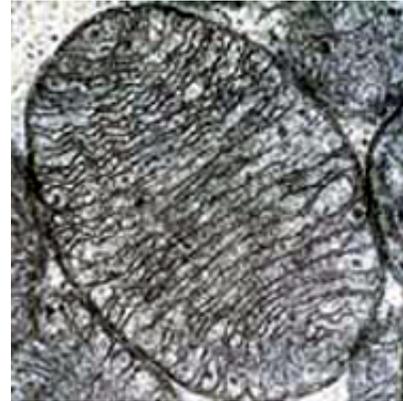
mini-atoll - a ring-shaped patch reef with a central area (lagoon) containing sand

mitigation - the act of making less severe or intense; measures taken to reduce adverse impacts on the environment

mitigation plan - a proposal to reduce or alleviate potentially harmful impacts

mitochondrial genome - the genetic material of the mitochondria. It is similar in structure to that of the prokaryotic genetic material, formed of a single circular DNA molecule. The mitochondria of sexually-reproducing animals usually comes only from the maternal side, and is essentially the same as that of the mother. Sometimes mitochondria from spermatozoa are also passed on to offspring. Mitochondrial DNA has been studied to trace lineage far back in time

mitochondrion - an organelle found in the cells of most eukaryotes. Mitochondria are sometimes described as cellular "power plants" because their primary function is to manufacture adenosine triphosphate (ATP), which is used as a major source of cellular energy



Electron micrograph of a single mitochondrion showing the organized arrangement of the protein matrix and the inner mitochondrial membranes. (Photo: U.S. Dept. of Health and Human Services/National Institutes of Health)

mitogen - any substance that causes cells to begin dividing by mitosis

mitosis - the process of nuclear division in eukaryotic cells that produces two daughter cells from one mother cell, all of which are genetically identical to each other. See cell division -

mitotic spindle - a network of fiber-like microtubules that forms in a cell's nucleus during mitosis (nuclear division) which connects the centrosomes to the kinetochores and helps move the chromosomes around

mixed layer - near-surface waters subject to mixing by the action of wind and waves. There is little variation in salinity or temperature at depths below the mixed layer

mixed zone - the populous region of most bank/barrier reefs seaward of the lower palmata zone. It begins at a depth of 6-8 m

MJO (Madden Julian Oscillation) - a major perturbation of tropical convection which moves and completes a global circuit every 30 to 60 days. It is a dominant cause of intraseasonal variability in tropical equatorial regions

MLCD (Marine Life Conservation District) - a designated area for the conservation and replenishment of marine resources. MLCDs allow only limited fishing and other consumptive uses, or prohibit such uses entirely. They provide fishes and other aquatic life with a protected area in which to grow and reproduce, and are home to a great variety of species

MMM (Maximum Monthly Mean SST climatology) - the highest expected (climatological) monthly SST expected at all ocean locations based on 15 years of monthly mean SST data (serves as the input threshold for the Coral Bleaching HotSpot charts)

mode - a statistical measure of central tendency. The number that appears most in a sequence of numbers. A list of numbers can have more than one mode

modifier gene - a gene that modifies the effect produced by another gene

moiety - a component part of a complex molecule

mole - the mass of a compound in grams numerically equal to its molecular weight. Also, the mass of a compound containing Avogadro's number of molecules

molecular biology - a branch of biology that studies the biology of a cell at the molecular level. Molecular biological studies are directed at studying the structure and function of biological macromolecules and the relationship of their functioning to the structure of a cell and its internal components. Great attention is given to genetic aspects such as replication, transcription and translation

molecular genetics - the study of how genes function to control cellular activities

molecular weight - the sum of the atomic weights of the atoms in a molecule

molecule - a small particle composed of two or more atoms. Molecules are a stable configuration of atomic nuclei and electrons bound together by electrostatic and electromagnetic forces. They have characteristic physical and chemical properties, different from the atoms of which they are composed

Mollusca - an animal phylum that includes bivalves, squids, octopuses and snails. They are distinguished by a muscular foot, a calcareous shell secreted by the underlying body wall (the mantle) and a feeding organ (the radula). Many species are common inhabitants of coral reefs



Atlantic deer cowrie (*Cypraea cervus*) grazing in the Flower Garden Banks National Marine Sanctuary. (Photo:

molt - to shed part or all of a coat or outer covering, such as, shell, feathers, cuticle or skin, which is replaced periodically by a new growth

monaxon - a linear spicule in sponges; a single rod or ray with a pointed, hooked, or knobbed end

Monera - the Kingdom composed of prokaryotic organisms. They have a cell wall, and lack both membrane-bound organelles and multicellular forms. The Archaeobacteria, the most ancient of this Kingdom, are so different that they may belong to a separate kingdom. Monera include the cyanobacteria and eubacteria

monitoring - the systematic collection of data over time

mono- - a prefix meaning one

monoecious - having combined sexes. Individuals of monoecious species contain the reproductive systems of both males and females

monofilament - a single large filament or threadlike structure of a synthetic fiber, such as a monofilament fishing line

monomer - in chemistry, a single molecule that is the subunit of a polymer; in genetics, a character determined by a gene or genes at a particular locus

monomorphic - occurring in only one form

monopectinate gill (ctenidium) - in mollusks, refers to having gill lamellae on one side of the ctenidial axis

monophyletic group - a group of organisms descended from a common ancestor

monosaccharide - a sugar that does not hydrolyse to produce other sugars; the simplest group of carbohydrates

monotype - in taxonomy, a situation where a genus group taxon is established with only one immediately subordinate taxon, e.g., a genus containing only one species

monsoon - a periodic wind caused by the effects of differential heating, with the largest being the Indian monsoon found in the Indian Ocean and southern Asia

Montastraea - a genus of hard (stony) coral that includes the boulder coral and the great star coral



Great star coral (*Montastraea cavernosa*) is one of four species of *Montastraea* found at the Flower Garden Banks in the Gulf of Mexico. (Photo: Dr. Stephen Gittings)

morphogenesis - a change in the shape or structure of an organism through growth and differentiation

morphology - a branch of biology that deals with the form and structure of organisms, apart from their functions (physiology)

morula - a stage of embryonic development in which the cleaving cells (blastomeres) appear as a cluster of blastomeres without a cavity; precedes the blastula stage of embryonic development

motile - capable of self-locomotion in organisms

motu - a coral island in the lagoon of an atoll

MOU (Memorandum of Understanding) - an interagency agreement defining the role and responsibility which each agency has in dealing with particular issues

mouthparts - a collective term for the appendages around the mouth of crustaceans which are concerned with feeding: mandibles, maxillae and maxillipeds

MPRSA (Marine Protection, Research, and Sanctuaries Act) - the MPRSA (1972) provides protection for many coral reefs by authorizing NOAA to designate areas as marine sanctuaries and promulgate regulations for the conservation and management of those areas. Since the Act was passed, thirteen sanctuaries have been designated, several of which contain coral reef communities. Coral research, monitoring, and management activities are conducted in these sanctuaries, as well as in the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve, which is currently (June 2004) under consideration to become the nation's fourteenth sanctuary

mRNA (messenger RNA) - an RNA molecule that encodes the amino acid sequence of a protein. It is the mediating template between DNA and proteins. The encoded information from a particular gene is transferred from a strand of DNA by the construction of a complementary template strand of RNA (mRNA) through the *transcription* process. Next, three nucleotide segments of RNA, called tRNA (transfer RNA), which are attached to specific amino acids, match up with the template strand of mRNA to order the correct sequence of amino acids. These amino acids are then bonded together to form a protein in a process, called *translation*. Translation occurs in the ribosomes, which are composed of proteins and a third kind of RNA, rRNA (ribosomal RNA)

MSS (Multispectral Scanner) - a scanner system that simultaneously acquires images of the same scene in various wavelength bands

mucus - a gelatinous material secreted by specialized mucous cells. In corals, it functions in protection from bacterial invasion, food capture, and removal of sediment particles. Mucus is usually moved by cilia (motile hair-like extensions of the cell membrane)

mud - a fine sediment often associated with river discharge and buildup of organic material in areas sheltered from high-energy waves and currents

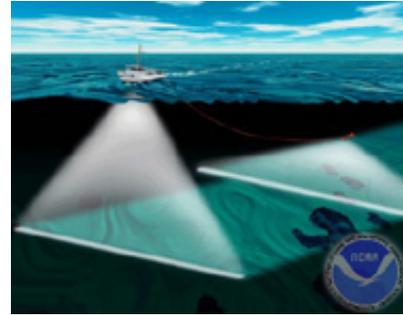
mud flat - a relatively level area of fine silt along a shore (as in a sheltered estuary) or around an island, alternately covered and uncovered by the tide, or covered by shallow water



Nutrient-rich mudflats at the Gulf of the Farallones National Marine Sanctuary in California. (Photo: Dan Howard)

Mullerian mimicry - a form of protective mimicry in which noxious species evolve through convergent evolution to resemble each other

multibeam sonar - sonar signals arriving at a target, or the towfish, from a single source but along different paths. The multibeam sonar system consist of a transducer, motion sensor, gyrocompass, and navigation system. When collected in slightly overlapping swaths (fanlike coverages from sonar scans), multibeam sonars can produce a sonar data set that represents nearly 100 percent acoustic coverage of the seafloor



Hull-mounted multibeam sonar (left) and towed side scan sonar (right)
(Graphic: NOAA)

multimodal distribution - a distribution with more than one mode

multivariate analysis of variance - an analysis of variance with two or more dependent variables

multivariate community analyses - statistical methods for analyzing physical and biological community data using multiple variables

municipal discharge - discharge of effluent from waste water treatment plants, which receive waste water from households, commercial establishments, and industries in the coastal drainage basin

municipal Sewage - wastes (mostly liquid) originating from a community; may be composed of domestic wastewaters and/or industrial discharges

muon - a charged lepton about 200 times more massive than an electron; an elementary particle with a negative charge and a half-life of 2 microsecond; decays to electron and neutrino, and antineutrino

mutagen - an agent that causes a permanent genetic change in a cell other than that which occurs during normal genetic recombination

mutation - changes in the nature of single genes or segments of chromosomes, which are then inherited by successive generations

mutualism - a symbiotic interaction between two species in which both derive some benefit

mycelium - the mass of filamentous growth (hyphae) from which the vegetative part of a fungus develops



Drawing of the mycelium of a fungus.
(Photo: Jon Houseman\BIODIDAC)

mycophage - an animal which primarily eats fungi

myoepithelial cell - a contractile cell in cnidarians

myoglobin - an oxygen-binding protein found in the muscle cells of animals. It functions as an oxygen storage unit, providing oxygen to the muscles. Diving marine mammals, such as seals and whales are able to remain submerged for long periods because they have greater amounts of myoglobin in their muscles than other animals do. There is a close chemical similarity between myoglobin and hemoglobin, the oxygen-binding protein of red blood cells

myotome - any segment of embryonic mesoderm that develops into skeletal (voluntary) muscle in the adult; any of the segmentally arranged blocks of muscle in lower vertebrates, such as fishes

nacre - the iridescent innermost layer of a molluscan shell that is secreted by the mantle. It is also called the mother-of-pearl layer



A mussel shell showing the nacre or

mother-of-pearl layer.

NACRI (Netherlands Antilles Coral Reef Initiative) - NACRI was established in 2000 as part of an effort to improve nature conservation and management in the Netherlands Antilles in general, and specifically targeting coral reefs in order to give more attention to, and better coordinate protection of the coral reefs of the islands. Beginning in 2004, NACRI plans to establish a central monitoring node and database for the Netherlands Antilles as part of the Global Coral Reef Monitoring Network (GCRMN), to complement other existing sub-regional nodes in the Caribbean. A catch survey of reef fisheries in all islands is also planned. The Netherlands Antilles consists of five islands in the Caribbean: Bonaire and Curacao just over 100 km off the Venezuelan mainland, and Saba, St. Eustatius and St. Maarten about 900 km to the north-east in the arc of the Lesser Antilles. The Netherlands Antilles is a so-called territory of the Kingdom of the Netherlands, although it is an independent state

nanobiology - biological studies at the extremely small to molecular levels. Many fundamental biological functions are carried out at the level of molecular machineries that have the sizes of 1-100 nm. The emergence of nanobiology allowed understanding of the functions of these machineries, with the invention of nano- technology, e.g., scanning probe microscopy, modern optical techniques, and micro- manipulating techniques

nanometer - a unit of length equal to 0.001 microns (one thousandth of a micron), 0.000001 millimeters, or 0.000000001 meters; also called a millimicron

nanoscience - the extension of existing sciences into the realms of the extremely small, as in nanomaterials, nanochemistry, nanobiology, nanophysics, nanoengineering, etc

nape - the area behind the head of a fish, extending from the back of the skull to the origin of the dorsal fin

NARS (Natural Area Reserve System) - the State of Hawai'i created the Natural Area Reserves System, or NARS, to preserve and protect representative samples of Hawaiian biological ecosystems and geological formations. The diverse areas found in the NARS range from marine and coastal environments to lava flows, tropical rainforests, and even an alpine desert. One can find rare plants and animals within these areas, many of which are on the edge of extinction. The reserves also protect some of the major watershed areas which provide vital sources of fresh water

National Biological Information Infrastructure (NBII) - a broad, collaborative program to provide increased access to data and information on the nation's biological resources. The NBII links diverse, high-quality biological databases, information products, and analytical tools maintained by NBII partners and other contributors in government agencies, academic institutions, non-government organizations, and private industry

natural climate record - a record of climatic events found by examining the natural environment (e.g., coral growth bands, tree rings, layers of ice in glaciers)

natural selection - a natural process by which organisms (and their genes) that adapt to their environment survive while those that do not adapt become eliminated progressively

NAUI (National Association of Underwater Instructors) - a scuba diving certifying and instruction agency

nauplius larva - a free-swimming, planktonic larval stage of many crustaceans

nautical mile - the length of a minute of arc, 1/21,600 of an average great circle of the Earth. Generally one minute of latitude is considered equal to one nautical mile. The accepted United States value as of 1 July 1959 is 1,852 meters (6,076.115 feet)

Navassa - a small (35 km²) isolated and uninhabited island located at 18°25'N, 75°05'W, approximately 55 km west of the Tiburon Peninsula of Haiti and 220 km northeast of Jamaica. Navassa was designated as a United States National Wildlife Refuge in 1999. Corals and sponges grow on large underwater rocks that have broken off from the cliffs

neap tide - a tide that occurs when the difference between high and low tide is least; the lowest level of high tide. Neap tide comes twice a month, in the first and third quarters of the moon

necrolysis - the decomposition of an organism's body after it dies

necromass - the weight of dead organisms, usually expressed per volume of water or per unit of land surface or volume

necropsy - an examination and dissection of a body of a dead organism in order to determine the cause of death or changes produced by disease

necrosis - the death of living tissues due to infection or injury



Elkhorn coral, suffering from recent necrosis. (Photo: U.S. Geological Survey)

nectophore - a highly modified medusa that remains with a floating hydrozoan colony and pulsates for locomotion of the colony

Needham's sac - a sac that stores spermatophores in cephalopods

negative charge - an electrical charge created by having more electrons than protons.

nekton - organisms with swimming abilities that allow them to move actively through the water column and to move against currents



Fish are a large component of marine nekton. (Photo: Dr. Anthony Picciolo)

nematocyst (cnidocyte) - a specialized stinging cell found in cnidarians

neoplasm - a cancerous growth

neotype - in taxonomy, a specimen selected as type specimen subsequent to the original description in cases where the original holotype, or lectotype, or all paratypes, or all syntypes are lost or destroyed, or suppressed by the Commission (Zoology)

NEPA (National Environmental Policy Act) - passed in 1969, the purposes of NEPA are: to declare a national policy which will encourage productive and enjoyable harmony between man and his environment; to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; to enrich the understanding of the ecological systems and natural resources important to the Nation; and to establish a Council on Environmental Quality

nephridium - a simple excretory organ of many invertebrates, consisting of a tube through which waste products pass to the exterior

neritic - refers to the ocean environment landward of the shelf-slope break

neritic zone - the relatively shallow water zone that extends from the high tide mark to the edge of the continental shelf

nerve - a bundle of neurons (nerve cells); specifically, a bundle of axons which are the motor processes of neurons which carry nervous impulses in the direction away from the cell bodies

nerve net - the non-centralized, disorganized network of nerve cells under the epidermis, and sometimes the gastrodermis, of cnidarians. It is comprised of multipolar cells with multiple synaptic junctions, but no polarization. Impulses pass either way across the synapse. Both neuron endings of a synapse have secretory vesicles

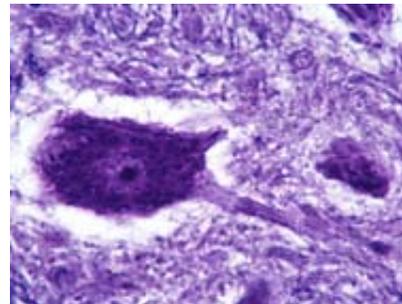
nerve net - a diffuse, two-dimensional plexus of interconnected bipolar or multipolar neurons with no central control organ; found in cnidarians

NESDIS (National Environmental Satellite, Data and Information Service) - the NOAA agency that operates and manages the U.S. civilian weather satellites and the national environmental data centers, such as the National Oceanographic Data Center (NODC), the National Climatic Data Center (NCDC), and the National Geophysical Data Center (NGDC)

net photosynthetic rate - the total rate of photosynthetic CO_2 fixation minus the rate of loss of CO_2 during respiration

net primary productivity - the total amount of chemical energy fixed by the processes of photosynthesis minus the chemical energy lost through respiration; same as 'net photosynthetic rate'

neuron - a nerve cell; a specialized cell that can react to stimuli and transmit impulses. A neuron consists of a cell body which contains the nucleus; dendrites, which are usually short sensory branches off the cell body that receive incoming impulses; and a single, long axon which carries impulses away from the body (motor function) and to the next neuron, gland or muscle



A neuron in a mammalian brain.
(Photo: University of Kansas Medical Center)

neurophysiology - the branch of neuroscience that studies the physiology of the nervous system

neuropodium - a lobe of the parapodium closer to the ventral side in polychaete worms

neuroscience - the scientific disciplines concerned with the development, structure, function, chemistry, pharmacology, clinical assessments and pathology of the nervous system

neurotoxin - a toxic substance which interferes with the electrical activities of nerves and inhibits, damages or destroys the tissues of the nervous system, especially neurons (nerve cells)

neurotransmitter - a chemical substance ("messenger") produced in and released by one neuron that carries a nervous impulse across a synapse (the small gap between the axon and dendrite of communicating neurons). They relay nervous impulses among neurons and between neurons and other types of cells, such as in muscle and glandular tissues. Neurotransmitters can excite or inhibit another neuron or receptor organ. There are more than 300 known neurotransmitters. A few of the more common ones are acetylcholine, dopamine, norepinephrine, and serotonin

neuston - planktonic organisms associated with the air-water interface

neutralism - the lack of any interaction between two organisms or species in a shared habitat. Neither has any effect on the other

neutrino - a lepton with no electric charge. Neutrinos participate only in weak (and gravitational) interactions and therefore are very difficult to detect. There are three known types of neutrino, all of which have very low or possibly even zero mass

NGO (Non-governmental Organization) - a non-profit group or association organized outside of institutionalized political structures to obtain particular social objectives (such as environmental protection) or serve particular constituencies

niche - the role of an organism in an ecological community; the environmental requirements and tolerances of a species; sometimes seen as a species' "profession" or what it does to survive

nitrogen narcosis - a hazardous condition that scuba divers may experience at depths usually in excess of 80 ft (24.38 m). It occurs when nitrogen builds up in the body tissues and replaces some of the oxygen required by the brain. The longer a diver with conventional scuba stays at a deep depth, the more nitrogen accumulates. As the brain is deprived of oxygen, the ability to think and function clearly diminishes. It may progress from a slightly confused feeling to an almost intoxicated state, where thinking and judgement is severely impaired. If the diver does not ascend to a shallower depth and off-gas nitrogen, nitrogen narcosis may eventually cause death. Although this can happen at any depth, it is especially a problem with dives in excess of 80 feet. Nitrogen narcosis is also called 'rapture of the deep'

nitrox - any mixture of nitrogen and oxygen that contains less than the 78 percent nitrogen as found in ordinary air

no take zone - a marine protected area that is completely (or seasonally) free of all extractive or non-extractive human uses that contribute impact (some exceptions may be permitted for scientific activities); also called "marine reserve" or "fully protected area"

NOAA (National Oceanic and Atmospheric Administration) - the National Oceanic and Atmospheric Administration (NOAA) is a federal agency within the US Department of Commerce that is dedicated to predicting and protecting the environment. NOAA's overall mission is to understand and predict changes in the Earth's environment, protect life and property, provide decision makers with reliable scientific information, conserve and manage the Nation's living marine and coastal resources to meet our Nation's economic, social, and environmental needs, and foster global environmental stewardship. To achieve its mission, NOAA's focus through 2008 will be on four mission goals:

1. Protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management
2. Understand climate variability and change to enhance society's ability to plan and respond
3. Serve society's needs for weather and water information
4. Support the Nation's commerce with information for safe, efficient, and environmentally sound transportation



The National Oceanic and Atmospheric Administration (NOAA) is a federal agency within the U.S. Department of Commerce that is dedicated to predicting, protecting, and providing information about the marine environment.

NOAA Coral Reef Conservation Program - a NOAA program whose purposes are: (1) to preserve, sustain, and restore the condition of coral reef ecosystems; (2) to promote the wise management and sustainable use of coral reefs; (3) to develop sound scientific information on the condition of coral reef ecosystems and the threats to such ecosystems; (4) to assist in the preservation of coral reefs by supporting conservation programs, including projects that involve affected local communities and nongovernmental organizations; (5) to provide financial resources for those programs and projects; and (6) to establish a formal mechanism for collecting and allocating monetary donations from the private sector to be used for coral reef conservation projects

NOAA Diving Program - the NOAA Diving Program is administered by NOAA and is headquartered at the NOAA Diving Center in Seattle, WA. The Program trains and certifies scientists, engineers and technicians to perform the variety of tasks carried out underwater to support NOAA's mission. With more than 300 divers, NOAA has the largest complement of divers of any civilian federal agency. In addition, NOAA's reputation as a leader in diving and safety training has led to frequent requests from other governmental agencies to participate in NOAA diver training courses

NOAA's Coral Reef Conservation Grant Program - each year, subject to the availability of funds, NOAA publishes its Coral Reef Conservation Grant Program Funding Guidance, as authorized by the Coral Reef Conservation Act of 2000, to solicit proposals for coral reef conservation activities. The Act authorizes the Secretary of Commerce, through the NOAA administrator and subject to the availability of funds, to issue matching grants of financial assistance for broad-based coral reef conservation activities, consistent with the purposes of the Act

NOAA's National Marine Fisheries Service (NOAA Fisheries) - NOAA Fisheries is the federal agency responsible for the stewardship of the nation's living marine resources and their habitat. It is responsible for the management, conservation and protection of living marine resources within the United States' Exclusive Economic Zone (water three to 200 miles offshore). Using the tools provided by the Magnuson-Stevens Act, NOAA Fisheries assesses and predicts the status of fish stocks, ensures compliance with fisheries regulations and works to reduce wasteful fishing practices. Under the Marine Mammal Protection Act and the Endangered Species Act, it recovers protected marine species (i.e. whales, turtles) without unnecessarily impeding economic and recreational opportunities. With the help of the six regional offices and eight councils, NOAA Fisheries is able to work with communities on fishery management issues. NOAA Fisheries works to promote sustainable fisheries and to prevent lost economic potential associated with overfishing, declining species and degraded habitats. It strives to balance competing public needs and interest in the use and enjoyment of our oceans' resources. For more information, see: <http://www.nmfs.noaa.gov/>

NOAA's National Ocean Service (NOS) - NOS is a scientific and technical organization of NOAA whose mission is to preserve and enhance the nation's coastal resources and ecosystems along 95,000 miles of shoreline and 3.5 million square miles of coastal ocean. At the same time, it works to support economic growth for the long-term benefit of the nation. This theme is central to the sustainable development agenda of both NOAA and the U. S. Department of Commerce (DOC). For detailed information, see: <http://www.oceanservice.noaa.gov/about/welcome.html>

NOAA's Office of Oceanic and Atmospheric Research (NOAA Research) - the Office of Oceanic and Atmospheric Research (OAR) or "NOAA Research" works in partnership with NOAA's National Weather Service, National Ocean Service, National Environmental Satellite Data Information Service and National Marine Fisheries Service as the research and development organization of the agency. It is through NOAA Research that work results in better weather forecasts, longer warnings for natural disasters and an overall greater understanding of our oceans, climate and atmosphere. NOAA Research explores the Earth and atmosphere from the very surface of the sun to the depths of the ocean. Its role within NOAA is to provide products and services that describe and predict changes in the environment. NOAA Research results allow decision makers to make effective judgments in order to prevent the loss of human life and conserve and manage natural resources. Research is conducted, with its partners in academia, in three major areas: atmosphere, climate, and ocean and coastal resources. For more information, see: <http://www.research.noaa.gov/>

nociceptor - a sensory receptor which responds to potentially harmful stimuli; produces a sensation of pain

nocturnal - being primarily active at night

nodulose - with small nodules, knobs or swellings

noise - unwanted sound

nomenclature - the description of new taxa or alterations to the concept of previously described taxa which involve changes in the names of taxa

nominal taxon - in taxonomy, a named taxon, objectively defined by its type taxon. Thus the nominal family Chaetodontidae is always the one to which its nominal type genus, *Chaetodon*, belongs

non-point source pollution - a pollution source without a single point of origin, or not introduced into a receiving stream from a specific outlet. It occurs when rainfall, snowmelt, or irrigation runs over land or through the ground, picks up pollutants, and deposits them into rivers, lakes, and coastal waters or introduces them into ground water. Common nonpoint sources are agriculture, forestry, mining, construction, dams, channels, land disposal, saltwater intrusion, and city streets

nonallele - a gene that is not a competitor at the same locus (specific location on the chromosome)

nonbiodegradable material - a material that cannot be broken into simpler chemicals by living organisms

noncoding DNA - DNA that does not encode any product (RNA or protein). The majority of the DNA in plants and animals is noncoding

nondegradable pollutant - a polluting substance that is not broken down by natural processes

nonessential amino acid - an amino acid which can be synthesized by the organism's body, and not required in the nourishment source. Humans can make 13 nonessential amino acids

nonionizing radiation - radiation that carries enough energy to excite an atom or molecule, but not enough energy to remove an electron from the atom or molecule. This type of radiation does not cause damage to cells and tissues; examples include radio waves, microwaves, infrared light, and ordinary light

nonrenewable resource - an environment resource which is not replaced or replenished by natural processes at a rate comparable to the use of the resource; a resource depleted or exhausted by use

nonseptate - lacking cross walls (septa); also termed "aseptate"

notochord - a flexible rodlike structure that forms the supporting axis of the body in the lowest chordates, (e.g., tunicates and lancelets) and lowest vertebrates (e.g., lampreys), and in the embryos of all higher vertebrates, where it is replaced by the vertebral column; a prime defining characteristic of the phylum Chordata

notopodium - a lobe of the parapodium closer to the dorsal side in polychaete worms

NOWRAMP (Northwestern Hawaiian Islands Coral Reef Assessment and Monitoring Program) - a multi-agency, multi-year effort that began in 2000. NOWRAMP's objective is to rapidly evaluate and map the shallow water reef habitats in the NWHI. The agencies which contribute to NOWRAMP are: NOAA, the U.S. Fish and Wildlife Service, the State of Hawai'i Department of Land and natural Resources, the University of Hawai'i, the Bishop Museum, the Hawai'i Maritime Service, the U.S. National Park Service, and scientists from the University of California at Santa Cruz

NPDES (National Pollutant Discharge Elimination System) - a provision of the Clean Water Act (CWA) which prohibits discharge of pollutants into waters of the United States unless a special permit is issued by EPA, a state, or where delegated, a tribal government on an Indian reservation

nuchal - pertaining to the neck

nuchal organ - a sense organ on upper side of head in many branchiopods; photoreceptor-like sensory cells in the nuchal region (posterodorsal region of the head) of some cephalopods; paired chemosensory structures in some annelids

nuclease - one of the several classes of enzymes that degrade nucleic acid; an enzyme that can degrade DNA or RNA by breaking phosphodiester bonds that link adjacent nucleotides

nucleic acid - a large molecule found in biological cells composed of nucleotide subunits

nucleic acid isolation - a prerequisite for molecular genetic studies is, by definition, the ability to isolate nucleic acids (DNA and RNA)

nucleoprotein - a conjugated protein composed of nucleic acid and protein; chromosomes are composed of nucleoproteins

nucleotide - one of the structural components, or building blocks, of DNA and RNA. A nucleotide consists of a base (one of four nitrogenous bases: adenine, thymine, guanine, and cytosine) plus a molecule of sugar and one of phosphoric acid

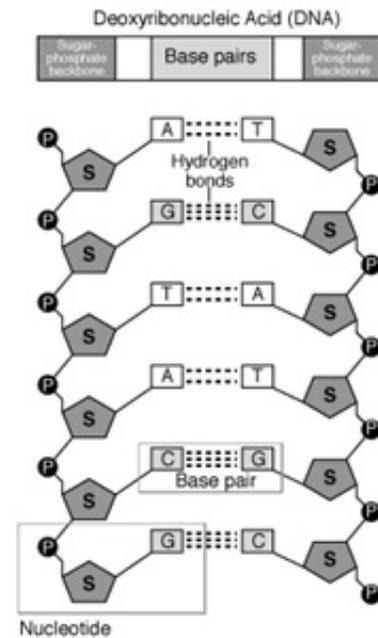
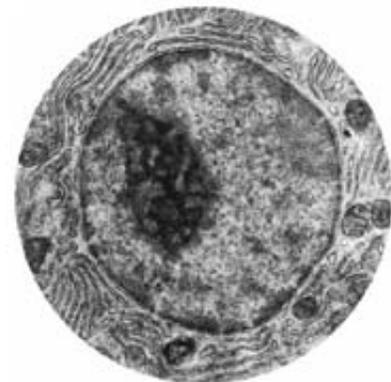


Diagram of DNA shows nucleotide structure. (Diagram: NIH/Human Genome Project)

nucleus - a central cell structure that contains the chromosomes, and as such, controls the activities of the cell; the center of an atom, containing protons, neutrons, and most of the mass



A cell with a large central nucleus. The dark mass within the nucleus are the chromosomes.

nudibranch - a opisthobranchiate mollusk (sea slugs), having no shell except while very young. The gills are naked and situated upon the back or sides



A Pacific nudibranch. (Photo: Dr. Bill Rudman)

null hypothesis (Ho) - the statistical hypothesis that states that there are no differences between observed and expected data. The null hypothesis is used in experimental research. It asserts arbitrarily that there is no relationship among the variables being studied. Then statistical tests are used to determine if any relationship shown by the research data is due to chance alone or to alternative hypotheses

numerical taxonomy - study of the relationships of taxa by the application of numerical similarity values to characters so as to rank into categories based on degree of overall similarity

numericulture - an attempt to express the natural order (i.e. classification) of organisms in numbers, so that each taxon name is represented by a numerical code, the structure of which indicates its taxonomic position, rank and affinities

NURP (NOAA National Undersea Research Program) - a unique national service that provides undersea scientists with tools and expertise that they need to work in the undersea environment. Each year, the program supports 200 or more undersea research projects related to NOAA's mission as steward of oceanic resources and environments. A key strength of NURP is its partnership with the nation's science community, carried out primarily through six regional NURP Centers

nutrient - any substance assimilated by organisms that promotes growth. Marine scientists typically measure nitrites, nitrates, phosphates, and silicates as nutrients for plant growth

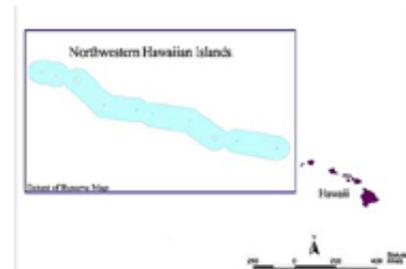
nutrient cycle - the cyclic conversion of nutrients from one form to another within biological communities

nutrient cycling - all the processes by which nutrients are transferred from one organism to another. For instance, the carbon cycle includes uptake of carbon dioxide by plants, ingestion by animals, and respiration and decay of the animal

nutrient pollution - contamination of water resources by excessive inputs of nutrients. In surface waters, excess algal production is a major concern

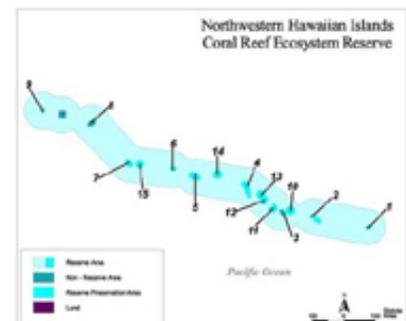
nutrient regeneration - the release of nutrients from organic matter by decomposer organisms

NWHI (Northwestern Hawaiian Islands) - the Northwestern Hawaiian Islands (NWHI) are a chain of small islands, atolls, submerged banks, and reefs beginning approximately 120 nautical miles west of the main Hawaiian islands, and stretching northwest for more than 1,079 nautical miles or 2,000 kilometers. This vast archipelago is uninhabited (except for Midway Island) and is surrounded by some of the most extensive and pristine coral reefs in U.S. waters



Graphic showing location of Northwest Hawaiian Islands

NWHI Coral Reef Ecosystem Reserve - the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve was established by Executive Order 13178 in December 2000, and January 2001 (Executive Order 13196). It was established to conserve and protect the NWHI coral reef ecosystem and related natural and cultural resources of the area



Reference map of the Northwestern Hawaiian Islands Ecosystem Reserve. (1) Nihoa Island, (2) Necker Island, (3) French Frigate Shoals, (4) Gardner Pinnacles, (5) Maro Reef, (6) Laysan Island, (7) Lisianski Island, (8) Pearl and Hermes Atoll, (9) Kure Atoll, (10) The First Bank immediately east of French Frigate Shoals, (11) Southeast Brooks Bank (the first bank immediately west of French Frigate Shoals), (12) St. Rogatien Bank, (13) The First Bank immediately west of St. Rogatien Bank, (14) Raita Bank, and (15) Pioneer Bank. (Graphic: NOAA)

OBIS (Ocean Biogeographic Information System) - the marine component of the Global Biodiversity Information Facility. It links marine databases around the world to provide an internet accessible, dynamic interface for comparing species level, geo-referenced biodiversity data in relation to ocean habitats. All Census of Marine Life (CoML) field project data will be managed in and accessible through OBIS (www.iobis.org)

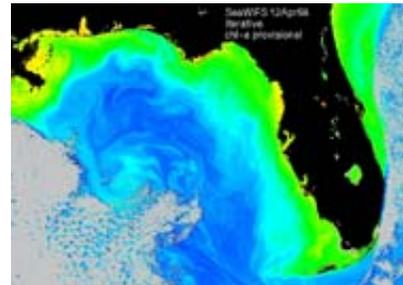
obligate mutualism - a mutualistic relationship where one species cannot survive without the presence of the other

obligatory - obligate or required. For example, an obligatory cleaner fish relies entirely on this feeding mode to obtain nutrients; opposite of facultative

oblong - elongated (stretched) from a square or circular shape

obtuse - blunt or rounded at the end

ocean color - a term that refers to the spectral dependence of the radiance leaving a water body



SeaWiFS (Sea-viewing Wide Field-of-view Sensor) ocean color image of chlorophyll-a in the Gulf of Mexico.

ocean color sensor - an instrument for the remote sensing of ocean color, usually from aircraft or satellite



This SeaWiFS (Sea-viewing Wide Field-of-view Sensor) is an ocean color sensor.

oceanic - associated with sea-water environment seaward of the shelf-slope break

oceanic crust - that part of the Earth's crust underlying the ocean basins. It is composed of basalt and has a thickness of about 5 km

oceanic island - an island in the ocean formed by breaking away from a continental landmass, volcanic action, coral formation, or a combination of sources

oceanic reef - a reef that develops adjacent to deeper waters, often in association with oceanic islands

ocellus - an eye-like spot, usually surrounded with a ring of a lighter color, e.g. the ocellus toward the caudal peduncle of some butterflyfish. It may function to deflect attacks to the eyes in agonistic encounters. Ocelli are also present in other animal groups, especially insects



These butterflyfish have a prominent ocellus (pl. ocelli), which may serve to deflect predator attacks from the head region of the fish.

Octocorallia - a subclass of the Anthozoa that contains the sea pens, sea pansies, sea fans, whip corals, and pipe corals. Octocorals always possess 8 tentacles and 8 complete septa (hard corals and anemones possess 12 or more tentacles and septa). They are colonial cnidarians whose polyps are connected by a tissue mass called the coenenchyme. This tissue connects the gastrovascular (digestive) cavities of all the polyps in the colony



An octocorallian (sea fan) with brain coral (sceractinian) in the foreground.

octopus - in scuba, a backup second stage regulator connected to the first stage, intended for the benefit of other scuba divers in case their air supply should fail. It is the alternate air source that forms the basis for the "buddy" system

Oculina Banks - a series of deepwater coral pinnacles and ridges, 15 to 30 miles off the east coast of Florida, extending from Ft. Pierce to Cape Canaveral. Formed by a single species of coral, the Ivory Tree Coral, *Oculina varicosa*, they form pinnacles of up to 100 feet tall, growing below the Gulf Stream at depths of approximately 70 to 100 meters. This is a slow-growing, branching coral often associated with high biodiversity because they provide ideal habitats and spawning sites for numerous species of fishes and invertebrates



The Oculina Banks are deep water coral reefs occurring along the shelf edge off the central east coast of Florida. The *Oculina varicosa* habitat hosts a diverse array of macroinvertebrates and fishes. The habitat also comprises significant spawning grounds for economically important species of reef fishes.

odontophore - a tooth-bearing structure found in most mollusks, except bivalves. It consists of several muscles and a cartilage which support the radula and radula sac; the term is also applied to the radula alone

off-reef - a synonym of reef slope

offshore current - any current flowing away from shore

offshore wind - a wind blowing seaward from the land in the coastal area.

oligomer - a molecule of intermediate relative molecular mass, the structure of which essentially comprises a small plurality of units derived, actually or conceptually, from molecules of lower relative molecular mass; a polymer that consists of two, three, or four monomers

oligonucleotide - a short sequence (usually 2-50 bases) of DNA. Oligonucleotides of up to 30 bases are routinely synthesized for use as PCR primers or as probes for their sequence complements in a complex mixture of DNA

oligotrophic - refers to water bodies with low concentrations of nutrients

omnivore - an organism whose diet consists of a wide variety of foodstuffs, including plants and animals

oncogene - a gene thought to be capable of causing cancer

oncology - the science dealing with the physical, chemical and biological properties and features of cancer, including the causes and progression of the disease

one-gene--one-polypeptide hypothesis - the concept that one gene in DNA codes for a sequence of amino acids in a specific polypeptide

onshore - a direction landward from the sea

onshore wind - a wind blowing landward from the sea in the coastal area

ontogenesis - the entire development of an individual organism from fertilization to completion of its life history

ontogeny - the development, growth, and maturation of an individual

ooocyte - a female gametocyte that develops into an ovum after two meiotic divisions; the female reproductive cell, also called an egg or ovum

ooecium - a brood chamber for developing embryos in the Ectoprocta (bryozoans); one of the special zooids of ectoprocts destined to receive and develop ova; an ovicell.

oogamous - characterized by reproducing by the fusion of small motile male gametes and large nonmotile female gametes

oogamy - the union of a large nonmotile egg with a small motile or nonmotile male sperm cell

oogenesis - the process of ovum (egg) development in female animals, in which the diploid number of chromosomes is reduced by half to the haploid number in the ovum

oolitic limestone - rock composed primarily of petrified corals or the skeletons of other calcareous animals

open circuit scuba - a diving apparatus in which exhaled air is expelled into the water as bubbles; no part is rebreathed by the diver. It is most commonly used in recreational scuba diving

open circulatory system - a circulatory system, characteristic of some invertebrates, e.g., arthropods, in which blood flows through an interconnected system of open sinuses rather than blood vessels. The tissues and cells are directly bathed by the blood for gaseous exchange and nutrient uptake. The circulatory fluid is called the hemolymph

open sea - that part of the ocean that extends outward from the continental shelf

open system - a system that exchanges energy and matter with its environment

operator gene - a region of the chromosome, adjacent to the operon, where a repressor protein binds to prevent transcription of the operon

operculate - having an operculum

operculum - a lid or flap covering an aperture, such as the gill cover in most bony fishes; the gill cover; also the horny lid closing the aperture of various species of mollusks



A ventral view of the gill chamber and opercular chamber of a fish. Note the gill (branchial) arches, each with a large number of gill filaments. (Photo: University of California at Davis)

operon - a sequence of genes responsible for synthesizing the enzymes needed for biosynthesis of a molecule. An operon is controlled by an operator gene and a repressor gene

ophiopluteus larva - larva of a brittle star (phylum Echinodermata)

opisthobranch - a marine gastropod, many of which have lost or reduced their shell, mantle and gills

optical oceanography - the subdiscipline of oceanography concerned with the propagation and interaction of radiation, typically at wavelengths between about 350 and 750 nm, with seawater

optimum - a state that is the best fit for the current situation. All minor changes make the situation worse; in biology, it is the level of some environmental factor, within a species' or population's tolerance range, at which the species or population can function most efficiently or with the greatest positive effect to its physiological or reproductive fitness

oral - pertaining to the mouth



The oral surface of some sea urchins. The central opening is the mouth.

oral cavity - the cavity within the mouth

oral disc - the area around the mouth of an anthozoan polyp that bears from eight to several hundred tentacles

orbit - a bony or cartilaginous eye socket

order - a taxonomic group containing one or more families

organ - a collection of tissues which performs a particular function or set of functions in an animal's body. Organs are composed of tissues, and may be organized into larger organ systems

organ system - collection of organs which have related roles in an organism's functioning. The nervous system, circulatory system, and muscle system are all organ systems

organ-pipe coral - the organ-pipe coral, *Tubipora musica*, is a reef-building (hermatypic) octocoral



The organ-pipe coral, a reef-building octocoral. (Photo: A. Bruckner, NOAA)

organelle - a structurally discrete component of a cell, e.g., the nucleus or a mitochondrion

organic - refers to those substances produced by the metabolism of a living organism, especially carbon-containing compounds

organic enrichment - the addition of nutrients from organic matter

organic molecule - a molecule that contains one or more carbon atoms

organically polluted - made unfit for living organisms by excess addition of organic matter

organism - any form of unicellular or multicellular life; a living thing that has (or can develop) the ability to act or function independently

orientation - the way an organism positions itself in relation to environmental cues

ornamental - a non-food species that is produced and maintained solely for exhibit purposes in home or public aquaria, or in ornamental garden ponds

ornithology - the scientific study of birds



A white tern from Laysan Island, Hawaiian Archipelago. (Photo: NOAA)

ortholog - a gene found in different species that evolved from a common ancestral gene by speciation. Normally, orthologs retain the same function in the course of evolution

oscillation - any steady back and forth movements

oscillator - the internal biological clock mechanism that produces a measurable biological rhythm in an organism

osculum - a large opening through which water flows out of a sponge. Sponges may have more than one osculum



Distinct osculi of some Caribbean sponges. (Photo: Copyright Digital Stock Corp.)

osmoregulation - the process of controlling the amount of water in tissues and cells

osmosis - the passage of water through a semipermeable membrane from a solution with a lower concentration of solute to one with a higher concentration of solute

osmotic pressure - the pressure that is needed to counteract the osmotic passage of water molecules across a semipermeable membrane into the more concentrated solute

osmotroph - an organism that obtains nutrients through the active uptake of soluble materials across the cell membrane

ossicle - one of numerous small calcareous structures that form the exoskeleton of certain echinoderms. Their size, shape and location are highly variable, and they may be movable or fixed in position. They may appear as thin fused plates. In brittle stars they form "vertebrae" in the arms, which with together with their attached muscles, gives the brittle star its serpentine ophiuroid motion. Sea cucumbers hve microscopic ossicles embedded in their dermis. The small, sound transmitting bones in the vertebrate middle ear are also called 'ossicles'

ossified - made or converted into bone

ostium - in sponges, a microscopic pore through which water enters the sponge body

outer slope - a synonym of reef slope. It is sometimes used to represent the lower reef slope

overexploitation - the removal of individuals or biomass from a population at a rate greater than the population is able to compensate for with its own recruitment

overfishing - a level of fishing effort or fishing mortality such that a reduction of this level would, in the medium term, lead to an increase in the total catch

ovicell - the brood chamber of a bryozoan (Ectoprocta), usually located at the distal end of the maternal zooid. Embryos are brooded until they develop into non-feeding larvae, which swim briefly, then settle and metamorphose to found a new colony

oviparity - the reproductive mode where eggs are released from the body and later hatch

oviposition - the process of depositing eggs



A marine turtle depositing eggs (oviposition) on a tropical beach. (Photo: Seaturtle Preservation Society of Brevard County, FL)

ovoid - egg-shaped

ovoviviparity - the reproductive mode where the eggs hatch and develop in the female's reproductive tract (or a specialized pouch in the males of some species), are not nourished in any way by the female, and are free-swimming when released from the parent

ovulation - the release of an egg from the ovary

ovum - the mature female germ cell (egg; female gamete)

oxidant - an oxidizing agent

oxidation - the combination of a substance with oxygen. Oxidation can also describe a type of reaction in which the atoms in an element lose electrons and the valence is correspondingly increased

oxidative stress - a process whereby the metabolic balance of a cell is disrupted by exposure to environmental substances, resulting in the accumulation of free radicals, which can damage components of cells' membranes, proteins or genetic material by "oxidizing" them

oxygen isotope ratio (18O) - an expression for the ratio of the ^{18}O to ^{16}O atoms in a sample relative to a standard, defined as: $\delta^{18}\text{O} = \frac{(^{18}\text{O}/^{16}\text{O} \text{ sample} - ^{18}\text{O}/^{18}\text{O} \text{ standard})}{^{18}\text{O}/^{16}\text{O} \text{ standard}}$

oxygen isotopes - oxygen atoms that have the same atomic number (protons) but different mass numbers (and different numbers of neutrons). The two stable isotopes of oxygen are ^{16}O and ^{18}O

PADI (Professional Association of Diving Instructors) - the world's largest scuba diving certification agency

paedomorphy - the retention of juvenile features in an adult organism



Cope's giant salamander (*Dicamptodon copei*) is an example of paedomorphy. The adult retains the juvenile external gills. (Photo: U. S.D.A. Forest Service)

PAH (polycyclic aromatic hydrocarbon) - a class of stable organic molecules made up of only carbon and hydrogen. These molecules are highly carcinogenic, but also very common in the environment. PAHs are formed during the incomplete burning of coal, oil and gas, garbage, and other organic substances, such as tobacco or even charcoal broiled meat. PAHs enter water through discharges from industrial and wastewater treatment plants or through the release of boat engine exhausts. Ultraviolet light (UV) transforms the PAHs into toxic forms that kill crustaceans, polychaetes, and coral larvae

pair bond - the temporary or permanent association formed between a female and male animal during courtship and mating. Pair bonding is characteristic of monogamous species

paired fins - the pectoral and pelvic fins of fishes



Note the paired fins on this Townsend angelfish. The pelvic fins (and pelvic girdle) are in the thoracic position. (Photo: Jackie Reid, NOAA)

palatine - a bone in the roof of the mouth of fishes. The palatine is cartilaginous in some primitive bony fishes

paleobiogeography - the distribution of organisms as revealed by the fossil record

paleoclimatology - the study of past climates throughout geological history, and the causes of the variations among them

paleoecology - the study of the relationship of extinct organisms or groups of organisms to their environments



A paleoecological microfossil, this rotifer (*Callindina angusticollis*) is from the Beringia region of the Arctic. (Photo: Wendy Eisner)

paleoenvironmental proxy - an environmental remnant of the past (pollen grains, tree rings, lake sediments, pack rat middens, ice cores, coral skeletons) used to assist researchers in deciphering past climatic conditions

paleopathology - the study of sickness, injuries and other abnormalities in the health of ancient organisms

paleothermometer - a proxy that provides absolute estimates of past temperature. An example is the Sr/Ca ratio found in coral skeletons

Paleozoic - an era of geologic time lasting from 570 to 245 million years ago

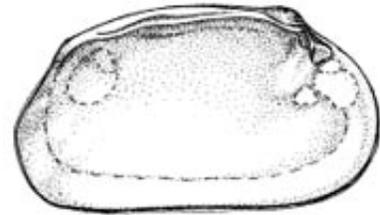
paliform crown - a circle of paliform lobes that surround the columella

paliform lobe - an upright skeletal rod or plate at the inner margin of septa formed by upward growth of the septum

pallial - of or pertaining to a mantle, especially to the mantle of mollusks

pallial chamber - the cavity enclosed by the mantle in mollusks

pallial line - a linear impression which marks the attachment of the mantle on the inner surface of a bivalve shell



One side of a bivalve shell showing muscle scars, pallial line created by the mantle, hinge and hinge teeth. (Graphic: Biodidac)

palmata zone - the region of a reef crest or a bank or barrier reef that is closest to the water surface. It is composed almost completely of elkhorn coral (*Acropora palmata*) in the Caribbean



Acropora palmata in a shallow reef zone.

palmate - hand-shaped

palolo - a polychaete worm (*Palola viridis*) that burrows in the coral reefs of some Pacific Islands. Just before the last quarter of the moon in October and November, they swarm and breed in vast numbers at the sea surface. They are gathered and highly esteemed as food by the islanders. An allied species inhabits the tropical Atlantic and swarms in June or July



The portion containing the reproductive gametes (the epitoke) of the palolo worm, *Palola viridis*, is considered a delicacy in Samoa and other Pacific islands. (Photo: Smithsonian Institution)

palustrine - pertaining to swamps or marshy habitats



Palustrine habitat in the Jobos Bay National Estuarine Research Reserve. (Photo: NOAA)

pan-tropical - throughout the tropics

pandemic - an epidemic that is geographically widespread; occurring throughout a region or even throughout the world

Pangea - a supercontinent that existed from about 300 to 200 million years ago. It included most of the continental crust of the Earth

panmixis - random mating in a population

papilla - a raised bump or nipple-like projection on a tissue surface; a cellular outgrowth. Papillae have the appearance of little bumps or fingers on the surface of cells

papillose - covered with papillae

PAR (Photosynthetically Active Radiation) - those wavelengths of light that can be absorbed by chlorophyll or other light harvesting pigments

paradox - a statement that seems self-contradictory, yet may nevertheless be true

parameter - a particular physical, chemical, or biological property that is being measured

parapodium - one of the short unsegmented processes located on each side of most of the body segments in many annelid worms. Parapodia (pl) function in locomotion and often also as tactile or branchial organs. In some marine snails (e.g., sea hares and pteropods) it is a broad lateral expansion of either side of the foot, forming a broad swimming organ



A polychaete worm showing a pair of parapodia per segment. Note the bristle-like chaetae borne by each parapodium. (Photo: Dr. Anthony Picciolo)

paratype - in taxonomy, every specimen in a type series, other than the holotype, which were before the author at the time of preparation of the original description, and were so designated and indicated there

parenchyma - the primary tissue of higher plants composed of thin-walled cells that remain capable of cell division, even when mature. Parenchyma constitutes the greater part of leaves, roots, the pulp of fruits, and the pith of stems. They are fundamental plant tissues as opposed to more highly differentiated tissues. In animals, the parenchyma constitutes the essential functional part of an organ, as contrasted with the organ's connective tissue, nerves, and blood vessels

parenchyme - in cnidarians, mesenchyme with dense cellular components

parenchymula - a sponge larva which appears as a solid ball with exterior flagellated cells (except at the "posterior end")

paresthesia - abnormal neurological sensations which include: numbness, tingling, burning, prickling and hyperesthesia (increased sensitivity); one possible symptom of ciguatera poisoning

parthenogenesis - reproduction without fertilization; the development of an unfertilized ovum, seed, or spore. It occurs naturally in several species and may also be induced artificially by chemical or mechanical means

partial pressure - the pressure exerted by a single component of a gas within a gas mixture, or dissolved in a liquid

particulate - a very small solid suspended in water

particulate organic matter - particulate material of biological origin that is suspended in water

parts per million (ppm) - number of parts of a substance found in one million parts of a particular gas, liquid, or solid

parts per thousand (ppt) - number of parts of a substance found in one thousand parts of a particular gas, liquid, or solid

patch reef - a coral boulder or clump of corals formed on a shelf, usually of less than 70 m depth, often in the lagoon of a barrier reef or atoll. It is unattached to a major reef structure

patchiness - the condition where organisms occur in aggregations

pathogen - an organism which causes a disease within another organism

pavement - rock exposed at the Earth's surface in the form of a more or less horizontal surface, usually with crevices or joints

PCR (polymerase chain reaction) - a method of creating copies of specific fragments of DNA. PCR rapidly amplifies a single DNA molecule into many billions of molecules

pectinate - comb-like; in mollusks, it refers to the comb-like lamellae of the ctenidia (gills)

pectoral fin - the farthest forward or uppermost of the paired fins of most fishes, usually located in the thoracic position



A flying fish with huge pectoral fins.
(Photo: NOAA)

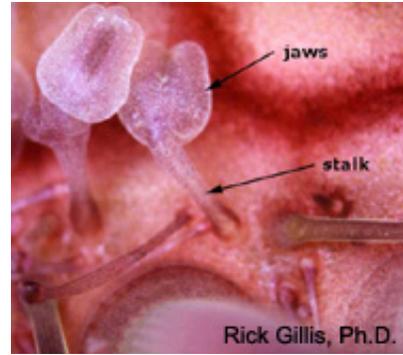
pedal disc - a disc at the aboral end of the body trunk used for attachment. A synonym of basal plate



An anemone maintains its grip on substrate with its pedal disc. (Photo: Copyright Digital Stock Corp.)

pedal laceration - a type of asexual reproduction in some sea anemones in which parts of the pedal disc break off and are left behind as the anemone moves

pedicellarium - a forceps-like organ which occurs in large numbers on starfishes and sea urchins. Pedicellariae, in general, are multifunctional appendages involved in defense, feeding, and cleaning. They are mainly used to keep small organisms from settling on the aboral surface, to capture small prey, and to discourage predators from feeding on soft tissue. The basic structure of pedicellariae consists of a head, neck, and stalk. The head usually has three jaws and, in some pedicellariae, contains poison glands



A single pedicellarium from a starfish. (Photo: Rick Gillis, Ph.D., Biology Dept., University of Wisconsin-La Crosse)

pelagic - refers to organisms that inhabit open water, as opposed to benthic



An ocean sunfish, *Mola mola*, is a pelagic species, frequently seen basking at the surface of the water.

Pelecypoda (Bivalvia or Lamellibranchia) - a class of Mollusca that includes clams, oysters and mussels



A member of the Pelecypoda, a live scallop (*Placopecten magellanicus*) in the Stellwagen Bank National Marine Sanctuary. (Photo: Dann Blackwood and Page Valentine, USGS)

pelvic fin - the paired fin located ventrally beneath, in front of, or behind, the pectoral fin

pentamerous - divided into five parts; a characteristic of the body plan of echinoderms



Bright orange seastar
(*Pseudarchaster myobranchius*) with a
typical pentamerous body shape.

peptide - two or more amino acids joined by a peptide bond

peptide bond - the bond between two amino acids formed when a carboxyl (-COOH) group of one amino acid joins an amino (-NH₂) group of another amino acid, releasing water in the process

percentile - one of the division points that divides a set of ranked data into one hundred equal points; a value on a scale of zero to one hundred that indicates the percent of a distribution that is equal to or below it. A score in the 95th percentile is a score equal to or better than 95 percent of all other scores

Period - in the geologic time scale, a unit of time less than an era and greater than an epoch

Periodic Table - a chart of the known chemical elements, arranged according to their atomic numbers. Elements with similar physical and chemical properties and similar electron arrangements are in the same column

periostracum - the outside layer or covering of a bivalve (Mollusca) shell

periphery - the outermost part or region within a precise boundary

perisarc - the chitinous outer coat of common tissue connecting individuals in some colonial hydrozoans

peritoneum - the mesodermally-derived membrane that lines the coelom and covers the coelomic viscera

permeable - having pores or openings that permit liquids or gasses to pass through

perradial canal - one of four branched ciliated canals that originates directly from the stomach of scyphozoan medusae and moves partially digested food materials from the ring canal to the stomach

perturbation - a disturbance or abnormality

petabyte - a measure of data size. One petabyte is equivalent to 1,000 terabytes

petaloid - describes a form that is similar to a flower petal

petaloid septa - primary septa which have a tapered or curved shape because they are enclosed by other septa

pH - the logarithm of the reciprocal of hydrogen-ion concentration in gram atoms per liter; provides a measure on a scale from 0 to 14 of the acidity or alkalinity of a solution (where 7 is neutral and <7 is acidic and >7 is basic)

phaceloid coral - a coral that has corallites of uniform height which are adjoined toward their base

phage - a virus that infects bacteria; also called a bacteriophage

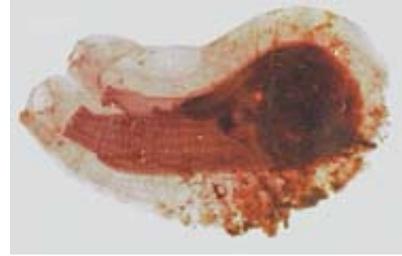
phagocyte - a cell that engulfs and digests debris and invading microorganisms

phagocytosis - "cell eating." A process in which phagocytes engulf and digest microorganisms and cellular debris; an important defense against infection

pharmaceutical - refers to man-made and natural drugs used to treat diseases, disorders, and illnesses

pharyngeal arch - one of several columns of mesenchyme found in the neck region of the developing vertebrate embryo. In lower vertebrates, blood vessels formed here become part of the gills; in higher vertebrates derivatives include portions of the jaw and middle ear; also known as branchial arches, gill arches, or visceral arches

pharyngeal basket - a feeding structure in tunicates (sea squirts) which is a type of pharyngeal gill formed into a mesh-like basket. Cilia on the gill draw water into the mouth, through the basket mesh, and out the excurrent siphon



Water entering this sea squirt carries particulate matter which is filtered as water passes through openings in the pharyngeal basket. Food particles are carried to the bottom in mucus and enter the digestive tract. Water that has passed through basket is expelled via the excurrent siphon opening, on right in this illustration. The anus opens at the excurrent siphon so fecal material is carried away. (Photo: Houseman at U. Ottawa; BIODIDAC)

pharyngeal teeth - in fishes, teeth located on the bones in the pharynx, which is the posterior part of the oral cavity

phenetic classification - classification based on degree of overall similarity

phenocopy - an organism whose phenotype (but not genotype) has been changed by the environment to resemble the phenotype usually associated with a mutant organism

phenotype - the total characteristics of an individual, i.e., its appearance, resulting from interaction between its genotype (genetic constitution) and its environment

pheromone - a hormone-like substance that is secreted by an organism into the environment as a specific signal to another organism, usually of the same species

phospho-diester bond - a bond in which a phosphate group joins adjacent carbons through ester linkages

phosphorylation - the addition of a phosphate group to a compound

photic zone - the vertical zone in the ocean extending from the surface to that depth permitting photosynthetic activity

photo-quadrat - a quadrat that is photographed for purposes of later analysis and permanent record for species monitoring or measurement

photometric - of or relating to photometry; a more precise measurement of the brightness (intensity) of light, which can be digitized and calibrated

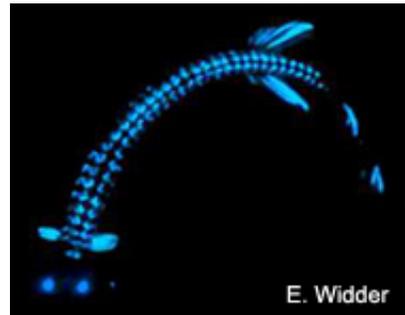
photometry - the quantitative measurement of visible radiation, primarily intensity (brightness), from light sources

photomosaic - an assemblage of photographs, each of which shows part of a region, and put together in such a way that each point in the region appears once and only once in the assemblage, and scale variation is minimized



Photomosaic of St. John, U.S. Virgin Islands. Images such as these are valuable in studying and managing coral reefs and other habitats. (Courtesy of NOAA National Ocean Service)

photophore - a light-producing organ, found especially in marine fishes and cephalopods. Photophores emit light from intrinsic structures, or derive light extrinsically from symbiotic luminescent bacteria



This bright bluish lights are given off by photophores on this black dragonfish (Photo: E. Widder, Harbor Branch Oceanographic Institution)

photosynthesis - process by which autotrophic chlorophyll-containing organisms manufacture their own energy sources (simple sugars) from the intracellular chemical reaction of carbon dioxide and water in the presence of sunlight and chlorophyll. Oxygen is a photochemical byproduct of photosynthesis

photosynthetic capacity - the maximum photosynthetic rate per unit of biomass

photosynthetic pigment - a pigment that efficiently absorbs light within the 400-700 nm range and is essential for photosynthesis

phototropism - the response of an organism to light, usually expressed as movement of a part of an organism toward or away from the light stimulus, as when plants grow toward sunlight

phycocyanin - a blue, water soluble pigment found in red algae and cyanobacteria

phycoerythrin - a red, water soluble pigment found in red algae and cyanobacteria

phycology - the scientific study of algae

phyllopod - any of various branchiopod crustaceans having swimming and respiratory appendages that resemble leaves

phylogenetics - the field of biology that deals with the relationships among organisms

phylogeny - the evolutionary relationships among organisms

phylum - a major division of a biological kingdom, consisting of closely- related classes; represents a basic fundamental pattern of organization and, presumably, a common descent

physiology - the branch of biology that is concerned with the study of functions of particular structures or organs of organisms

phytoplankton - microscopic green plant component of the plankton which is responsible for most of the photosynthetic activity in the ocean



A phytoplankton species of the genus *Ceratium*.

phytotoxin - a substance similar in its properties to an extracellular bacterial toxin

picture element - in a digitized image, this is the area on the ground represented by each digital value. Because the analogue signal from the detector of a scanner may be sampled at any desired interval, the picture element may be smaller than the ground resolution cell of the detector. It is commonly abbreviated as pixel

pinacocyte - a cell type which forms the surface layer (pinacoderm or epidermis) of a sponge. Pinacocytes are capable of synthesising collagen

pinacoderm - the external surface of a sponge, lined with pinacocytes in a single cellular layer

ping - a single output pulse of a sonar system

pinnacle reef - a nearly cylindrical reef with vertical sides; may be up to 200 m diameter and 50 m in height

pinnate - having side branches

pinnule - a side branch structure on the tentacle of soft corals, giving them a feathery appearance

piscivore - an animal that feeds on fishes

pixel - abbreviation of picture element

plague (white plague disease) - a coral disease characterized by a sharp line between apparently healthy coral tissue and freshly exposed coral skeleton. -There is no obvious microbial band present. -The infective pathogen is a bacterium. Plague is currently epidemic throughout the Caribbean, and affects stony corals. For more information and illustrations, see: http://www.coral.noaa.gov/coral_disease/white_plague.shtml



White plague disease. (Photo: Dr. A. Bruckner, NOAA)

planktivorous - feeding on planktonic organisms

plankton - the passively floating or weakly motile aquatic plants (phytoplankton) and animals (zooplankton)



This large copepod (*Neocalanus sp.*) is part of the Arctic marine plankton community.

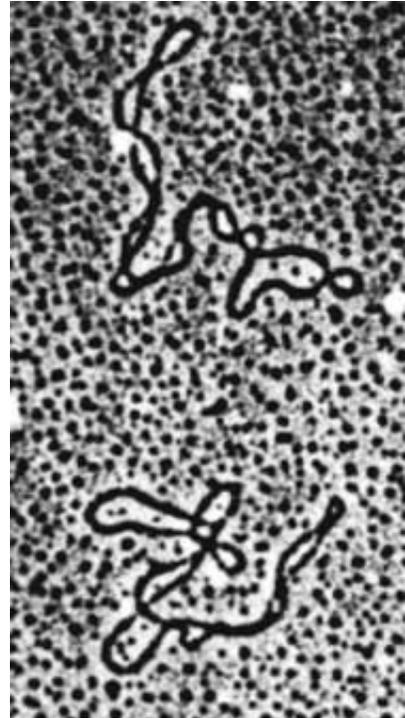
Plantae - the kingdom of immobile multicellular eukaryotes that obtain energy through photosynthesis, and have cells encased in cell walls composed of cellulose



Green plants in a Hawaiian intertidal community.

planula - a planktonic larval form produced by some anthozoans

plasmid - an autonomous (self-replicating) circular piece of DNA found outside the chromosome in bacteria. Plasmids carry information that give the bacteria resistance to antibiotics. They are often used in genetic engineering as cloning vectors to carry desired genes into organisms



A super coiled plasmid is the predominant *in vivo* form in which the plasmid is coiled around histone-like proteins. Supporting proteins are stripped away during extraction from the bacterial cell, causing the plasmid molecule to supercoil around itself *in vitro*. (Photo: Stanley Maloy, Ph.D., Director, Center for Microbial Sciences, San Diego State University)

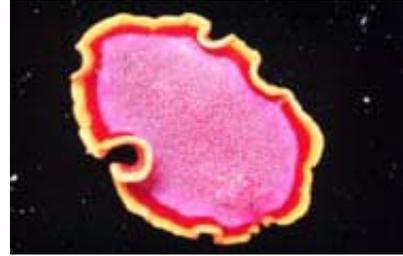
plasmogamy - a process of fusion of the cytoplasm of two sex cells or gametes; the first step in syngamy (fertilization)

plastid - a membrane-bound organelle in plant cells that functions in storage (of food or pigments) or food production. Chloroplasts contain the pigments for photosynthesis

plate like - resembling thin, flat sheets of uniform thickness

platform reef - a large reef of variable shape lacking a lagoon, seaward of a fringing reef and/or a barrier reef, for which the width is more than half its length

Platyhelminthes - an animal phylum containing four classes of flatworms. Three are parasitic (tapeworms, flukes) and one, the Turbellaria, is free-living and contains coral reef inhabiting species



A free-living polyclad flatworm.

Pleistocene epoch - an interval of the Quaternary period, from 1.8 million years before present to 10 thousand years before present

pleurite - one of the external lateral processes of a somite (body segment) of a crustacean; also called a 'pleuron'

plexus - a group or network of intersecting nerves and/or blood vessels

plication - a fold

Pliocene epoch - an interval of the late Neogene period, from 5.3 to 1.8 million years before present

plocoid colony - a coral colony which has conical corallites with their own walls

pluripotent - ability of a single stem cell to develop into many different cell types of the body of an organism

pluteus larva - a free-swimming, bilaterally symmetrical, ciliated larva of some echinoderms, such as sea urchins and brittlestars



Pluteus larva of an Australian sea

urchin. (Photo: Ellen Popodi and Rudolf A. Raff)

pneumatocyst - one of many gas-filled bladders found in some algae that act as a buoys. In some large brown algae, such as kelp, they act to raise the blades closer to the surface where photosynthesis can occur. Pneumatocysts keep the brown alga, *Sargassum*, afloat in the Sargasso Sea



The pneumatocysts are the swellings at the bases of the blades in this kelp. (Photo: Monterey Bay Aquarium Research Institute)

pneumatophore - a modified aerial root rising above ground that may function as a respiratory organ in plant species such as mangroves, which are subjected to inundation or soil saturation. Such evolutionary adaptations enable trees to obtain oxygen directly from the air and also helps consolidate swamp sediments. They have special air channels (lenticels) for gas exchange in the atmosphere and there is an internal pathway for getting oxygen into the root and to supply submerged roots. The aerial loop of a mangrove root is sometimes called a "knee" or "peg root"



Mangrove pneumatophores emerging from the sediments. These structures, also known as rhizophores, have bark rich in lenticels to function in gas exchange for roots that are constantly in water-saturated soil.-(Photo: Copyright Dr. Joseph E. Armstrong, Illinois State University)

point intercept transect - a linear transect protocol where a tape is secured at each end of the transect with the tape draped over the reef in between. Observations are collected on each species and substrate component at specified points along the line

point mutation - a mutation in which a single nucleotide in a DNA sequence is substituted by another nucleotide

point source pollution - origin of a pollutant discharge from a discrete conveyance, such as an effluent from the end of a pipe

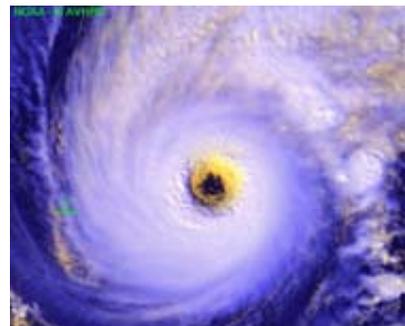
PointCount - PointCount for Coral Reefs is a Windows/Win95-based program developed to utilize the random point count method to accurately estimate percent coverage of corals, sponges, and associated substrate from frame grabbed underwater video imagery

poisonous - an organism that contains poison in its tissues that can be harmful if the organism is ingested



The liver, gonads, intestines, and skin of puffer fish (and other related and unrelated animals) contain high concentrations of tetrodotoxin, a powerful neurotoxin that can cause respiratory paralysis and death, in approximately 60% of persons who ingest it. (Photo: NOAA)

polar-orbiting satellite - a satellite traveling in a near-polar orbit around the globe; civilian satellite program managed and operated by NESDIS



Polar-orbiting satellite data was used to derive this image of Hurricane Erin, September 2001.

polyadenylation - the process by which the 3' ends of most eukaryotic mRNAs are formed; the covalent modification of a macromolecule (e.g., mRNA) by the formation of a polyadenyl moiety covalent linked to the macromolecule; post-transcriptional addition of a polyadenylic acid tail to the 3' end of eukaryotic mRNAs; also called 'poly-(A) tailing'

polyadenylic acid - a polymer of adenylic acid that is sometimes attached to eukaryotic mRNA (messenger RNA) and stabilizes the molecule before transport from the nucleus into the cytoplasm

polycentric distribution - the establishment of a population, species or other taxonomic unit in several widely separated geographic places

Polychaeta - a class of the segmented worm phylum Anellida. There are approximately 8,000 species of polychaetes which include errant (free-moving) forms and sedentary ones that live in stabilized burrows, galleries or tubes of various degrees of complexity. Some burrow into coral. Many species are common inhabitants of coral reefs, such as the Christmas tree worms, feather duster worms, fanworms, fireworms, scaleworms, threadworms, and others



A marine polychaete worm grazing on the surface of a coral head.
(Photo: Dr. Anthony Picciolo)

polyclad flatworm - a free-living flatworm belonging to the order Polycladida (Class Turbellaria; Phylum Platyhelminthes). Many species are coral reef inhabitants

polyculture - the cultivation of more than one species of organism in an aquaculture system

polygene - one of many genes of small effect that influence the development of a quantitative trait; results in continuous variation and in quantitative inheritance

polygenic trait - a phenotype controlled by many genes of small effect (polygenes)

polymer - a compound of high molecular weight consisting of up to millions of repeated linked light and simple molecules

polymerase - a general term for enzymes that carry out the synthesis of nucleic acids

polymorphic species - species which have a variety of morphological types

Polynesia - scattered islands of the central and southern Pacific Ocean roughly between New Zealand in the southwest, Hawaii in the north, and Easter Island in the southeast. The larger islands are volcanic, the smaller ones are generally coral formations



The island of Bora Bora in French Polynesia. (Photo: Anthony R. Picciolo, NOAA)

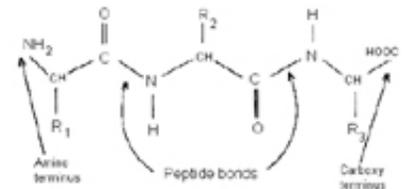
polyp - an individual of a solitary cnidarian or one member of a cnidarian colony



Cnidarian polyp.

polyp bail-out - the dissociation and dispersal of coral polyps from adult colonies

polypeptide - a long chain of amino acids joined by peptide bonds



Amino acids in proteins (or polypeptides) are joined together by peptide bonds.

polyphyletic group - a group of species that resemble each other but are evolved from different ancestors. A polyphyletic group is composed of members that originated, independently, from more than one evolutionary line

polyploid - cells or organisms having more than twice the haploid number of chromosomes

polysaccharide - any of a class of carbohydrates whose molecules contain chains of monosaccharide molecules -

pony bottle - a small, but independent alternate air supply for scuba divers, to be used in case of main air failure. It is a small scuba tank with an attached regulator



A pony bottle attached to the main size cylinder. (Photo: Aqua Explorers)

population - a group of individuals of the same species living in the same area at the same time and sharing a common gene pool; a group of potentially interbreeding organisms in a geographic area

population (statistics) - any entire collection of animals, plants, people, or things from which we may draw a sample and collect data. It is the entire group we are interested in, which we wish to describe or draw conclusions about. In order to make any generalizations about a population, a sample, that is meant to be representative of the population, is often studied. For each population there are many possible samples. A sample statistic gives information about a corresponding population parameter. For example, the sample mean for a set of data would give information about the overall population mean

population crash - sudden decline in the number of individuals found in a population because of a scarcity of required environmental resources

population density - the number of organisms per unit area or volume

population dynamics - the study of the factors that affect the growth, stability, and decline of populations, as well as the interactions of those factors

population explosion - sudden increase in the number of individuals found in a population because of an abundance of useable environmental resources

Porifera - an animal phylum that contains the sponges. They are the most primitive of the multicellular animals. Sponges assume many sessile body forms, such as finger, branching, bushy, spherical, tubular, vase and tube-like, encrusting, amorphous and massive. Some bore into coral and mollusk shells. Many of the 5,000 species are colorful and prominent inhabitants of coral reefs



A barrel sponge (Porifera). (Photo: Dr. Anthony Picciolo)

Porites - an important and dominant genus of hermatypic coral. Porites brood or release live young rather than sperm and egg packets like most corals

porocyte - in sponges, a cell surrounding a pore (ostium)

posterior - morphologically, toward the rear or back end of an individual, or distal portion of a bodily part



The prehensile tail at the posterior

end of the seahorse's body allows it to hold on to aquatic plants

potable water - water that is safe for drinking by humans. Specifically, freshwater that generally meets the standards in quality as established in the U.S. Environmental Protection Agency (EPA) Drinking Water Standards

potential coral reef bleaching episode - potential for coral bleaching occurs when the sea surface temperature is at least 1 degree C above the maximum expected summertime temperature

precision - the ability of an instrument to measure a variable and to repeatedly obtain the same result

prehensile - capable of or adapted for grasping, such as the prehensile tail of a seahorse



This seahorse keeps its position by anchoring itself with its prehensile tail. (Photo: Dr. Tom Doepner, Brown University)

Primary male or female - a male or female that is genetically determined at birth or hatching and is not the result of sex change

primary production - a synonym of primary productivity

primary productivity - the rate at which new plant biomass is formed by photosynthesis. Gross primary productivity is the total rate of photosynthetic production of biomass; net primary productivity is gross primary productivity minus the respiration rate

prime meridian - an imaginary line running from north to south through Greenwich, England, used as the reference point for longitude

primer - in genomics, a short pre-existing single-stranded polynucleotide chain to which new deoxyribonucleotides can be added by DNA polymerase. It anneals to a nucleic acid template and promotes copying of the template starting from the primer site; a single-stranded nucleic acid that can "prime" replication of a template

primeval soup - Soviet biologist, Aleksandr Ivanovich Oparin, in 1924, put forward a theory of life on Earth developing in the oceans through gradual chemical evolution of carbon-based molecules in a rich organic broth or "primeval soup." He hypothesized that the early oceans were rich in organic compounds

primitive character - in evolution, an attribute of taxonomic group which all members of the group possess, i.e., the more common shared characters of a given group of organisms. Primitive characters are also called 'plesiomorphies'

probability - a quantitative description of the likely occurrence of a particular event. Probability is conventionally expressed on a scale from 0 to 1; a rare event has a probability close to 0; a very common event has a probability close to 1

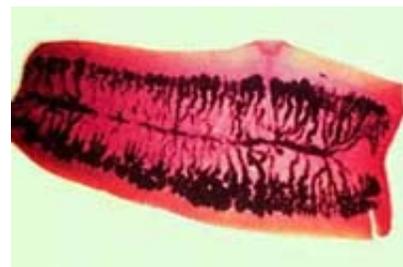
probe - in genetics, a DNA or RNA sequence that is labelled or marked with a radioactive isotope. It is used to detect the presence of a complementary sequence by hybridization with a nucleic acid sample

proboscis - an elongated tubular organ of varying use and form, usually associated with the oral region of many invertebrates

producers - the first level in a food pyramid; usually consist of photosynthetic organisms that generate the food used by all other organisms in the ecosystem

progenitor - an ancestor or precursor

proglottid - one of the segments of a tapeworm, containing both male and female reproductive organs



Gravid proglottid of the tapeworm *Taenia saginata*. The dark branched structure is the uterus. Note the mid-lateral genital pore. (Photo: U.S. Center for Disease Control)

prokaryote - an organism whose chromosomes are not enclosed within a nuclear membrane, e.g., a bacterium or cyanobacterium

prokaryotic - descriptive of organisms with cells possessing no distinct nucleus. Prokaryotes include bacteria and cyanobacteria

proliferation - to reproduce or increase rapidly and repeatedly

promoter - a DNA sequence that is located in front of a gene and controls gene expression. Promoters are required for binding of RNA polymerase to initiate transcription

prop root - an adventitious root that grows from and supports the trunk above the ground in plants, such as mangroves



The intertidal understory of a mangrove forest shows the muddy soil, the fairly high density of stems, and the tangle of prop and drop roots. (Photo: Copyright Dr. Joseph E. Armstrong, Illinois State University)

propagule - a structure for mangrove reproduction. After a mangrove is pollinated, it produces a propagule, which grows on a parent plant and requires carbon dioxide and water from the parent, but produces its own sugars from photosynthesis. After a while, it separates from the parent tree and falls into the water where it can be transported great distances. Propagules can resist desiccation and survive for long periods of time until they root in a suitable environment.



Cigar-shaped propagule of the red mangrove, *Rhizophora mangle*. It

may reach 15 cm in length. (Photo: Bill Keogh)

proprioceptor - a specialized sensory nerve ending that monitors internal changes in the body brought about by movement and muscular activity. Proprioceptors are located in muscles, tendons, and joint capsules and when stimulated, transmit information concerning movements and position of the body; also called "proprioceptor"

prosopinacocyte - in sponges, an endopinacocyte lining an incurrent canal

prosopinacoderm - in sponges, a surface lined with prosopinacocytes

prosopyle - the opening into the excurrent canal in sponges

prostomium - the anteriormost, presegmental region of the body of an annelid worm, sometimes bearing eyes and antennae; the portion of the head in annelids that is situated anterior to the mouth

prostrate colony - a coral colony which sprawls horizontally over the substrate

protandry - a state in hermaphroditic systems characterized by the development of male reproductive organs, or maturation of their gametes, before the appearance of the corresponding female product, thus insuring against self-fertilization

protease - an enzyme that hydrolyzes proteins, cleaving the peptide bonds that link amino acids in protein molecules

protected area - a legally established land or water area under either public or private ownership that is regulated and managed to achieve specific conservation objectives



This brilliant sea anemone is from the protected Gulf of the Farallones National Marine Sanctuary.

protected species - species which are protected by federal legislation such as the Endangered Species Act, Mammal Protection Act, and Migratory Bird Treaty Act

protein - a large complex molecule made up of one or more chains of amino acids. A typical protein contains 200-300 amino acids but some are much smaller and some much larger, e. g., titin, a protein found in skeletal muscle contains approximately 27,000 amino acids in a single chain. Proteins perform a wide variety of essential activities in cells: they largely form the physical structure of cells and cellular matrices; catalysts for all biochemical reactions are enzymes, which contain protein; the transport of materials in body fluids depends of proteins; the receptors for hormones and other signaling molecules are proteins; motion and locomotion of cells and organisms depends on contractile proteins; the transcription factors that turn genes on and off are proteins; proteins are an essential nutrient for heterotrophs; and many more - the activities of cells and organisms are largely reflections of the activities of their proteins

protein sequencing - the process of determining the amino acid sequence of a protein, or its component polypeptides

protein synthesis - the creation of proteins from their constituent amino acids, in accordance with the genetic information carried in the DNA of the chromosomes

proteinaceous - any structure composed of proteins

proteome - all of the proteins produced from all the genes of a genome

Protista - earliest evolved eukaryotic kingdom. It includes the protozoans, the slime molds, the unicellular algae, and the multicellular algae. However, some consider the multicellular marine algae (seaweeds) as belonging to the kingdom Plantae

protogyny - a state in hermaphroditic systems characterized by the development of female reproductive organs, or maturation of their gametes, before the appearance of the corresponding male product, thus insuring against self-fertilization

protonephridium - a simple type of excretory organ of simple invertebrates, such as flatworms and rotifers. It is also called a 'flame bulb.' Protonephridia are primarily concerned with removing excess water from the animal

protoplasm - the complex colloidal substance which constitutes the living matter of cells and performs the life process functions. The protoplasm found between the cell (plasma) membrane and the nuclear membrane is termed the cytoplasm; the protoplasm within the nucleus and separated from the cytoplasm by the nuclear membrane is termed the nucleoplasm

protostome - an evolutionary line of coelomates that include mollusks, annelids, and arthropods. They develop their embryo by spiral cleavage, and the blastopore of the gastrula develops into the mouth. The group exhibits bilateral symmetry

Protozoa - heterotrophic eukaryotic unicellular organisms that belong to the kingdom Protista

protractile - capable of being protruded or thrust out

proximal - the direction towards center of the body; opposite of distal

proxy signal - paleoclimatic evidence that can be used to indirectly infer or estimate some aspect of the paleoenvironment, such as precipitation or temperature

pseudocoelom - a closed fluid-filled cavity that acts as a hydrostatic skeleton to maintain body shape, circulate nutrients, and hold the major organs in roundworms, rotifers, spiny-headed worms, and horsehair worms

pseudocoelomate - any of a group of triploblastic invertebrates that has a fluid-filled body cavity, the pseudocoelom, lying between the endoderm and the mesoderm. The pseudocoelom is contrasted with the coelom of mollusks, annelid worms, and the more complex animals, including vertebrates, by lacking an endothelial lining. Pseudocoelomates lack a circulatory system, using the pseudocoelom to transport nutrients. The hydrostatic pressure of the pseudocoelom gives the body a supportive framework that acts as a skeleton. Nematodes (roundworms), rotifers, acanthocephalans (spiny-headed worms), kinorhynchans, and nematomorphs (horsehair worms) are pseudocoelomate groups



Spiny-headed worms (Acanthocephala) attached to the intestinal lining of a fish. This parasitic pseudocoelomate uses a spiny attachment organ to secure itself to the intestine. (Photo: Maine Department of Inland Fisheries and Wildlife)

pseudopodium (pseudopod) - a protoplasmic filament or irregular process that can project from any unicellular organism. Formation of pseudopodia (or pseudopods) assist in feeding and locomotion



An amoeba thrusting out pseudopodia (false feet). (Photo: NASA)

psi (pounds per square inch) - a unit of air or water pressure expressed as pounds per square inch (psi)

pterygiophore - in fishes, one of several bones or cartilage with which the base of the rays of the median fins articulate

punctate - describes a surface stippled with tiny pores

punctuated equilibrium - an evolutionary model in which change occurs in relatively rapid bursts, followed by little or no discernible change in a lineage (stasis)

pure line - a genetically uniform strain in which all members have descended by self-fertilization or close inbreeding

purine - a nitrogen-containing, double-ring, basic compound that occurs in nucleic acids. The purines in DNA and RNA are adenine and guanine

pustule - a pimple- or wart-like projection; a bump or raised knob on the outside surface of a mollusk shell

pycnogonid - pycnogonids, or sea spiders, are benthic, marine arthropods, with a superficial resemblance to true spiders, to which they are probably only distantly related. They are carnivores and use a muscular pharynx to suck soft food into the gut. The mouth is at the end of a large proboscis. Digestion is intracellular and most feed on sponges, cnidarians, or bryozoans from which they suck fluids. There are no excretory organs, respiratory organs, or body cavity (coelom)



The pycnogonid *Anoplodactylus evansi* is a predator of small marine gastropods as well as other soft bodied invertebrates. (Photo: Dr. Bill Rudman)

pyramid of biomass - in ecology, the total biomass of all organisms at each trophic level in a food chain; typically biomass declines with successively higher trophic levels

pyramid of energy - in ecology, the total energy content of all organisms at each trophic level in a food chain; the energy content declines at successively higher trophic levels

pyramid of numbers - in ecology, the number of organisms supported at each trophic level in a food chain; typically, fewer organisms are supported at successively higher trophic levels

pyriform - pear-shaped

pyrimidine - a nitrogen-containing, double-ring, basic compound that occurs in nucleic acids. The pyrimidines in DNA are cytosine and thymine. The pyrimidines in RNA are cytosine and uracil

pyrosome - a large barrel-shaped colony of colonial pelagic tunicates belonging to the genus *Pyrosoma*. The colony propels itself through the water by means of cilia that pump water through the individual tunicates. It responds to mechanical, chemical, and light stimuli by moving and by spectacular blue-green bioluminescent displays

quadrat - a square or rectangular sampling unit of known area (e.g., 1 m²) within which organisms are counted or measured. Quadrats can be used to estimate the percent cover of each species or other reef components and obtain information about density, abundance, colony size, and biodiversity



Scientist conducting a quadrat survey.

quadrate - square-shaped

qualitative analysis - the analysis of a phenomenon to determine its qualitative characteristics versus its quantitative characteristics, i.e., characteristics for which precise numerical characterization is not appropriate

quanta meter - an instrument used to measure the number of photons

quantitative analysis - the analysis of a phenomenon that uses environmental variables represented by numbers or ranges, often accomplished by numerical modelling or statistical analysis

quantitative inheritance - inheritance of measurable traits (height, weight, color intensity, etc.) that depend on the cumulative action of many genes.

Quaternary period - the second period of the Cenozoic era containing the Pleistocene epoch and the Holocene epoch, and dating from 1.8 million years to the present

Røst Reef - the world's largest known deep-water *Lophelia* coral complex. It lies in depths between 300-400m west of Røst Island in the Lofoten archipelago, Norway. It covers an area approximately 40 km long and 3 km wide

race - a distinguishable group of organisms of a particular species that is geographically, ecologically, physiologically, physically, and/or genetically distinct from other members of the species

RACE (Rapid Amplification of cDNA Ends) - a technique used to obtain the 3' and 5' end of a cDNA. The technique involves three sequential enzymatic steps: reverse transcription, addition of homopolymeric tails, and polymerase chain reaction (PCR)

radial canal - a part of the water vascular system of echinoderms. Specifically, a branch off of the ring canal that leads to an arm (ray) and gives rise to the tube feet. In hydrozoan medusae, the radial canal is part of the gastrovascular cavity. it is one of four extensions leading from the mouth to the outer margin of the bell

radial cleavage - a type of cleavage characteristic of deuterostomes. When changing from a four-cell stage to an eight-cell stage embryo, the cells divide such that each cell in the top four cell plane is directly over one other cell in the bottom plane

radial corallite - a corallite on a side of a branch as opposed to an axial corallite on the tip of the branch

radial symmetry - a basic morphological plan of organisms that have their body parts arranged around a central axis. Such organisms tend to be circular or cylindrical in shape, e.g., a coral polyp, or have projections around a central disc, e.g., starfish



Radial symmetry, illustrated by this starfish (Echinodermata).

radiant energy - energy traveling in the form of electromagnetic waves; energy emitted by the sun, typically in photons and waves

radiant flux - the rate of flow of radiant energy (electromagnetic waves)

radiation - energy that comes from a source and travels through some material or through space. Light, heat and sound are types of radiation

radii - inconspicuous septal elements which connect septa with the columella

radioactive decay - natural decay of the nucleus of an atom where alpha or beta and/or gamma rays are released at a fixed rate

radioactivity - the spontaneous decay of the nucleus of an element. It involves the change in the number of protons in the nucleus and therefore creates an atom of a new element

radiocarbon age - the age of plant or animal remains, determined by measuring the remaining activity of the ^{14}C atoms in the sample: $A=A_0 e^{-t}$ where A is the measured activity, A_0 is the initial activity, e is the decay constant, and t is the sample age

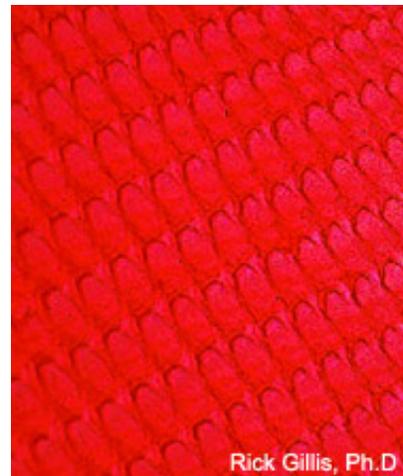
radiocarbon dating - a dating method used to determine the age of samples containing carbon. The method measures the disintegration of the ^{14}C atom. ^{14}C is produced in the atmosphere by cosmic ray bombardment, and has a half-life of 5,570 years, making it useful for dating samples in the range of 0-40,000 years

radiocarbon time - regular known rates of radiocarbon decay that are used to determine the exact ages of carbon-based life

radiometer - an instrument used to measure radiant energy

radiometry - the science of the measurement of radiant energy

radula - a scraping organ for mastication in certain mollusks, such as snails. In many gastropods the radula consists of a variable number of chitinous teeth, of different shape and size, located in the anterior portion of the pharynx. In the cone shell family it has been reduced to a sharp and grooved tooth, fit to harpoon and inject prey with a powerful venom, which is also potentially fatal to humans



A stained section of a snail radula. The numerous chitinous teeth on this ribbon-like membrane are used to scrape, pierce, tear or cut off small pieces of food that are then directed in a continuous stream toward the

digestive tract by conveyor belt like movements of the membrane.
(Photo: Rick Gillis, Ph.D., Biology Dept., University of Wisconsin-La Crosse)

rampart - a narrow ridge, 1-2 m high, built by waves along the seaward edge of a reef flat. It consists of boulders, shingle, gravel or reef rubble, commonly capped by dune sand

random sample - a sample in which each individual in a population has the same chance of being selected as any other

random sampling - a sampling technique where a group of subjects (a sample) is selected for study from a larger group (a population). Each individual is chosen entirely by chance and each member of the population has a known, but possibly non-equal, chance of being included in the sample. By using random sampling, the likelihood of bias is reduced

range - the range of a set of numbers is the largest value in the set minus the smallest value in the set. It is a single number

ranked data - data for which the observations have been replaced by their numerical ranks from lowest to highest

Rapid Ecological Assessment (REA) - a method for gathering data pertaining to ecologically significant biological components of a reef habitat over small spatial scales. Because the method provides a quick "snapshot" of major reef biota during a single dive or snorkel survey, it is particularly useful in assessing remote areas that are only rarely visited and where little time can be spent. REA is usefully employed by Coral Reef Ecosystem Division (CRED) at the NMFS Pacific Island Fisheries Science Center. During research cruises to these remote areas, teams of CRED divers survey the reef communities in a comprehensive manner, recording species abundance, diversity, and spatial distribution simultaneously for four key components of the ecosystem: fishes, corals, other invertebrates, and algae. Specific protocols are followed for field work and subsequent laboratory analyses

raster - an abstraction of the real world where spatial data is expressed as a matrix of cells or pixels, with spatial position implicit in the ordering of the pixels. With the raster data model, spatial data is not continuous but divided into discrete units. This makes raster data particularly suitable for certain types of spatial operation. The term may also refer to the region of a CRT (cathode-ray tube) or LCD (liquid crystal display) monitor that is capable of rendering images

raster map - a map or chart encoded in the form of a regular array of cells

raw sewage - untreated domestic or commercial waste water

RDBMS (Relational database management system) - a database management system with the ability to access data organized in tabular files that can be related to each other by a common field (item). An RDBMS has the capability to recombine the data items from different files, providing powerful tools for data usage

real time - time in which reporting of events or recording of events is simultaneous with the event

real-time data - data collected by automated instrumentation and telemetered and analyzed quickly enough to influence a decision that affects the monitored system



Seakeys stations transmit real-time data. (Photo: NOAA)

receiving waters - water bodies that receive treated or untreated waste waters

recombinant DNA - a new DNA sequence formed by the joining, usually *in vitro*, of two non-homologous (from different sources) DNA molecules, using recombinant DNA technologies

recombinant DNA technology - procedures used to join together DNA segments in a cell-free system. Under appropriate conditions, a recombinant DNA molecule can enter a cell and replicate there, either autonomously, or after it has become integrated into a cellular chromosome

recombination - in genetics, the process by which offspring derive a combination of genes different from that of either parent. In higher organisms, this can occur by crossing over

recruitment - the influx of new members into a population by reproduction or immigration

red algae - red algae belong to the Division Rhodophycota. Most of the over 4000 species are marine. They range in complexity from simple unicellular organisms to unbranched and branched filaments to complex multiaxial uprights and crusts. Their pigments include chlorophyll a and the phycobiliproteins, red phycoerythrin (often the dominant pigment) and blue phycocyanin, as well as carotenes, lutein, zeaxanthin. Most red algae have a complex life history with three phases: tetrasporophyte, gametophyte and carposporophyte



Red algae. (Photo: Dept. Natural Resources and Parks, Water and Land Resources Division, Kings County, WA; from <http://dnr.metrokc.gov/wlr/waterres/marine/algae.htm>)

red tide - discoloration of surface waters, most frequently in coastal areas, caused by large concentrations of microorganisms, such as algae or cyanobacteria



Image of red tide taken from the NOAA vessel *Ron Brown*, April 5, 2001 during the Aerosols Characterization Experiments (see <http://www.ogp.noaa.gov/ace-asia/index.htm>.) (Photo: NOAA)

red-band disease - a disease of corals manifested by a narrow band of filamentous cyanobacteria that advances slowly across the surface of a coral, killing tissue as it progresses. The band is reddish to maroon in color



Red-band disease on a sea fan. (Photo: Dr. A. Bruckner)

redox potential (Eh) - a measure of a systems capacity to oxidize material; the energy gained by transferring 1 mole of electrons from an oxidant to H₂. It is measured in volts relative to a hydrogen electrode which is at zero

reef base - the area below the consolidated slope extending up to 1 km but no deeper than 50 m. A synonym of talus slope

reef block - a large, isolated rock section that has been displaced from the reef platform, reef margin, reef front zones or the non-calcium carbonate bedrock, usually resulting from storm waves

Reef Check - a volunteer, community-based monitoring protocol designed to measure the health of coral reefs on a global scale. Reef Check is active in over 60 countries and territories throughout the tropics



Reef Check divers surveying an Indonesian coral reef. (Photo: Reef Check)

reef complex - the entire reef structure, including reef surface lagoon deposits and off-reef deposits

reef crest - the sharp break in slope at seaward margin or edge of reef flat

Reef Environmental Education Foundation (REEF) - REEF is a grass-roots, non-profit organization of recreational divers who regularly conduct fish biodiversity and abundance surveys during their dives

reef flat - the shallow area between the shoreline intertidal zone and the reef crest of a fringing reef



Reef flat, Palau Archipelago, Micronesia, containing various species of branching coral (*Acropora*). (Photo: Jerry Wellington)

reef front - a synonym of reef slope

reef mound - a structure that lacks reef characteristics, such as diversification and domination stages

reef rubble - dead, unstable coral pieces often colonized with macroalgae. This habitat often occurs landward of well-developed reef formations in the reef crest or back reef zone



Coral reef rubble from storm damage. (Photo: Kip Evans)

reef slope - the portion of a reef seaward of reef crest



Reef slope covered with live corals.

reef system - a cluster of reefs

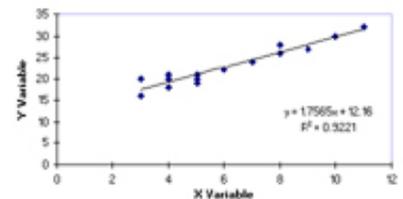
reef top - the area comprising the reef flat and reef crest

regenerate - to replace a lost or damaged organ or part through formation of new tissues

regression - a statistical technique used to establish the relationship of a dependent variable and one or more independent variables

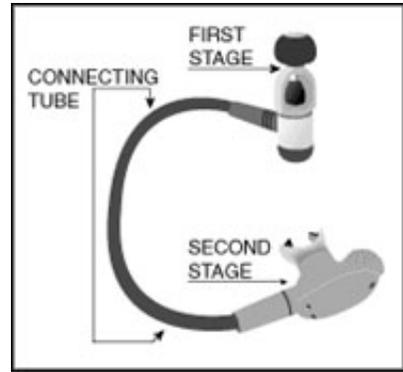
regression analysis - a statistical technique applied to data to determine the degree of correlation of a dependent variable with one or more independent variables, in other words, to see if there is a strong or weak cause and effect relationship between things; a statistical process for fitting a line through a set of data points. It gives the intercept and slope(s) of the "best fitting" line. It tells how much one variable (the dependent variable) will change when other variables (the independent variables) change

regression line - a line fit to a set of data points (scatterplot) using least-squares regression; a graph of the mathematical relationship between two variables



An example scatter plot data set with a regression line fit to the data.

regulator - a regulator is a piece of scuba equipment that reduces the high pressure of air in a scuba air tank to a pressure level that is usable by the diver. It delivers air to the diver only during inhalation. The modern scuba regulator is a very simple and reliable device with only a few moving parts. Regulators have two stages: a first stage that attaches to the scuba tank, and a second stage that has a mouthpiece. Air under high-pressure from the scuba tank is reduced sequentially in each stage. The first stage reduces the high tank pressure to an intermediate pressure of 100 to 150 psi above the surrounding water pressure. The second stage reduces the intermediate pressure to that needed for comfortable breathing



Regulators have two stages: a first stage that attaches to the scuba tank, and a second stage that has a mouthpiece.

regulatory gene - a gene that acts to control the protein-synthesizing activity of other genes; also called a 'regulator gene'

rehabilitation - the recovery of specific ecosystem components in a degraded ecosystem or habitat

relational database - a method of structuring data as collections of tables that are logically associated to each other by shared attributes. Any data element can be found in a relation by knowing the name of the table, the attribute (column) name, and the value of the primary key

relative frequency - the number of items of a certain type divided by the number of all the numbers being considered

relict - a persistent remnant of an otherwise extinct taxon; a biological or geological feature that has survived in a considerably changed environment

remote sensing - the collection of information about an object or event without being in physical contact with the object or event. Remote sensing is restricted to methods that record the electromagnetic radiation reflected or radiated from an object, which excludes magnetic and gravity surveys that record force fields



This remote sensing (SeaWiFS) image shows sediment stirred up along the North Carolina coast by Hurricane Floyd, September 1999.

remote sensing tool - an instrument used in remote sensing often combined with a geographic information system to provide synoptic and objective views and data of the environment

renaturation - the conversion of denatured protein or DNA to its native configuration. This is rare for proteins. However, if DNA is denatured by heating, the two strands separate. If the heat-denatured DNA is then cooled slowly, the double stranded helix reforms

renewable resource - a resource or substance that can be replenished through natural or artificial means

repetitive dive - any dive within a certain time frame after a previous dive. Some dive tables consider any dive within 12 hours of a previous dive as repetitive

replication - reproduction or duplication; in genetics, the synthesis of duplex (double-stranded) DNA by copying from a single-stranded template, i.e., the synthesis of an informationally identical macromolecule from a template molecule

repressor - a protein that binds to an operator adjacent to a structural gene, inhibiting transcription of that gene

repressor gene - a gene that prevents a nonallele from being transcribed

reproductive isolating mechanism - a mechanism that prevents reproduction from occurring between two populations. Pre-zygotic reproductive isolating mechanisms (which take effect before fertilization) include environmental, temporal, behavioral, mechanical, and physiological barriers that prevent individuals of different populations from producing viable progeny. Post-zygotic reproductive isolating mechanisms (which take effect after fertilization) include gamete incompatibility, hybrid inviability, and hybrid sterility

reproductive isolation - a species is an interbreeding natural population that is reproductively isolated from other such groups. Species are usually separated by discontinuities, which constitute barriers that prevent, or at least inhibit, an interspecific gene flow and gene exchange. Establishment of reproductive isolation is essential for development of a new species

residual nitrogen time (RNT) - a theoretical mathematical representation of the amount of nitrogen absorbed in body tissues after a scuba dive. It is expressed on dive tables in minutes which are added to the no-decompression limit for a repetitive dive, i.e., the time it would take to off-gas any extra nitrogen remaining after a dive

resilient - resumes the original shape after deformation; elastic

resolution - the ability to distinguish closely spaced objects on an image or photograph. It is commonly expressed as the spacing, in line-pairs per unit distance, of the most closely spaced lines that can be distinguished

respiration - a biochemical process by which living organisms take up oxygen from the environment and consume organic matter, releasing both carbon dioxide and heat energy

respiratory tree - a respiratory organ of sea cucumbers (Holothuroidea-Echinodermata)

restoration - the return of an ecosystem or habitat to its original community structure, natural complement of species, and natural function



A diver prepares to reattach an elkhorn coral fragment in a Mona Island, PR, reef as part of restoration work performed after the 1997 grounding of the *Fortuna Reefer*.
(Photo: Erik Zobrist, NOAA Restoration Center)

restriction endonuclease - a class of endonucleases that cleaves DNA after recognizing a specific sequence

restriction enzyme - an enzyme that cleaves double-stranded DNA; an endonuclease that recognizes specific nucleotide sequences and cleaves DNA at these highly specific locations. In genetic engineering, new genes can be inserted into these gaps

restriction fragment length polymorphism (RFLP) - variation in DNA sequence between individuals that is detectable by variation in the length of DNA fragments generated by digestion with restriction endonucleases

restriction fragment - a fragment of DNA produced by cleaving (digesting, cutting) a DNA molecule with one or more restriction endonucleases

reticulate - net-like

retractable - capable of being drawn or pulled back

retractor - a muscle that withdraws an eversible or protrusible body part

retrovirus - a virus that contains the enzyme, reverse transcriptase. This enzyme converts the viral RNA into double-stranded DNA copies of their genome, (by using reverse transcription), which can combine with the DNA of the host cell and produce more viral particles. Many naturally occurring cancers of vertebrates are caused by retroviruses

reverse transcriptase - an enzyme that is able to synthesize DNA from information in RNA. It requires an RNA template and a DNA or RNA primer

reverse transcription - the synthesis of DNA on a template of RNA, accomplished by the enzyme, reverse transcriptase

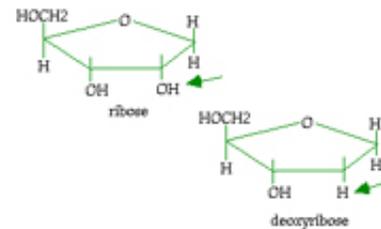
rhizome - a horizontal stem

rhopalium - one of the sensory receptors in some jellyfish (Scyphozoa), located on the margin of the bell. Rhopalia contain statocysts for equilibrium, and ocelli, which are photosensitive cells which allow the animal to respond to light stimulation

ribbed - describes a surface with a series of ridges

ribbon reef - a large offshore linear reef, seaward of a fringing reef, which is linear but does not form a barrier to the land. A synonym of shelf-edge reef and sill reef

ribose - a monosaccharide containing five carbon atoms per sugar molecule, $C_5H_{10}O_5$. Ribose is a major component of ribonucleic acid (RNA)



A nitrogenous base is combined with a five-carbon sugar, either ribose (for RNA) or deoxyribose (for DNA). The arrows point to the single structural difference between ribose and deoxyribose. (Graphic: San Diego State University)

ring canal - a part of the water vascular system of echinoderms. Specifically, a circumoral ring around the esophagus with connecting radial canals each leading to an ambulacrum .It connects to the madreporite via the stone canal; also, the part of the distributive portion of the digestive system of scyphozoan medusae that is located in the margin of the bell. The ring canal communicates with the radial and adradial canals

riparian - having to do with living or being located on the edges or banks of streams or rivers



This healthy riparian habitat includes undercut banks, woody debris in the water, and a clean stream bottom.

RNA (Ribonucleic acid) - a single-stranded nucleic acid found in the nucleus and cytoplasm of a cell. It is a polymer of the sugar ribose, phosphate, purine and pyrimidine bases. RNA is very similar to DNA, but substitutes the nucleotide, uracil, for thymine. It acts as a "middle-man", converting genetic information from DNA to proteins. There are three types of RNA: mRNA (messenger RNA), which contains the specific sequence of nucleotides necessary to dictate amino acid sequence in proteins; tRNA (transfer RNA), which serves as the "adaptor" to position the appropriate amino acid next to a growing polypeptide chain during protein synthesis; and rRNA (ribosomal RNA), which is the RNA component of ribosomes. In some viruses, RNA is the genetic material

RNA polymerase - an enzyme that catalyzes the bonding reaction between nucleotides of DNA and RNA. Organisms use RNA polymerase to accelerate the process of copying DNA strands during cell reproduction

RNAi (RNA-mediated interference) - a technology based on the silencing of specific genes by double stranded RNA (dsRNA). RNAi has great potential for treating many diseases, including ocular, viral diseases and cancers by silencing RNA messages, thereby preventing the production of disease causing proteins

roe - fish eggs or egg-filled ovary; the egg mass or spawn of certain crustaceans, such as lobsters



Salmon roe marked for sale at a seafood market in Japan. (Photo: NOAA)

rosette - rose-shaped in appearance; arranged in a fashion resembling a rose flower

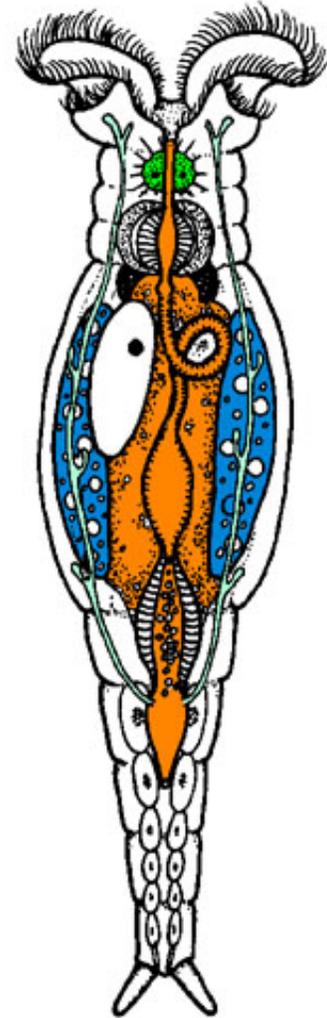
rostrum - an elongate or extended snout



Most dolphins have an elongated beak called a rostrum. (Photo: Copyright Corel Corp.)

rotenone - a very potent general use pesticide found in the roots and stems of several tropical plants. Jewel vine (*Derris* spp.), Lacepod (*Lonchocarpus* spp.), and hoary pea (*Tephrosia* spp.) are the more common plants from which rotenone is derived. It used in some countries to kill predatory fishes prior to introducing parent fish for natural spawning or newly hatched fry. As an effective fish biocide, rotenone is also used for collecting fish specimens, and in some areas for fishing, where it is added to the water and the dead and dying fishes are collected as they float to the surface. In fishes, rotenone impedes circulation to the gills, causing asphyxiation

rotifer - rotifers are small invertebrates in the Phylum Rotifera. They range in size from 100 to 2500 microns, with approximately 2000 described species. Rotifers are found in aquatic and semi-aquatic habitats, but are predominantly freshwater inhabitants. Most species are free-living herbivores, bacteriovores or predators, and possess a ciliated, wheel-like organ for feeding and locomotion. Rotifers move by swimming or crawling. Some sessile species are permanently attached to freshwater plants



Internal anatomy of a rotifer. The major systems have been highlighted in color. (Graphic: Livingstone, BIODIDAC)

rRNA (ribosomal RNA) - any one of several large RNA molecules that are structural and functional components of ribosomes

rubbery - a tough, resilient mass

rubble zone - the shallowest part of a reef crest landward of the palmata zone. It consists of broken pieces of coral washed back by storms

rugose - having a rough or ridged surface

rugose corals - an extinct group of non-scleractinian corals

rugosity - an important coral reef parameter that describes the amount of "wrinkling" or roughness of the reef profile. It is an index of substrate complexity. Areas of high complexity are likely to provide more cover for reef fishes and more places of attachment for algae, corals and various sessile invertebrates



A coral reef with a high degree of rugosity.

runoff - water that has been on land and moves seaward as a result of rain, flooding, irrigation or flushing . Runoff is frequently high in nutrients and suspended sediments, as well as toxicants



Urban runoff or 'storm drain pollution' is one of the leading causes of water pollution in this country. (Photo: NOAA/NOS/Monterey Bay National Marine Sanctuary)

S phase - the cell cycle phase during which the DNA doubles with replication of the chromosomes

saccate - sac-like

safety stop - on ascending from a dive, a safety stop is a specified time spent by a scuba diver at a specific depth, for nitrogen off-gassing. While not mandatory during a no-decompression dive, it is a sound safety practice. A safety stop may be 3-5 minutes at 10-15 ft below the surface

sagittal - relating to the sagittal plane, which extends through the midline of a bilateral animal, dividing it into two equal halves

salinity - a measure of the salt concentration of water

salt marsh - a marsh periodically flooded by marine water



A salt marsh. (Photo: NOAA)

sampling - the probabilistic, systematic, or judgmental selection of a sub-element from a larger population, with the aim of approximating a representative picture of the whole

sampling bias - the tendency of a sample to exclude some members of the sampling universe and over-represent others

sampling error - the variability of a statistic from sample to sample due to chance

sampling unit - the sub-element of the total population selected for sampling

sampling universe - the largest entity to be described, of which the sample is a part

sand - coarse sediment typically found in areas exposed to currents and wave energy



Tidal current patterns in the sand and sea grass at low tide.

sand flat - sandy areas found in depressions and gullies in a coral reef, or between patch reefs, or in deeper areas below or beyond the reef. Seemingly near barren during the day, at night sand flats teem with biological activity; also a sandy tidal flat barren of vegetation. A tidal flat is an extensive, nearly horizontal, marshy or barren tract of land that is alternately covered and uncovered by the tide. It consists of unconsolidated sediment (mostly mud and sand)



A patch reef surrounded by sand flats. (Photo: <http://www.biosbcc.net>)

sanguivore - an animal that obtains its nourishment primarily as blood

saprophyte - any plant that lives and feeds on dead organic matter

saprotroph - an organism which feeds on dead and decaying organisms, allowing the nutrients to be recycled into the ecosystem. Fungi and bacteria are two groups with saprophytic members

satellite - a small celestial body orbiting a larger one; a man-made object designed to orbit a celestial body

satellite colony - a colony that develops within the tissue of a parent colony and which has its own unattached skeleton

satellite imagery - a representation of the measurement of energy emitted or reflected by the Earth in a variety of wavelengths. Earth observation imagery takes a number of forms, of which the most traditional are optical and near-infrared radiation, from about 0.4 (blue) to 2.0 (IR) micrometers. Apart from visual and near-infrared, other bands of the spectrum commonly used include thermal infrared (heat) and microwave (radar). Each of these has its own applications



GOES-8 (May 1999) image of airborne dust over the Caribbean Sea. This dust originated in the Sahara Desert where it was carried off the coast by strong winds.

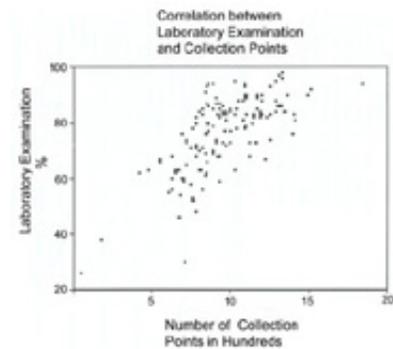
satellite mapping - digital maps derived from satellite images

saturation - in diving, the degree to which a gas is dissolved in the blood or other tissues. Full saturation occurs when the pressure of gas dissolved in the blood or tissues is the same as the ambient pressure of that gas

saturation diving - the situation where a diver is at a depth or pressure for a long enough period of time (12 hours or longer) to have the partial pressures of the dissolved gases in the body at equilibrium with the partial pressure of the gases in the surrounding environment. Scientists are able to live in and work around underwater habitats for extended periods without the risk of developing decompression sickness (the bends). Divers breathe compressed air mixed with light, inert gases, such as helium. When the diver's blood becomes saturated with helium, the time required for decompression, even if the diver returns to the surface after a period of weeks, is no greater than that required after a dive lasting just a few hours

scale-like corallites - corallites that form a pattern which resembles fish scales

scatter diagram - a two-dimensional histogram showing the joint probability density of two variables within a data sample; it is used to interpret data by graphically displaying the relationship between two variables



A scatter diagram.

scavenger - an animal that feeds on dead or decaying organic matter



A scavenger feeding on a dead

aquatic animal.

schizocoelous - the mesoderm and coelom initially develop from a solid block of mesodermal tissue in an embryo that subsequently develops a split down the middle. The cavity thus formed is the coelom. Schizocoelous development of the coelom occurs in protostomes

school - a social group of fishes (and some other aquatic animals), usually of the same species, which tends to orient and move in the same direction



A school of smallmouth grunt with elkhorn coral in the background.
(Photo: Paige Gill, Florida Keys NMS)

schreckreaktion - an alarm response in some fishes as a result of an alarm substance (schreckstoff), or alarm pheromone being introduced into the water via rupture of specialized dermal club cells. Presumably a fish attacked by a predator releases schreckstoff into the water, resulting in the conspecifics making a variety of coordinated escape or fright actions

schreckstoff - a chemical alarm substance (a pheromone) produced by the skin of some groups of fishes when injured. It stimulates conspecifics and perhaps some other fishes to exhibit fright and escape movements

science - a method of learning about the physical universe by applying the principles of the scientific method, which includes making empirical observations, proposing hypotheses to explain those observations, and testing those hypotheses in valid and reliable ways; also refers to the organized body of knowledge that results from scientific study

scientific law - a statement of a scientific fact or phenomenon that is invariable under given conditions. A law may be either quantitative (including measurement) or qualitative (general characteristics). It must describe evidence that has been gathered using acceptable scientific standards of reproducibility. Examples of scientific laws: Faraday's Law of electromagnetic induction, Coulomb's Law of electrostatic attraction, Dalton's Law of partial pressures, and Boyle's Gas Law

scientific name - the Linnaean binomial. A name of a species composed of two words: the genus (or generic) name and the species (or trivial) name, e.g., *Acropora palmata*. The scientific name is always written in italics. The first letter of the generic name is always capitalized; that of the species name is never capitalized

Scleractinia - an order of Cnidaria, usually producing calcareous skeletons with hexamerl symmetry



A scleractinian - elkhorn coral (*Acropora sp.*)

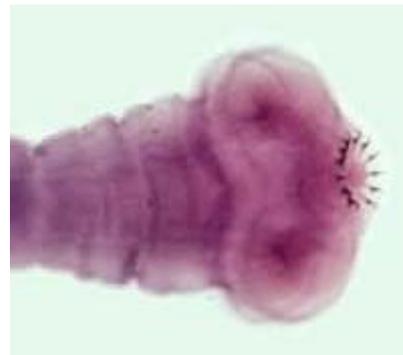
sclerite - a skeletal element in octocorals. Sclerites are composed of calcite spicules; also, a hard plate or element of the exoskeleton of some arthropods

sclerocyte - a cell in sponges that produces spongin or spicules

sclerodermite - the basic unit of coral skeletal microstructure. A center of calcification from which bundles of acicular aragonite crystals radiate outward; the hard integument of Crustacea.

scleroseptum - one of many radiating calcareous partitions in the skeletal cup (corallite) of stony corals

scolex - the knoblike anterior end of a tapeworm, having suckers and/or hooklets that, in the adult stage, serve as organs of attachment to the host organism



The scolex of the tapeworm, *Taenia solium*. (Photo: Center for Disease Control)

SCUBA (Self-Contained Underwater Breathing Apparatus) - a diving mode independent of surface air supply in which the diver uses open circuit self-contained underwater breathing apparatus which supplies air or breathing gases at ambient pressure



Diver training with a full face mask and underwater communications.

scute - an external horny, chitinous or bony plate or scale, such as those on the shell of a turtle



Sea turtle with shell comprised of hard, platelike scutes.

sea cow - a large, herbivorous aquatic mammal of the order Sirenia that contains two Recent families: Dugongidae for the genera *Dugong* (dugong, one species) and *Hydrodamalis* (Steller's sea cow, one species hunted to extinction); and Trichechidae for the single genus *Trichechus* (manatees, three species). The dugong inhabits coastal regions in the tropical parts of the Old World, and some individuals go into estuaries and rivers. Steller's sea cow inhabited the Bering Sea, and was the only Recent member of this order adapted to cold waters. Manatees live along the coast and in coastal rivers in the southeastern United States, Central America, the West Indies, northern South America, and western Africa



The West Indian Manatee, *Trichechus manatus*, in Florida bay. (Photo: Copyright Laurel Canty-Ehrlich, NOAA)

sea snake - a member of the family Hydrophiidae. Sea snakes are common in the Indo-Pacific. Related to cobras, these live-bearing reptiles are highly venomous but not aggressive by nature



This sea snake was photographed and released during a 1998 cruise of the NOAA ship *McARTHUR* to South America.

sea state - a description of the sea surface with regard to wave action



Fishing vessel battles through rough conditions (sea state). (Photo: NOAA/ National Weather Service/Ocean Prediction Center)

seagrass - a flowering plant, complete with leaves, a rhizome (an underground, usually horizontally-oriented stem) and a root system. They are found in marine or estuarine waters. Most seagrass species are located in soft sediments. However, some species are attached directly to rocks with root hair adhesion. Seagrasses tend to develop extensive underwater meadows



Seagrass bed.

SEAKEYS - NOAA and the Florida Institute of Oceanography (FIO) supply daily and historical enhanced Coastal-Marine Automated Network (C-MAN) data via the SEAKEYS program. Since 1992, SEAKEYS has provided hourly data from up to seven meteorological and oceanographic monitoring stations situated throughout the Florida Keys National Marine Sanctuary and Florida Bay. These stations measure the usual C-MAN meteorological parameters, such as wind speed, gusts and barometric pressure, but are enhanced with oceanographic instruments measuring salinity, sea temperature, fluorometry and turbidity. These data are collected and presented via email and the Web daily, and are supplied through a historical database on the Web. Unique software developed for SEAKEYS data operates in near real-time and provides alerts as to conditions conducive to natural events such as coral bleaching (Coral Reef Early Warning System [CREWS]), larval conch survival, and in the future, harmful algal blooms.



Coastal-Marine Automated Network (C-MAN) Station.

seawall - a massive structure built along the shore to prevent erosion and damage by wave action

seaward slope - the area of a barrier reef or atoll from the reef crest. It includes spurs, grooves, terraces, reef walls, etc.

SeaWiFS - Sea-viewing Wide Field-of-view Sensor carried on the SeaStar satellite

Secchi depth - the depth at which a Secchi disk disappears from view as it is lowered in water. A Secchi disk is a white disk 20-30 cm in diameter, used as a qualitative way of measuring water clarity. It is lowered from a vessel and viewed from above the surface in full solar illumination to estimate the light attenuation in the water column. This is done empirically by relating the depth at which the disk disappears to the attenuation of light.

Second Law of Thermodynamics - each time energy is converted from one form to another, some of the energy is always degraded to a lower-quality, more dispersed, less useful form; no system can convert energy from one form to another useful form with 100 percent efficiency; energy cannot be transferred spontaneously from a cold body to a hot body. As a result of this fact, natural processes that involve energy transfer must have one direction, and all natural processes are irreversible. This law also predicts that the entropy of an isolated system always increases with time

second stage regulator - in scuba breathing equipment, the second stage regulator, which is attached to the mouthpiece, reduces the intermediate pressure from the first stage regulator (attached to the air tank) to that needed for comfortable breathing at depth



The second stage regulator is contained in this NOAA diver's mouthpiece. (Photo: NOAA/National Undersea Research Program)

secondary male or female - a male or female that is the result of sex change. A secondary male would be derived from a protogynous female, while a secondary female would be derived from a protandrous male

secondary production - the production of living material per unit area (or volume) per unit time by herbivores. It is usually expressed as grams carbon per meter square per year

secretion - the passage of a molecule from the inside of a cell through the cell membrane into the periplasmic or interstitial space, or the extracellular medium; the organic process of synthesizing and releasing some substance from the body of an organism

secretory product - a functionally specialized substance, not a waste product, released from a gland or cell. Hormones, for example, are secretory products

sedentary - not moving. Many organisms, both plants and animals, spend the majority of their lives in one place

sediments - soil, sand, and minerals washed from land into water, usually after rain. They pile up in reservoirs, rivers, harbors, and coastal areas destroying habitats, and clouding the water so that sunlight cannot reach aquatic plants. Careless farming, mining, and building activities expose sediment materials, allowing them to wash off the land after rainfall

segmentation - in many animals, the body is divided into repeated subunits called segments, such as those in centipedes, insects, and annelid worms. Segmentation is the state of having or developing this type of body plan

selective pressure - forces acting on populations that determine that some individuals are more reproductively successful or genetically fit than others, and contribute more descendants (or genes) to subsequent generations

self-fertilization - when a sperm cell and ovum from the same organism fuse and form a zygote

semelparity - the reproductive condition where individuals reproduce only once during their lifetime

seminal receptacle - a sac that stores spermatozoa (sperm cells) prior to fertilization of an egg

semipermeable membrane - a thin membranous barrier that permits passage of particles up to a certain size or of a special nature; also referred to as a 'differentially permeable membrane'

sensor - a device that receives electromagnetic radiation and converts it into a signal that can be recorded and displayed as numerical data or as an image

sensory receptor - a neurological structure specialized to respond to stimuli and changes in the internal or external environment of an organism. Sensory receptors consist of neuron endings and specialized cells in close contact with neurons

septate shell - a shell divided into smaller chambers, as in the chambered nautilus (Cephalopoda-Mollusca)

septum (pl. septa) - the skeletal plate that projects into the calyx from the theca. Septa may be subdivided into primary, secondary, and tertiary structures



Skeleton of a coral polyp. Notice the septa radially arranged around a central axis.

sequencing - analytical procedures for the determination of the sequential order of amino acids in a polypeptide chain or nucleotides in a DNA or RNA molecule

sequential hermaphrodite - a form of hermaphroditism where individuals can change sex, but the sexes are separate

serial homology - representative or repetitive relation in the segments of the same organism, as in the lobster, where the parts follow each other in a linear series; repeated structures within an organism that have similar developmental origins

serrate - saw-like; notched

sessile - describes an immobile organism because of its attachment to a substrate. The term has also been applied to organisms, such as anemones, that move very slowly



A sessile colonial anemone
(*Epizoanthus americanus*) living in
Gray's Reef off Sapelo Island, GA.

seston - minute particulate material moving in water that is composed of both living organisms, such as plankton, and non-living matter such as plant debris and suspended soil particles

set - in mathematics, a collection of things without regard to their order

seta - a cuticular hair arising from the outside of the exoskeleton of an invertebrate

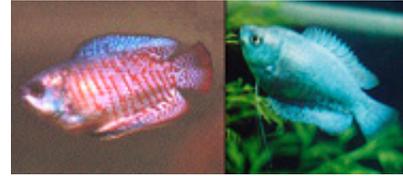
setose - bearing setae

sewage - the total of organic waste and waste water generated by residential and commercial establishments

sex chromosome - a heteromorphic chromosome that plays a role in sex determination, such as the X and Y chromosomes, whose distribution in a zygote determines the sex of the organism; a chromosome whose DNA determines sexual characteristics in females (X)-and males (Y)

sex-linked gene - a gene coded on a sex chromosome, such as the X-chromosome-linked genes

sexual dichromatism - pertaining to differences in color and color pattern between the sexes of a particular species



Sexual dichromatism in the freshwater southeast Asian dwarf gourami, *Colisa lalia*. The male is to the left of the female.

sexual dimorphism - pertains to systematic differences between males and females. The two sexes are markedly dissimilar in appearance



Female (above) and male (below) sockeye salmon (*Oncorhynchus nerka*) show extreme sexual dimorphism (color, male hump).

shelf break - nearshore bathymetry characterized by rapid and substantial increases in depth that are continuous with the deeper parts of the ocean

shelf escarpment - the edge of the bank/shelf where depth increases rapidly into deep oceanic water

shelf reef - a reef that forms on the continental shelf of large land masses

shelf-edge reef - a synonym of ribbon reef

shellfish - a term that includes both molluscs, such as clams and oysters, and crustaceans, such as lobsters and shrimp

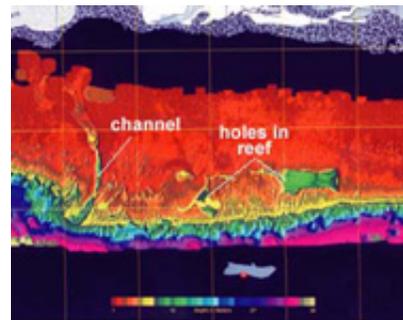


Edible crabs, shrimp, lobsters, crayfish, clams, mussels, scallops, and oysters are considered shellfish.

shoal - a submerged expanse of coral reef, surrounded by deep water, which does not form a part of a barrier or fringing reef

shoal (biol.) - a social group of fishes of the same species that are not always similar in size or equal in social status. The shoal does not usually move in a highly coordinated fashion, as does a school. Shoals are typically found in shallow water or at the surface. Some consider shoals to be schools in shallow water

SHOALS (Scanning Hydrographic Operational Airborne Lidar Survey) - SHOALS is a laser-based scanning LIDAR bathymeter which collects high-resolution bathymetric data in shallow, offshore areas. Map products provide a view of sea-floor topography. In areas with coral reefs, this includes not only the top surface of the reef but also associated channels and sand flats



SHOALS imagery of the South Moloka'i reef tract shows the position of a distinctive channel that crosses the reef and a large hole in the reef. The large hole is shown below in oblique view. The origin of features such as this one is being investigated by USGS scientists. (Photo: U.S. Geological Survey)

shore reef - a synonym of fringing reef

shoreline - the line separating land and water. It fluctuates as water rises and falls



Shoreline of Fanning Island in the South Pacific.

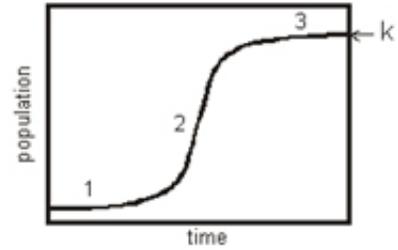
sibling species - closely-related species that are nearly morphologically indistinguishable

side scan sonar - sonar designed to look sideways and at a downward angle from both sides of a towed unit, called a towfish. The bottom and any objects in the water above the bottom reflect sound waves back to the towed array. An image is produced from this information



Deployment of the side scan sonar tow vehicle, also called a 'fish'.
(Photo: NOAA)

sigmoid growth - a growth rate trend characterized by an elongated S-shaped, or sigmoid curve. It is typical of population growth rate trends which begin rapidly at an exponential rate but slow as limiting factors are encountered until a limit is approached asymptotically



This sigmoid (or s-shaped) curve is characteristic of many growth situations.

significance level (level of significance) - in statistics, the probability of a false rejection of the null hypothesis in a statistical test

Sikes Act - passed in 1960, and amended several times, the Sikes Act authorizes the Secretary of Defense to develop cooperative plans for conservation and rehabilitation programs on military reservations and to establish outdoor recreation facilities. The Act also provides for the Secretaries of Agriculture and the Interior to develop cooperative plans for conservation and rehabilitation programs on public lands under their jurisdiction. Some coral reefs are affected by this Act

siliceous - composed of silicon or primarily of silicon

sill reef - a synonym of ribbon reef

simultaneous hermaphrodite - a form of hermaphroditism where individuals simultaneously possess functional testes and ovaries, and can release either male or female gametes during spawning

single-stranded - a term used to describe nucleic acid molecules consisting of only one polynucleotide chain. The genomes of certain phages are single-stranded DNA molecules; rRNA, mRNA and tRNA are all single-stranded nucleic acids

single-stranded DNA - a single chain of deoxyribonucleotides that occurs in some bacteria and viruses. It usually exists as a covalently closed circle

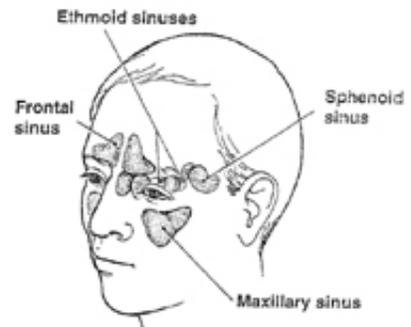
sinistral - left, as opposed to dextral, or right

sink - a process or place that acts to absorb or remove energy or a substance from a system. The ocean, for example, is a sink for carbon dioxide



The marine environment is a sink for many nutrients. (Photo: copyright Digital Vision Ltd.)

sinus - one of several air spaces within the skull that are in contact with ambient pressure through nasal passage openings in the posterior pharynx; a sac-like space



The sinuses are a group of 4 pairs of air filled spaces in the head. They are called the ethmoid, maxillary, sphenoid, and frontal sinuses. They warm and humidify the air as one breathes. They also trap and filter organic and non-organic particles from the air, such as bacteria, spores, and dust. (Graphic: Cystic Fibrosis Center at Stanford University)

siphon - an opening in molluscs or in urochordates (tunicates) which draws water into the body cavity. In many molluscs, such as octopods and squids, the siphon may be used to forcibly expel water, providing a means of propulsion



An octopus rapidly swimming by forcibly expelling water through the tubular siphon projecting from the head. (Photo: Jeff Jeffords)

siphonoglyph - a groove in the pharynx of some cnidarians that is lined with cilia which pump water into the animal's gastrovascular cavity. This water current inflates the body, circulates fluids, and provides a volume of water to act as a hydrostatic skeleton

siphuncle - a tubelike structure in the body of a shelled cephalopod, such as the chambered nautilus, extending through the partitions of each chamber of the septate shell; the term is also used to describe tubular structures that direct water flow, or as a feeding siphon of several different kinds of invertebrates

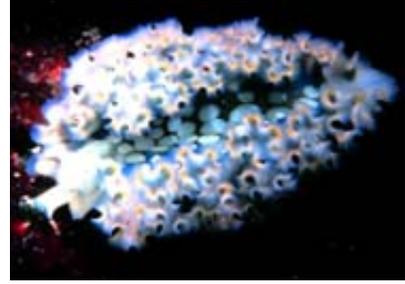
Sipuncula - an animal phylum that contains the peanut or starworms. They are small, non-segmented benthic animals (they are not worms), some of which live in coral crevices, empty mollusk shells or marine worm tubes. Several species bore into coralline rock

siRNA (short interfering RNA) - a 21-23 nucleotide-long RNA that mediates messenger RNA (mRNA) catalysis; used in gene suppression

skeletal density - certain massive coral species (e.g. *Porites*) exhibit annual variations in the density of their calcium carbonate (CaCO_3) skeleton, similar to tree rings. The annual density bands are revealed when slices of coral skeleton are X-rayed

skeleton - a supportive or protective structure or framework of an animal, a plant, or part of an animal or plant. In animals it is an external (exoskeleton) or internal (endoskeleton) support structure, against which the force of muscles acts. Vertebrates have a skeleton of bone or cartilage; arthropods have one made of chitin; corals have one of calcium carbonate; sponges have a mass of spicules; many other invertebrates use a hydrostatic skeleton, which is an incompressible fluid-filled region of their body. In plants, the skeleton may be a rigid protective covering, as in the shell of a diatom, or the vascular system of a vascular plant

slug - a pulmonate or opisthobranch gastropod in which the shell is absent, or reduced and buried within the mantle



Lettuce sea slug (*Tridachia crispata*) from the Florida Keys National Marine Sanctuary.

smooth - describes a surface without projections; glabrous

snorkel - a breathing device that allows a swimmer to breathe while face down in the water. It consists of a bent plastic or rubber tube fitting into a swimmer's mouth and extending above the surface



This swimmer is breathing through a snorkel. (Photo: Courtesy of Cayman Islands Department of Tourism)

snout - the portion of the head that is just anterior to the eyes



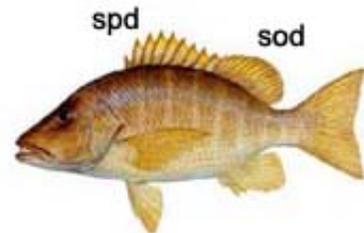
Measuring the snout length of a fish.

soft coral - common name for species of the anthozoan order Alcyonacea of the subclass Octocorallia. In contrast to the hard or stony corals, most soft corals do not possess a massive external skeleton



Beautiful specimen of soft coral

soft dorsal - a dorsal fin containing only soft rays, or the soft-rayed hind part of the dorsal fin, if both spines and soft rays are present (as in squirrelfish)



The spiny dorsal (spd) and soft dorsal (sod) fin of a schoolmaster snapper. (Photo: Fishing-Florida.com)

sol - a liquid colloidal dispersion; a cytoplasmic phase (the other phase is a gel)

solar energy - electromagnetic energy from the Sun

solar radiation - the amount of radiation or energy received from the sun at any given point

solar year - the time it takes the Earth to make one orbit around the Sun; approximately 365.2422 days

solute - the chemical substances dissolved in a solution, such as salts in seawater

solution - a liquid mixture in which the minor component, the solute, is uniformly distributed within the major component, the solvent

solvent - the liquid in which a solute is dissolved to form a solution

somatic mutation - a change in the genetic structure that can occur in any of the cells of the body except the reproductive cells, and therefore is neither inherited nor passed to offspring. Also called an 'acquired mutation'

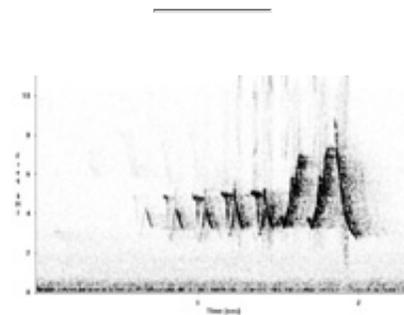
somite - a segmental mass of mesoderm in the vertebrate embryo, occurring in pairs along the notochord, and developing into skeletal muscles and vertebrae; in some invertebrates, the term "somite" refers to a metamere

sonar - SONAR is an acronym for "sound navigation and ranging." Active sonar describes an apparatus that transmits high frequency sound waves in water and registers the vibrations reflected back from an object. Passive sonars listen without transmitting. They are usually military (although a few are scientific). Some marine animals, such as whales and dolphins, use echolocation systems similar to active sonar to locate predators and prey



Mother and juvenile bottlenose dolphins (*Tursiops truncatus*). Dolphins and whales can use echolocation to help navigate.

sonograph - a hard copy display of sound data generated either in real time or from recorded data. Also known as a sonogram



Sonograph of a crested warbler. Time is on the x-axis and frequency (pitch) is on the y-axis. The sonograph shows discrete pulses of sound over time. Loudness (amplitude) is

indicated by the darkness of the pulse.

sorus - a group or cluster of sporangia

sound - a longitudinal pressure wave produced by the vibration of molecules in an elastic medium, which can be a liquid, solid, or gas. As the molecules are set in motion, they radiate outwards, colliding into other molecules (compression), then move apart farther than their equilibrium distance (rarefaction), travelling in this manner until they stimulate a sound receptor organ, such as an ear or tactile organ. The receptor translates the mechanical energy of the pressure wave to electrochemical energy of a nervous system, which stimulates a hearing or tactile sensation in the receiving organism

source DNA - the DNA from an organism that contains a target gene. This DNA is used as starting material in a cloning experiment

Southern Oscillation - a large-scale atmospheric and hydrospheric fluctuation centered in the equatorial Pacific Ocean. It exhibits a nearly annual pressure anomaly, alternatively high over the Indian Ocean and high over the South Pacific. Its period is slightly variable, averaging 2.33 years. The variation in pressure is accompanied by variations in wind strengths, ocean currents, sea-surface temperatures, and precipitation in the surrounding areas. El Niño occurrences are associated with the phenomenon

spat - tiny single corallites that form immediately after the metamorphosis of planula larvae

spatial data - information about the location and shape of, and relationships among, geographic features, usually stored as coordinates and topology

spatial index - the ratio of reef surface contour to linear distance. As part of a monitoring program employing a chain transect protocol, the spatial index provides a way to quantify changes in the topographical complexity of the reef

spatulate - spoon or broadly blade-shaped

spawn - to produce or deposit eggs; the eggs of aquatic animals; the mass of eggs deposited by fishes, amphibians or mollusks; offspring in great numbers or masses; to give forth young in large numbers



Fish spawn (egg mass) deposited on

spawning - in corals, the release of gametes into the water

specialist - an organism which has adopted a lifestyle or niche specific to a particular set of conditions

specialist species - species that have a relatively narrow ecological niche

speciation - the evolutionary process that gives rise to a new species

species - in sexually reproducing organisms, a species is a group of genetically related organisms, usually similar in physical appearance, that actually or potentially interbreed and are reproductively isolated from other groups

species diversity - the number of different species in an area and their relative abundance

species richness - the number of species in an area or biological collection

specific name - the second name in a binomen and in a trinomen

spectroradiometer - a radiometer that measures radiant energy as a function of wavelength

spermatangium - the male gamete-producing reproductive organ in certain algae

spermatium - a non-motile male gamete produced by a spermatangium in red algae

spermatogenesis - the process of sperm cell (spermatozoa) development in male animals, in which the diploid number of chromosomes is reduced by half to the haploid number in the spermatozoa

spermatophore - a packet containing sperm cells which is produced by the male genital system for transfer to the female. This method of sperm transfer is found in some vertebrates (salamanders) as well as invertebrates

spermatozoan - a sperm cell; the male reproductive cell; the male gamete

spicule - one of the numerous small to minute calcareous or siliceous bodies occurring in and serving to stiffen and support the tissues of various invertebrates, as in the majority of sponges, alcyonarians, and many radiolarians, holothurians and compound ascidians

spinate - spine-like or composed of spines

spiny lobster - a crustacean of the Family Palinuridae; it lacks large claws and has a flexible, leathery tail fan



Spiny lobsters in a seagrass bed.

spiracle - one of the external openings communicating with the air tubes (tracheae) or book lungs of certain arthropods; a tubular opening, formed from the modified first gill cleft, communicating with the gill cavity of certain ganoid (e.g., gar pike, bowfin) and all elasmobranch fishes

spiral cleavage - a developing embryo has spiral cleavage if, as it undergoes cleavage and changes from a four-cell embryo to an eight-cell embryo, the cells divide at slight angles to one another, so that the none of the four cells in one plane of the eight-cell stage is directly over a cell in the other plane. Spiral cleavage is characteristic of protostomes

splicing - the removal of introns and joining of exons to form a continuous coding sequence in RNA

split spawning - spawning occurring over consecutive nights or consecutive lunar cycles within a reef

sponge - a multicellular animal (metazoa) below the tissue grade of construction. Sponges belong to the phylum Porifera. There are approximately 5,000 living species classified in three distinct groups, the Hexactinellida (glass sponges), the Demospongia, and the Calcareo (calcareous sponges). They are important components of a coral reef ecosystem



Tube sponges (Phylum Porifera) with sea fans (gorgonia) in background.

spongin - a fibrous horny protein that forms the skeletal framework of some sponges

spongocoel - the central body cavity of sponges, which opens to the outside by way of the osculum.



The central cavity of this sponge is the spongocoel. Note the banded shrimp in the spongocoel. (Photo: Dr. Anthony Picciolo)

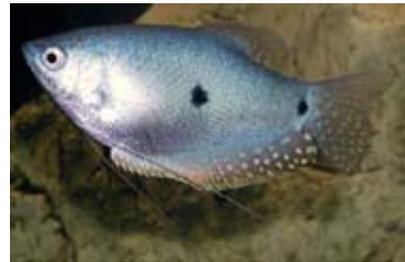
spongocyte - a cell that secretes spongin fibers in sponges

sporangium - an organ containing or producing spores in some algae and fungi

spore - a small reproductive cell produced by certain bacteria, algae, fungi and nonflowering plants. Spores contain at least one genome and are highly resistant to heat excess and dehydration

sporophyll - a fertile blade in attached brown algae

spot - a circular area of pigment



This female three-spotted gourami, *Trichogaster trichopterus*, gets its common name from the conspicuous spots on its flank and caudal peduncle. The third "spot" is the eye. (Photo: Miguel Pais)

spur and groove - a system of shallow ridges (spurs) separated by deep channels (grooves) oriented perpendicular to the reef crest and extending down the upper seaward slope

squeeze - pain or discomfort in an enclosed space (sinuses, middle ears, inside a face mask) experienced by scuba divers on descent and ascent, caused by barotrauma to the affected area

SST (Sea Surface Temperature) - the temperature of the layer of seawater (approximately 0.5 m deep) nearest the atmosphere

stable isotope - an isotope of a chemical element which is not spontaneously radioactive. Elements can exist in both stable and unstable (radioactive) forms. Most elements of biological interest (including C, H, O, N, and S) have two or more stable isotopes, with the lightest of these present in much greater abundance than the others. Among stable isotopes the most useful as biological tracers are the heavy isotopes of carbon and nitrogen. These two elements are found in the earth, the atmosphere, and all organisms

stakeholder - an individual or group with an interest in the success of an organization in delivering intended results and maintaining the viability of the organization's products and services. Stakeholders influence programs, products, and services

standard deviation - a measure of the spread or dispersion of a set of data. It is calculated by taking the square root of the variance

start codon - the set of three nucleotides in an mRNA molecule with which the ribosome starts the process of translation. The start codon sets the reading frame for translation. The most commonly used start codon is AUG, which is decoded as methionine in eukaryotes, and as *N*-formylmethionine in prokaryotes; also called 'initiator codon'

statistic - an estimate based on a sample or samples of a population, providing an indication of the true population parameter

statistical analysis - the application of probability theory to quantified descriptive data

statocyst - a sensory organ possessed by many invertebrates for the perception of gravity, thus body orientation and balance. Statocysts are found in many invertebrates. Each one has a cavity lined with sensory cells and contains a statolith

statolith - a sand grain or a calcium carbonate granule or other hard secreted substance, found in the cavity of a statocyst. Under the influence of gravity, a statolith makes contact with the lining of the cavity, thereby stimulating sensory cells that line it

status and trends analysis - a monitoring program designed to evaluate the current condition of physical and biological features found in an ecosystem and to detect changes that may occur over time.

stellate - star-shaped



The diver is holding a stellate-shaped starfish. (Photo: Copyright Corel Corp.)

stem cell - an embryonic cell that can give rise to any type of differentiated cell. They can be derived from two sources: the inner cell mass from a blastocyst or the primordial germ cells (eggs and sperm) of an older embryo

stenohaline - pertaining to an aquatic organism that can withstand a narrow salinity range

stenothermal - pertaining to an aquatic organism that can withstand a narrow temperature range

stereoblastula - a solid blastula, lacking a blastocoel

stereogastrula - a solid gastrula, lacking a gastrocoel

sternite - the ventral plate (or sclerite) of each segment of the body of an arthropod

stipe - stalk or erect portion, as in some brown algae

stipitate - body mass supported by a long stalk or stipe

stochastic - random; exhibiting variability due to random events

stolon - a type of stalk that lies in contact with the substrate; in corals, a horizontal polyp outgrowth from which daughter polyps are budded

stoloniferous - a type of colony formation in which the zooids are connected by a common stolon which is in contact with the substrate, as found in ectoproctans (moss animals)

stoma - any of various small openings or pores in an animal body, especially an opening resembling a mouth in many invertebrates; also a minute pore in the epidermis of the leaf or stem of a plant; plural is 'stomata'

stomadaeum - the pharynx in anthozoans; foregut of higher animals; the anterior or oral portion of the alimentary canal of an embryo

stone canal - the section of the water vascular system in echinoderms that connects the ring canal to the madreporite

stony coral - a synonym of hard coral

stop codon - a codon in mRNA for which there is no corresponding tRNA molecule to insert an amino acid into the polypeptide chain. Protein synthesis is terminated and the completed polypeptide is released from the ribosome. Three stop codons are known: UAA, UAG, and UGA. Mutations which generate any of these three codons in a position which normally contains a codon specifying an amino acid are known as 'nonsense mutations'; also called 'nonsense codons.' A stop codon signals the end of the amino acid chain in protein synthesis

storm surge - a rise above normal water level on the open coast due to the action of wind stress on the water surface



Storm surge swamps a house.
(Photo: NOAA)

str (short tandem repeats) - repetitive segments of DNA of a pattern of length from 2 to 10 bp, scattered throughout the genome in the non-coding regions between genes or within genes (introns), often used as markers for linkage analysis because of high variability in repeat number between individuals. These regions are inherently unstable and susceptible to mutations

strain - a group of individuals within a species having a common origin

strategic plan - a document used by an organization to align its organization and budget structure with organizational priorities, missions, and objectives. A strategic plan should include a mission statement, a description of the agency's long-term goals and objectives, and strategies or means the agency plans to use to achieve these general goals and objectives

stratigraphy - the branch of geology that deals with the origin, composition, distribution and succession of strata

stream bed - the stream bottom or surface over which a stream flows

stressor - a physical, chemical or biological factor that adversely affects organisms; an agent, condition or similar stimulus that causes stress to an organism

striated - marked with lines or grooves

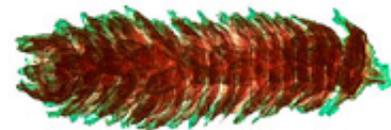
stridulation - the process in which a biological sound is produced when one body part rubs against another

stripe - a straight line of pigment that can vary in width, and which can be oriented vertically, horizontally, or obliquely on the head, body, or fins of an organism



Distinctive striping of the Moorish Idol (*Zanclus canescens*). (Photo: Dr. James P. McVey, NOAA)

strobila - a stage in the jellyfish life cycle. Free-swimming scyphozoan (true jellyfishes) medusae produce gametes which give rise to small polyps called scyphistomae. After a period of growth, a scyphistoma divides transversely to become a strobila that resembles a stack of discs. Each of the "discs" becomes an ephyra larva, detaches from the strobila and swims freely in the plankton. The ephyra larva will eventually grow into an adult medusa



Rick Gillis, Ph.D.

The late strobila stage of the jellyfish *Aurelia*. This sessile stage contains numerous discs stacked on top of one another. Eventually, each of these discs will break free from the stack as

free-swimming ephyra larvae.
(Photo: Rick Gillis, Ph.D., Biology
Dept., University of Wisconsin-La
Crosse)

stromatolite - a layered, fossilized deposit, mainly of limestone, formed by photosynthesizing colonial cyanobacteria and other microbes. They are the oldest known fossils, dating back more than 3 billion years. Stromatolites are prokaryotes that thrived in warm aquatic environments and built reefs much the same way as coral does today. They were common in Precambrian time (i.e., more than 540 million years ago). Although stromatolites continue to form in certain areas of the world today, they grow in greatest abundance in Shark Bay in western Australia

structural gene - a DNA sequence that forms the blueprint for the synthesis of a polypeptide, such as an enzyme

subclass - a taxonomic group that is below a class and above an order

subduction - the process in which one lithospheric plate collides with, and is forced down under another plate

subfamily - a taxonomic group that is below a family but above a genus

subgenus - a taxonomic group that is between a genus and a species

subgular - below the throat

subkingdom - a taxonomic group comprising a major division of a kingdom

submarine groove - a troughlike depression with vertical to overhanging walls which cut across the reef front at right angles

suborbital - an area below the eye

suborder - a taxonomic group that is a subdivision of an order

subphylum - a taxonomic group ranking that is between a phylum and a class

subradular organ - a sensory organ in chitons (Polyplacophora-Mollusca) which can be protruded and pressed against the substrate in the search for food

subset - in mathematics, a subset of a given set is a collection of things that belong to the original set

subspecies - a taxonomic group that is a division of a species. It usually evolves as a consequence of reproductive isolation of one or more populations within a species

substrate - the material making up the base upon which an organism lives or to which it is attached

subterminal - located some distance away from the end

subumbrella - the lower or oral surface of a medusa or jellyfish

sucker - a structure, such as those at the end of tube feet of echinoderms, or on the tentacles of octopods and squids, that can produce a small vacuum and enable the animal to stick to many surfaces



Suckers on an octopus tentacle allow the animal to adhere to almost any surface. (Photo: J'nie Woosley/ National Zoological Park)

Sula Reef - a deep water *Lophelia* reef located on the Sula Ridge on the Mid-Norwegian shelf at depths of 200 - 300 m. A very large deep water coral reef, it is about 13 km long, 700 m wide, and up to 35 m high

Sundarbans - the world's largest mangrove forest located in Bangladesh at the edge of the delta where the Ganges, Brahmaputra and Meghna Rivers come together

superclass - a taxonomic group that is below a phylum and above a class

superfamily - a taxonomic group that is below an order but above a family

superficial cleavage - a type of cleavage, typical of centrolecithal eggs found in most arthropods, in which karyokinesis (nuclear division) occurs without cytokinesis (cytoplasmic division), resulting in a syncytium. Cleavage furrows form to separate the nuclei

supergene - a group of neighboring genes on a chromosome that tend to be inherited together and sometimes are functionally related

superior - the anatomical term for "above" (e.g., the head is superior to the shoulder)

supernatant - the soluble liquid fraction of a sample after centrifugation or precipitation of insoluble solids

superorder - a taxonomic group that is above an order and below a class or subclass

suppressor gene - a gene that can reverse the effect of a mutation in other genes, i.e., a gene that suppresses the phenotypic expression of another gene, especially of a mutant gene

supraesophageal ganglia - a nerve plexus above the esophagus in the head of malacostracan crustaceans

supraorbital - an area above the eye

surface interval - the length of time that a scuba diver spends on the surface between two consecutive dives

surge channel - a deep channel in the windward side of a coral reef through which water moves in and out of the reef

suspension feeder - an organism that feeds by capturing particles suspended in the water column. A synonym of filter feeder



Suspension-feeding sponge among corals.

sustainability science - a multi-disciplinary approach to science that recognizes the limitations of traditional scientific inquiry in dealing with the complex reality of social institutions interacting with natural phenomena. Sustainability science seeks to improve on the substantial but limited understanding of nature-society interactions gained in recent decades. This has been achieved through work in the environmental sciences estimating and evaluating human impacts, and evidence from social and development studies that takes into account environmental influences on human well-being. Urgently needed is a better understanding of the complex dynamic interactions between society and nature so that the trend towards increasing vulnerability is reversed

sustainable development - those efforts to guide economic growth in an environmentally sound manner with an emphasis on natural resource conservation

sustainable yield - the number or weight of organisms in a population that can be harvested without reducing the population biomass from year to year, assuming that environmental conditions remain the same

sweeper polyp - a polyp that acts in an aggressive manner by stinging neighboring corals and sessile invertebrates

sweeper tentacle - A coral polyp tentacle that has an increased number of nematocysts and elongates in order to 'sting' neighboring corals and sessile invertebrates. A tool in the competition for space and resources



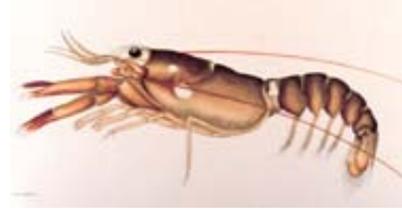
A hammer coral (right) thrusts out a sweeper tentacle towards a mushroom anemone (left). (Photo: Scott Brooks)

swell - the persistence of a wind-formed wave after the wind ceases



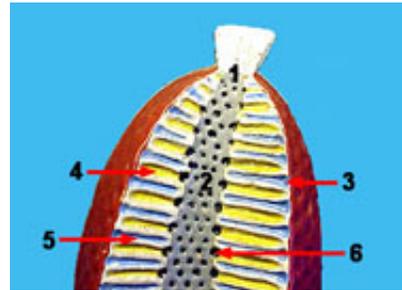
An ocean swell

swimmeret - one of several flat, fringed, and usually bilobed, paired appendages on the ventral surface of the abdominal somites of decapod crustaceans, used for swimming and reproduction



The arrow points to a swimmeret of a juvenile lobster. (Graphic: NOAA)

syconoid - a body form of medium complexity in sponges where the body wall has become folded and the choanocytes (flagellated collar cells) are not located along the spongocoel, but along radial canals. Water enters the sponge through a series of incurrent canals and passes through internal pores called prosopyles into the radial canals, which are lined with flagellated choanocytes.- It is the action of these choanocytes that keeps water moving through the sponge. From the radial canals, water then enters the central spongocoel through pores called apopyles, to exit to the environment through a single opening, the osculum.



Anterior end of a syconoid sponge in which the body wall has been folded into a series of internal and external canals.-1= osculum; 2= spongocoel; 3= ostium; 4= radial canal; 5= incurrent canal; 6= apopyle. (Photo: Rick Gillis, Ph.D., Biology Dept., University of Wisconsin-La Crosse)

symbiont - a symbiotic organism; either of two organisms participating in a symbiotic relationship



These clownfish exist in a symbiotic relationship with the sea anemone; the anemone provides protection and the clownfish feed and clean the anemone. Different clownfish species choose particular anemone species for their hosts. (Photo: Copyright Corel Corp.)

symbiosis - a relationship between two species of organisms in which both members benefit from the association (mutualism), or where only one member benefits but the other is not harmed (commensalism), or where one member benefits at the expense of the well-being of the other (parasitism)



A clownfish has a symbiotic relationship with a sea anemone, finding protection within the clump of stinging cell-bearing tentacles.

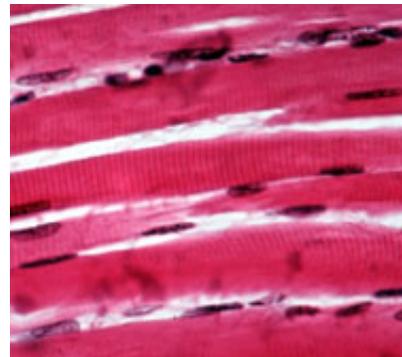
sympatric species - different species that live in the same area but are prevented from successfully reproducing by a reproductive isolating mechanism

symplesiomorphy - in evolution, a shared primitive character

synapomorphy - in evolution, a shared derived character

synapse - the site where neurons communicate with each other. A synapse is a small gap that physically separates neurons. Axon terminals of a neuron sending a nervous impulse (the presynaptic neuron) release neurotransmitters into the synapse. The neurotransmitters diffuse to the other side (the postsynaptic side) where they bind to receptors on the postsynaptic neurons, thereby relaying the nervous impulse

syncytium - a mass of cytoplasm containing several nuclei and enclosed in a membrane, but having no internal cell boundaries, e.g., skeletal muscle cells



Skeletal muscle cells are a multinucleate syncytium. The dark stained bodies are nuclei. (Photo: General College, University of Minnesota)

synecology - the branch of ecology that deals with whole communities and the interactions of the organisms within them

syngamy - the process of union of two gametes, also called fertilization. It encompasses both plasmogamy and karyogamy.

synonym - in taxonomy, one of two or more scientific names that are spelled differently, but refer to the same organism

synonymy - in taxonomy, the relationships between different names applied to the same taxon; a chronological list of taxonomic names which have been applied to a single taxon, including authors and dates

syntype - in taxonomy, each specimen of a type series from which neither a holotype nor a lectotype has been designated. The syntypes collectively constitute the name-bearing type

table reef - an isolated flat-topped coral reef which reaches the surface but lacks a lagoon

tabulate - having a flat surface



Coral (*Acropora*) having a tabulate shape.

tactile - pertaining to information, interpretations, and behavior derived from the sense of touch

talus slope - a synonym of reef base

tank - a hollow steel or aluminum cylinder, used to contain compressed air or other breathing gas mixtures used by scuba divers for an air supply; also called a cylinder or bottle



A NOAA diver breathing compressed air from the steel scuba tank (or cylinder) attached to his BCD (buoyancy control device). The diver is entering the water using the giant step technique. (Photo: NOAA National Undersea Research Program)

taphonomy - the study of everything that happens to an organism's body after it dies; includes probable cause and manner of death, movement of the body, chemical and physical alteration, burial, decomposition, diagenesis and fossilization

target - in genomics, the DNA or RNA being hybridized to a microarray; for diagnostic tests, the molecule or nucleic acid sequence that is being sought in a sample

tau - the third charged lepton (in order of increasing mass), with electric charge -1

taxon - a taxonomic group or entity

taxonomic group - a taxon with all its subordinate taxa and their individuals; e.g. the taxonomic group Crustacea consists of all crustaceans and their taxa

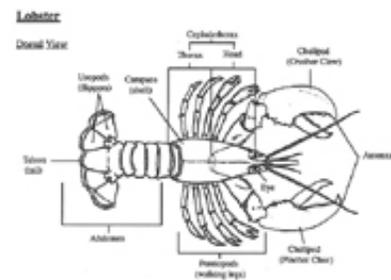
taxonomic key - a tabulation of diagnostic characters of taxa in dichotomous couplets to facilitate rapid identification

taxonomy - the science and methodology of classifying organisms based on physical and other similarities. Taxonomists classify all organisms into a hierarchy, and give them standardized Latin or Latinized names. There are seven main levels of classification in the hierarchy. They are, from most to least inclusive: Kingdom; Phylum (or Division for algae, fungi, and plants); Class; Order; Family; Genus; and Species. Taxonomists describe new species, classify organisms, and study speciation, the evolution of new species

technology - the creation of products and processes for the purpose of improving human chances for survival, comfort level, and quality of life

telolecithal - an egg cell in which the yolk is not evenly distributed throughout the cytoplasm, but is concentrated in one location, and cleavage is incomplete, e.g., a bird egg

telson - the terminal joint or movable piece at the end of the abdomen of crustaceans; middle piece of the tail fan



The telson, flanked by uropods, is the central part of the tail fan. (Graphic: Maine Department of Marine Resources)

temperate - region in which the climate undergoes seasonal change in temperature and moisture. Temperate regions of the earth lie primarily between 30 and 60 degrees latitude in both hemispheres

template - a molecule that serves as the pattern for synthesizing another molecule ; in the process of replication or transcription, the strand of DNA that serves as the source of information

tentacle - a finger-like evagination of the body wall. Tentacles surround the mouths of coral polyps, anemones and other invertebrates. They are used for capturing prey, defense, reproduction, gas exchange, and light absorption



Tentacles of a sea anemone. Each tentacle contains stinging cells (nematocysts) used for defense and food capture. (Photo: Dr. Anthony Picciolo)

tentacle-tube-foot suspension feeder - a suspension feeder that traps particles on distinct tentacles or tube feet (in echinoderms)

tentacular lobe - a lobe at the point of insertion (beginning) of a septum

tentacular sheath - one of the two cavities in the sides of the body of ctenophores (comb jellies) into which the tentacles can be withdrawn

terabyte - a measure of data size. A terabyte of data is equivalent to 1,000 gigabytes of data or 1,000,000 megabytes of data. One petabyte equals 1,000 terabytes

tergite - a hard plate (sclerite) forming one of the constituents of the dorsal exoskeleton (tergum) of an animal, such as an arthropod

tergum - the back of an animal

terminal - at the end position

terminator - a sequence of DNA bases that stops RNA polymerase from synthesizing RNA

terpenoid - a class of organic compound produced by soft corals for defense and for aggressive colonization of new substrates

territoriality - the defense of a given area

tessellated - a checkered appearance



A tessellated blenny. (Photo: NOAA)

test - shell or hard outer covering of echinoderms and ascidians



Dorsal view of sea urchin test.

tetraspore - a haploid spore in the red algae life cycle which is the meiotic product of the tetrasporangium of a diploid tetrasporophyte. The tetraspores are released, settle, and grow into gametophytes

tetrasporophyte - diploid phase in the life cycle of red algae which produces haploid tetraspores. The tetrasporophyte is the site of meiosis, more specifically, the tetrasporangia where haploid tetraspores are produced. These tetraspores are released, settle, and grow into the gametophyte, completing the basic red algal life history

tetraxon - in sponges, a spicule with four rays

tetrodotoxin (TTX) - tetrodotoxin (TTX) is an especially potent marine neurotoxin, named after the order of fish from which it is most commonly associated, the Tetraodontiformes (includes the puffers, porcupine fish, blowfish, cowfish, boxfish). The toxin appears in high concentrations in the gonads, liver, intestines and skin of pufferfish. The fatality rate when injected may be as high as 60 percent. Tetrodotoxin is more than 10,000 times deadlier than cyanide. Other marine and terrestrial organisms have been found to store TTX, for example, the Australian blue-ringed octopus, parrotfish, triggerfish, gobies, angelfish, ocean sunfish, globefish, seastars, starfish, xanthid and other crabs, a horseshoe crab, a number of marine snails, flatworms, tunicates, ribbonworms, mollusks and marine algae (*Jania spp.*) Terrestrial organisms include the Harlequin frogs (*Atelopus spp.*), three species of California newt and other eastern salamanders



A specially licensed Japanese chef prepares fugu, the ever-so-slightly tainted fillet of the extremely poisonous blowfish, whose internal organs contain tetrodotoxin.

thallus - the vegetative body of a plant or alga that is not differentiated into organs, such as roots, stems and leaves

thanatocoenosis - an assemblage of organisms or their parts brought together after their deaths, as for example, by flowing water; 'death assemblage'

theca - the calcareous wall of the corallite

theoretical probability - the chances of events happening as determined by calculating results that would occur under ideal circumstances

theory - a comprehensive explanation of a given set of data that has been repeatedly confirmed by observation and experimentation and has gained general acceptance within the scientific community

thermocline - the region below the surface layer of the ocean or lake, where the temperature gradient increases abruptly (i.e. where temperature decreases rapidly with increasing depth). A thermocline may reach the surface and become a front. It is usually an ecological barrier and its oscillations have significant consequences on population distribution and ocean productivity

thermohaline circulation - the density-driven convective circulation system of the world's oceans. Warm Atlantic water moves northward along the axis of the Gulf Stream, and evaporation increases water density while releasing heat to the colder atmosphere in the North Atlantic. Once significantly dense, the water sinks into the deep ocean, forming a downward limb of a giant conveyor-like circulation that extends around the world's oceans

thermoreceptor - a neurological receptor that detects changes in temperature

thigmotactic - responding to touch or outer surface contact

thoracic - pertaining to the chest area

thorax - the central region of a crustacean body

thymine - one of the four bases in DNA that make up the letters ATGC, thymine is the "T". The others are adenine, guanine, and cytosine. Thymine always pairs with adenine

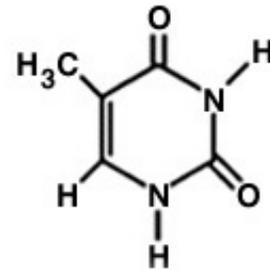


Diagram of the chemical structure of thymine, one of the four nitrogenous bases in DNA.

tidal delta - a delta formed at both sides of a tidal inlet

tidal inlet - a waterway from the open ocean into a lagoon

tide - the periodic rising and falling of the water that results from the gravitational attraction of the moon and sun acting on the rotating earth



High tide combined with a storm threaten a pier. (Photo: Mary Hollinger)

tide gauge - a device for measuring the height (rise and fall) of the tide; especially an instrument for automatically making a continuous graphic record of tide height versus time

TIFF (Tag Image File Format) - a common format for exchanging raster graphics (bitmap) images between application programs, including those used for scanner images

Tisler Reef - a deep water *Lophelia* reef located in the Skagerrak, the submarine border between Norway and Sweden, at depths of 74 to 155 m. It has the world's only known yellow *Lophelia pertusa* corals

tissue - a group of cells with a specific function in the body of an organism. Tissues are composed of nearly identical cells and their products, and are organized into larger units called organs

topographic map - a map containing contours indicating lines of equal surface elevation (relief)

topotype - in taxonomy, a specimen collected at the type locality

topotypical population - in taxonomy, a population occurring at the type locality

tornaria larva - a ciliated, free-swimming pelagic larva of a hemichordate



Young tornaria of *Balanoglossus biminiensis*. (Photo: University of Saskatchewan Archives)

torsion - twisting of the body during development so that the posterior of the body takes an anterior position over the head

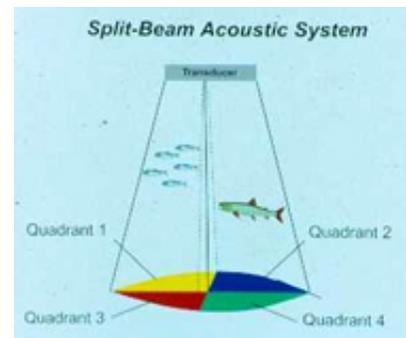
toxicant - any substance which is potentially toxic

trabeculum - in corallites, one of many rods or axial structures composed of fibrous tufts (sclerodermites), which form teeth along the upper septal margin

trade winds - a system of relatively constant low level winds that occur in the tropics. The trade winds blow from the northeast to the equator in the Northern Hemisphere and from the southeast to the equator in the Southern Hemisphere

transcription - the process by which the genetic information encoded in a linear sequence of nucleotides in one strand of DNA is copied into an exactly complementary sequence of mRNA (messenger RNA). The mRNA then carries this information to the cytoplasm of the cell, where it serves as the blueprint for the manufacture of a specific protein

transducer - the electromechanical component of a sonar system that is mounted underwater and converts electrical energy to sound energy and vice versa



Split beam transducer receives echoes with four different quadrants (Graphic: American Fisheries Society)

transduction - transfer of genetic material from one cell to another by means of a virus or phage vector

transect - a line used to survey the distribution of organisms or substrate across a given area. Sample plots or points are established along the transect for collecting data



NOAA divers collect data along a transect line.

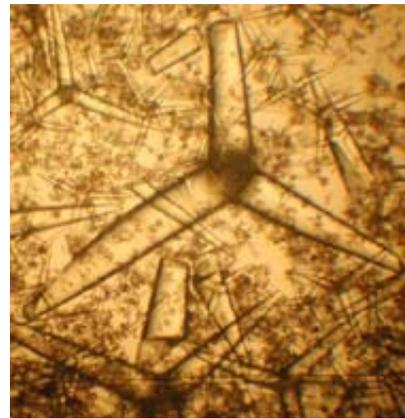
transfection - infection of a cell with nucleic acid from a virus, resulting in replication of the complete virus; gene transfer into eukaryotic cells

transforming gene - a gene that causes normal cells to change into cancerous tumor cells; also called an 'oncogene'

transgenic - having genetic material (DNA) from another species. This term can be applied to an organism that has genes from another organism

translation - in genetics, the process whereby genetic information coded in mRNA (messenger RNA) directs the formation of a specific protein at a ribosome in the cytoplasm

triaxon - in sponges, a spicule with three rays



Microscopic triaxon spicules in a sponge. (Photo: NOAA)

tribe - a taxonomic group that is between a genus and a subfamily

trichocyst - a stinging or grasping organelle in the outer cytoplasm of protists, especially ciliates. It consists of a hair-like filament that can be discharged suddenly from a minute capsule

trichogyne - receptive elongation of the carpogonium (female reproductive structure) in red algae where male gametes become attached

triglyceride - a complex molecule which is the main component of dietary and body fat. It is made up of a combination of glycerol and three fatty acids

trimix - a breathing gas mixture of helium, oxygen, and nitrogen. By using trimix, it is possible for divers to descend to hundreds of feet without suffering from toxic partial pressures of oxygen (which increases with depth), and also reduces the effect of nitrogen narcosis



Marine scientists breathing trimix working on a transect line in order to collect sponge and water samples at a depth of approximately 60 m (200 ft). (Photo: NOAA National Undersea Research Program)

trinomen - in taxonomy, the combination of a generic name, a specific name, and a subspecific name, that together constitute a scientific name subspecies

triplet - in genetics, a sequence of three nucleotides of DNA which specifies an amino acid.

tripton - the nonliving particulate matter in bodies of water

triturate - to grind or masticate

tRNA (transfer RNA) - short-chain RNA molecules present in the cell, in at least 20 varieties. Each variety is capable of combining with a specific amino acid, and attaches the correct amino acid to the protein chain that is being synthesized at the ribosome of the cell, according to instructions coded in the mRNA

trochophore larva - the ciliated planktonic larva of many invertebrates, including polychaete worms, mollusks, and rotifers



The trochophore larva of a marine worm. (Photo: University of Saskatchewan Archives)

trolling - a fishing method where lures or baits attached to lines are towed behind a slowly moving boat



Fishing vessel trolling for tuna.
(Graphic: NOAA)

trophic - related to or functioning in nutrition

trophic dynamics - the complex biological processes whereby energy and matter are passed up to successive levels of food webs

trophic group - a group of organisms consuming resources from a similar level in the energy cycle

trophic level - a classification system of organisms according to their means of obtaining nutrition. A segment of the food chain in which all organisms obtain food and energy in basically the same manner (e.g., photosynthesis, herbivory, or carnivory) and in which all organisms are the same number of links from the photosynthetic segment

tropical - region in which the climate undergoes little seasonal change in either temperature or rainfall. Tropical regions of the earth lie primarily between 30 degrees north and south of the equator

Tropical Ocean Coral Bleaching Indices - indices of selected coral reef sites/regions (maintained by NOAA/NESDIS) that present satellite-obtained measurements of relevance to coral reef ecosystems

tropical storm - a tropical cyclone with maximum winds less than 34 m/sec (75 mile per hour)

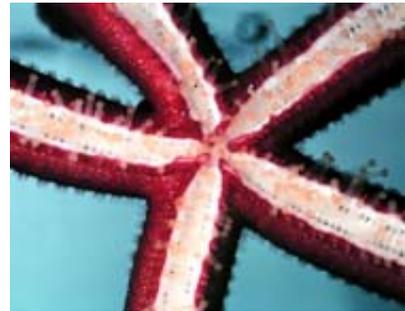
truncate - having the end squared off

tsunami - a long-period gravity wave generated by a submarine earthquake or volcanic event



Tsunami damage at Seward, Alaska, following 1964 Good Friday Earthquake. (Photo: NOAA)

tube feet - extensions of the water-vascular system of echinoderms, protruding from the body and often ending in suckers. They may be used for locomotion and/or for maintaining a tight grip on prey or on the substrate



The ventral side of a Pacific starfish shows its tube feet.

tubercle - any small, usually hard, knobby excrescence or lump. In pycnogonids and some cheliceramorph arthropods, the central eyes are carried on a tubercle

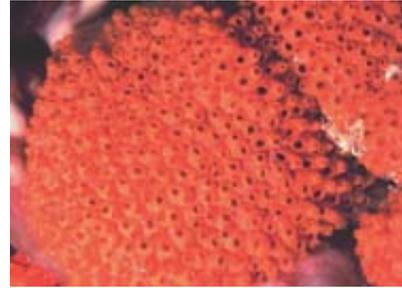
tubiform - a shape resembling a tube



The trumpetfish has a snout which is tubiform or tubular in shape. (Photo: Copyright Digital Stock Corp.)

tubules of Cuvier - eversible toxic or sticky tubules associated with the bases of the respiratory trees of some sea cucumbers (Holothuroidea-Echinodermata)

tunic - the outer covering of a tunicate (Urochordata). The tunic is mostly composed of a protein and carbohydrates



Orange colonial tunicate at Gray's Reef National Marine Sanctuary. Each of the individual tunicate's body is covered by the tunic. (Photo: NOAA)

turbidity - cloudy water, usually caused by the suspension of fine particles in the water column. The particles may be inorganic, such as silt, or organic, such as high densities of single-celled organisms

turbinate - resembling an inverted cone

type - in taxonomy, the standard of reference for determining the precise application of a name. Each taxon has, actually or potentially, a type: type of a nominal species is a specimen (type specimen or holotype); type of a nominal genus is the nominal species (type species); type of a nominal family is the nominal genus (type genus)

Type I error - the error of rejecting the null hypothesis when it is true

Type II error - the error of not rejecting the null hypothesis when it is false

type locality - in taxonomy, the geographical (and, where relevant, stratigraphical) location of the occurrence of the population from which the type specimen (i.e. holotype, lectotype or neotype) was taken

type series - in taxonomy, the series of specimens which either constitutes the name-bearing type (syntypes) of a nominal species or subspecies or from which the name-bearing type has been or may be designated

type species - in taxonomy, the nominal species that is the name-bearing type of a nominal genus or subgenus

type specimen - in taxonomy, any specimen of the type series

U.S. Coral Reef Task Force (USCRTF) - established by President Clinton in June, 1998, through Executive Order 13089 on Coral Reef Protection, to lead the U.S. response to this growing global environmental crisis. Chaired by the Secretary of the Interior and the Secretary of Commerce, the USCRTF is composed of the heads of 11 federal agencies and the Governors of 7 states, territories or commonwealths with responsibilities for coral reefs. The USCRTF is responsible for overseeing implementation of the Executive Order, and developing and implementing coordinated efforts to: map and monitor U.S. coral reefs; research the causes and solutions to coral reef degradation; reduce and mitigate coral reef degradation from pollution, overfishing and other causes; and implement strategies to promote conservation and sustainable use of coral reefs internationally

umbo - the earliest part of a bivalve or brachiopod shell; in bivalves, it is the most dorsal section of the shell, while in brachiopods, it is the most posterior



A bivalve shell: 1 = umbo; 2 = periostracum (the pigmented outermost layer of the shell). (Photo: Rick Gillis, Ph.D., Biology Dept., University of Wisconsin-La Crosse)

umbrella - describes the body of a jellyfish or medusa



The transparent umbrella of this jellyfish makes it less obvious to predators.

unavailable name - in taxonomy, a name which does not meet all mandatory provisions of the International Code of Zoological Nomenclature and thus has no status in nomenclature. Unavailable names include: *nomen oblitum*, *nomen negatum*, *nomen nudum*, *nomen nullum*, *nomen vetitum*

undercurrent - a current below another current, or beneath the surface

uniramious appendage - a type of appendage that is characteristic of insects and other members of the arthropod subphylum Uniramia. It consists of an unbranched series of segments

unite - in taxonomy, to combine or join two or more taxa

unused name - in taxonomy, an available senior synonym that is not known to have been used as a valid name in the past 50 years

upstream - toward the source or upper part of a stream or current; against the current

upwelling - the process by which warm, less-dense surface water is drawn away from a shore by offshore currents and replaced by cold, denser water brought up from the subsurface

uracil - one of the four bases in RNA. The others are adenine, guanine, and cytosine. Uracil replaces thymine, which is the fourth base in DNA. Like thymine, uracil always pairs with adenine

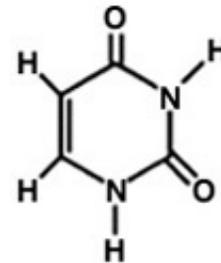
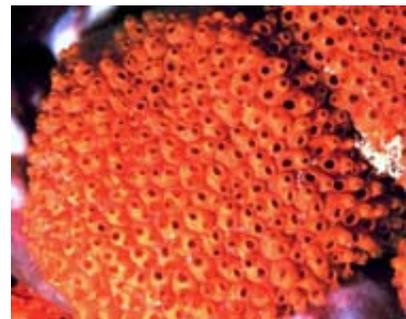


Diagram of the chemical structure of uracil, one of the four nitrogenous bases in RNA.

urea - a waste product of metabolism eliminated via the kidneys. In elasmobranchs (sharks, rays, skates), urea is found in the blood where it helps to maintain osmotic balance

Urochordata (Tunicata) - a subphylum of the animal phylum Chordata that contains the ascideans (sea squirts). Most adults are sessile and bear little resemblance to the other chordates. They are common inhabitants of coral reefs and mangrove roots



Orange colonial tunicates (Urochordata) at Gray's Reef National

Marine Sanctuary.

uropod - fan-shaped, paired posterior abdominal appendage in certain crustaceans, e.g., lobsters or shrimp, that are used for swimming

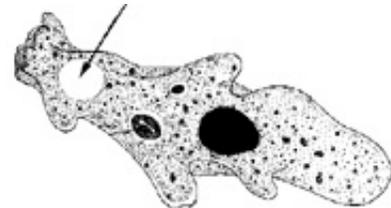


Ventral view of crayfish. (Photo: Copyright LTTM 2003)

UV (ultraviolet) radiation - the region of the electromagnetic spectrum consisting of wavelengths from 1 to 400 nm

vaccine - a preparation that contains an antigen, consisting of dead or weakened whole or parts of disease-causing organisms, that is used to confer immunity against the disease that the organisms cause. Vaccine preparations can be natural, synthetic or derived by recombinant DNA technology

vacuole - a membrane-bounded vesicle in eukaryotic cells that has a secretory, endocytotic, phagocytotic or storage function



A water vacuole in an amoeba.
(Graphic: Wappingers Schools)

vagrant - a species that has strayed beyond its natural range but has not established reproducing populations

valence - the chemical combining capacity of an element or ion; the number of electrons that are used by an atom to form a compound. A valence electron is in the outer or next outer shell of an atom

valid name - in taxonomy, the correct name for a given taxon, which may have several available names, one of which (usually the oldest) is chosen as the valid name. The valid name is always an available name, but an available name is not always a valid name

validated name - in taxonomy, a formerly invalid or unavailable name that has been made valid or available by the International Code of Zoological Nomenclature, e.g. by annulment or suppression of senior homonyms or synonyms

valve - the shell or shells of certain organisms, such as clams, oysters, and snails



A giant *Tridacna* clam with its two valves open.

variance - the population variance of a random variable is a non-negative number which gives an idea of how widely spread the values of the random variable are likely to be; the larger the variance, the more scattered the observations on average. It is a measure of the 'spread' of a distribution about its average value

variant - any individual or group that deviates from the typical anatomy or behavior; in genetics, an organism that is genetically different from the wild type organism

variegated color pattern - an irregular pattern of small, dark and light markings, with many of the dark marks connected

vascular plant - any plant containing a system of vessels which transport water and nutrients between different parts of the plant (e.g., from the roots to the leaves)

vector - an abstraction of the real world where positional data is represented in the form of coordinates. In vector data, the basic units of spatial information are points, lines and polygons. Each of these units is composed simply as a series of one or more coordinate points. For example, a line is a collection of related points, and a polygon is a collection of related lines. Vector images are defined mathematically as a series of points joined by lines. Vector-based drawings are resolution independent. This means that they appear at the maximum resolution of the output device, such as a printer or monitor. Each object is self-contained, with properties such as color, shape, outline, size, and position on the screen

vector - an organism which carries or transmits a pathogen; a vehicle that transfers genetic material into a host cell or organism. Typically, vectors are of two types: viral- or DNA-based. DNA vectors are autonomously replicating, circular macromolecules that can be easily manipulated to carry genetic information and are transferred into cells by standard laboratory techniques. These vectors include plasmids, cosmids, and yeast artificial chromosomes (YACs). Recombinant viruses that have been bioengineered to be harmless can also carry new genetic information for transfer into cells, or into an entire host organism (an example of gene therapy)

vegetal coloration - a resemblance to vegetation which allows organisms to conceal themselves from predators or prey

vegetal hemisphere - the half of an oocyte or egg with more yolk, or the corresponding half of an early embryo with the slower dividing yolk-laden cells

vegetal pole - the portion of an oocyte or egg that is opposite the animal pole and contains most of the yolk granules. See "**animal pole**"

velarium - a structure that resembles a hydrozoan velum In scyphozoan medusae, but has a different embryonic origin

veliger - a molluskan larva in which the foot, mantle and shell first make their appearance

velocity - the rate of change of position over time, calculated by dividing distance by time

velum - a circular shelf of tissue attached to the underside of the umbrella in a hydrozoan mesusa. It functions in locomotion

veneer reef - a reef with very little calcium carbonate accretion. A non-reef coral community

venomous - pertaining to an organism that has a venom, usually secreted by a gland, that is injected through hollow spines or teeth



A venomous cone shell. When close to its prey, usually another gastropod mollusk, it expands its long proboscis exploring for soft parts. A radular dart, bearing venom, is injected into the prey; death quickly results. (Photo: Dr. James P. McVey, NOAA Sea Grant Program)

vent - the posterior opening of the intestine, gonads, and kidney ducts. The vent is located just anterior to the anal fin in fishes

ventral - pertaining to, or situated near, the belly, or underside, of an animal

ventral disk - a "sucking disc " formed by the uniting of the pelvic fins in some fishes; for example, clingfishes



A clingfish's ventral disc allows it to hold onto rocks in strong currents or when waves crash over tide pools.

ventral fin - a synonym for pelvic fin

vermiform - worm-shaped

vermivore - an animal which feeds upon worms and worm-like animals

vernacular name - the colloquial or common name of a taxon, i.e., in any language or form other than that of biological nomenclature. Vernacular names have no status in nomenclature

verruca - a wart-like projection; a small cylindrical projection arising from the corallum that contain calices

verrucose - having a warty appearance

vertebra - one of the bony segments of the vertebral column of vertebrate animals; in brittlestars (Echinodermata-Ophiuroidea), a vertebra is one of the many articulated ossicles that join together along the length of the arms. They occupy most of the interior of each arm, and have sockets by which they connect to each other

vertebrate - an animal that possesses a vertebral column (back bone), such as fishes, amphibians, reptiles, birds and mammals



Vertebrate animals of the fish class Osteichthyes. (Photo: Dr. Anthony Picciolo)

vertical classification - classification which stresses common descent and tends to unite ancestral and descendant groups of a phyletic line in a single higher taxon, separating them from contemporaneous taxa having reached a similar grade of evolutionary change

vertical fin - the unpaired dorsal, caudal and anal fins. Vertical fins are also called median fins

vesiculate - thin and bladder-like

vestigial structure - an incompletely or ineffectively developed structure which is greatly reduced from the original ancestral form and is no longer functional

vibraculum - a bryozoan heterozoid that possesses long setae, or bristles, and may function in cleaning the colony

video transect - a nondestructive, repeatable procedure for assessing and monitoring diurnally active fishes and other macroscopic marine organisms. Videotaping along a linear transect reduces the variance in error inherent with visual observations made by a diver or snorkeler, and allows virtually unlimited time for study of the images by many individuals

viral DNA - DNA (deoxyribonucleic acid) that makes up the genetic material of viruses

virion - a complete infectious viral particle, existing outside of a host cell, with nucleic acid and capsid, and in some types, an outer lipid envelope

viroid - an infectious particle similar to a virus, but smaller. It consists only of a strand of nucleic acid without the protein coat (capsid) characteristic of a virus

virology - the study of viruses

virulence - the ability to infect or cause disease

virus - a sub-microscopic, obligate intracellular parasite that replicates itself only within cells of living hosts; many are pathogenic; the structure of a virus is basically a strand of nucleic acid (DNA or RNA) wrapped in a thin protein shell. A virus is not a cell, and is "lifelike" only when replicating itself at the expense of the host cell

viscera - the internal organs, collectively, of an coelomate organism, especially those located within the abdominal cavity, but also to the organs within the thoracic and mediastinal cavities

visceral hump - the main body of a mollusk, which contains most of the organs, including a complete digestive and excretory tract as well as the reproductive organs. The visceral hump also includes the mantle, which consists of two external flaps of tissue that secretes the material that forms the shell on some species, and it protects the mantle cavity. The mantle cavity contains the gills, which excrete waste and circulate oxygen. Most mollusks have a shell, which sits on the visceral hump and a protects the main body from predators

visible radiation - energy at wavelengths from 400 - 700 nm that is detectable by the human eye

visible wavelengths - wavelengths approximately 400 to 700 nm

visualization tool - a method of visually displaying data, such as a visualization theater, computer display, and map and chart

vitamin B complex - a large group of water soluble vitamins that function as co-enzymes

Vitareef program - a program that was established in order to provide a standardized method of characterizing the conditions of reef corals. It can and has been used by both researchers and non-scientists to document observations of reefs at specific points in time, which can be followed up in subsequent observations to assess changes in the state of individual coral colonies, selected coral species, or a reef as a whole

vitellaria larva - a ciliated larva of echinoderms, such as sea lillies (Crinoidea), some sea cucumbers (Holothuroidea), and brittle stars (Ophiuroidea)

viviparity - a form of reproduction where the offspring are nourished in the reproductive tract of the female (other than by a yolk sac) and then expelled from the mother as free-swimming young. Mangrove reproduction by means of propagules is also a form of viviparity in plants

waste water - water that is a mixture of water and dissolved or suspended solids carrying wastes from homes, businesses and industries

wastewater treatment plant - a facility containing a series of tanks, screens, filters and other processes by which pollutants are removed from water

water - pure water consists of hydrogen and oxygen, H₂O. It is a binary compound that occurs at room temperature as a colorless, odorless, tasteless, transparent liquid which is very slightly compressible. It freezes at 0 degrees C and boils at 100 degrees C. It is the most important natural solvent, and frequently contains impurities, which are mostly removed by distillation



Wave sweeps toward a coastline.
(Photo: Copyright Digital Vision Ltd.)

water column - the water mass between the surface and the bottom

water pressure - the force per unit area exerted by the weight of water. Each 33 feet of sea water exerts a pressure equivalent to one atmosphere, or 14.7 psi

water table - the level or depth below the ground that is saturated with water

water vascular system - in echinoderms, a system of internal canals and appendages that are water-filled and functions as a means of locomotion

watershed - an area of land that drains downslope to the lowest point. The water moves through a network of subterranean and surface drainage pathways which converge into streams and rivers, eventually reaching an estuary and finally the ocean. Because water moves downstream, any activity that affects the water quality, quantity, or rate of movement at one location can affect locations downstream to the ocean and out to coral reefs



Angel Falls, Venezuela. This great waterfall contributes to the Orinoco River watershed. Nutrients and minerals from the rainforests and savannas of the Orinoco River basin are transported with the Orinoco current and may effect coral reefs in the southeastern Caribbean. (Photo:

wave crest - the top of a wave

wave height - the vertical distance between the crest and adjacent trough of a wave

wave length - the distance between two successive wave crests or troughs

wave trough - the low spot between two successive waves

WCMC Global Coral Disease Database - the World Conservation Monitoring Centre (WCMC) and NOAA maintain the Global Coral Disease Database which is populated with over 2000 records of coral diseases from approximately 155 sources. The occurrence of a disease on a coral species (or genus) was recorded for each location and date on which it was observed. A unique combination of coral species, disease, date, and location therefore constitutes a single record

weather - temperature, precipitation, and wind speed and direction that occur on a daily basis

Weberian apparatus - the four anterior vertebrae and associated tissues in some fishes (catfishes, loaches, minnows, suckers) that connect the gas bladder to the inner ear, conveying pressure changes and sound

wedge shaped - a form that is thick at one edge and tapered to a thin edge at the other

weight belt - a belt worn during scuba diving that contains lead weights, either solid masses or as shot in pouches. The weight belt allows a diver to descend in the water column against the forces buoying the diver upwards

wet collection - a museum collection of specimens that are stored in ethanol, isopropanol, formalin or other liquid preservatives

wetland - an area that, at least periodically, has waterlogged soils or is covered with a relatively shallow layer of water. Bogs, freshwater and saltwater marshes, and freshwater and saltwater swamps are examples of wetlands



Wetlands provide for valuable nursery areas for many organisms.

white hole - an area along the spur and groove system (zone) where the sand channel widens considerably



A scientist stands in a sand channel within a reef spur-and-groove zone.

white pox disease - a coral disease characterized by circular lesions with coral tissue degradation on the Caribbean elkhorn coral, *Acropora palmata*. The pathogen is a bacterium, *Serratia marcescens*.



White pox disease is characterized by white circular lesions on the surface of infected colonies (Photo: Dr. A. Bruckner, NOAA)

white skeleton - the exposed white calcium carbonate skeleton of a coral colony

white-band disease - a coral disease characterized by complete coral tissue degradation of Caribbean acroporid corals.-Two species of Acroporidae are affected, the elkhorn coral, *Acropora palmata*, and the staghorn coral, *A. cervicornis*. The disease exhibits a sharp demarcation between apparently healthy coral tissue and exposed coral skeleton.- These signs are identical to plague, except that white band is acroporid specific (and plague has not been found on acroporids).- Tissue loss usually proceeds- from the base of the colony branch to the tip, although it can begin in the middle of a branch in *A. cervicornis*. White band disease affects acroporid corals throughout the Caribbean and has decimated populations at a regional scale.The infective agent has not yet been isolated. For more information and illustrations, see: http://www.coral.noaa.gov/coral_disease/white_band.shtml



Elkhorn coral populations have suffered widespread declines from white-band disease (Photo: Dr. A. Bruckner, NOAA)

wild - living in a natural state; living in nature

wild type - the form of an organism that occurs most frequently in nature

windward - refers to the side of an island or reef that faces the prevailing wind

worm reef - a massive structure composed of clusters of oval, table-like mounds constructed by marine polychaete worms in the family Sabellariide. They consist of all sorts of sediments consolidated by a mucoprotein cement produced by the worm. This reef may start in the intertidal zone and extend into the subtidal zone. Some are in deeper water. Unlike the colorful and ornate coral reefs, worm reefs are drab, monotonous and rounded clusters, mounds and platforms that grow upward and outward from the durable substrate from which their colonies develop. Worm reefs offer several ecological benefits. They provide feeding and browsing grounds for a diverse community of marine organisms and an ideal home for attaching plants, sponges and shelter-seeking animals. Also, unlike coral reefs, worm reefs are not restricted to the tropics

WW2BW (White Water to Blue Water Initiative) - the White Water to Blue Water (WW2BW) Initiative was formulated in 2002 during the World Summit on Sustainable Development. WW2BW responds to the World Summit's "Oceans" agenda with an integrated approach to sustainable use of water resources. In an effort to address water pollution and scarcity, United States government agencies, including the State Department, NOAA, USAID, as well as the United Nations, governments of the Wider Caribbean Region, and a number of non-governmental organizations have come together to plan and implement programs which will lead to the conservation and sustainable management of both freshwater and coastal



This photograph, used in a poster for WW2BW, suggests the relationships between the forested land, fresh water, the human community, and

marine resources in the Caribbean. WW2BW stimulates partnerships to promote integrated watershed and marine-based ecosystems management in support of sustainable development. Four thematic areas are supported: integrated watershed management, marine ecosystem-based management, sustainable tourism, and environmentally sound marine transportation. The outcome of the WW2BW partnership in the Wider Caribbean may serve as the blueprint for future programs on watershed and marine ecosystem-based management in Africa and the South Pacific

the sea. The photograph highlights the pitons of St. Lucia in the Caribbean Sea. (Photo: Dr. Anthony R. Picciolo, NOAA)

X-organ - groups of neurosecretory cells in the eyestalks of crustaceans that secrete a molt-inhibiting hormone

xantho- - a prefix meaning yellow

xanthochromic - yellow or golden color



A yellow tang, *Zebrasoma flavescens*.
(Photo: Jim McVey, NOAA)

xanthophore - a chromatophore which produces yellow pigments in the form of carotenoids

xenobiotic - a chemical which is not a natural component of the organism exposed to it; a chemical or other stressor that does not occur naturally in the environment. Xenobiotics occur as a result of anthropogenic activities such as the application of pesticides and the discharge of industrial chemicals to the environment; a synthetic chemical believed to be resistant to environmental degradation. A branch of biotechnology called 'bioremediation' seeks to develop biological methods to degrade such compounds

xenophyophore - a giant protozoan protist (*Syringammina fragilissima*), up to 25 cm in diameter, that inhabits deep-sea habitats. Large aggregations of xenophyophores appear on the Darwin Mounds



A xenophyophore photographed on the Blake Ridge. They construct complex, golf-ball-sized tests from sand and sediment grains. (NOAA photo)

xylem - tissue in vascular plants that carries water and nutrients from the roots to the shoot and leaves. The xylem contains tracheids, vessels, fiber cells and parenchyma. It also provides structural support

Y-organ - a gland situated near the external adductor muscles of the mandible of some crustaceans that secretes the molting hormone

YAC (yeast artificial chromosome) - a vector used to clone DNA fragments from 300 kb to one megabase (unit of length for DNA fragments equal to one million nucleotides) in length. These clones can span large portions of the genome rapidly, but can be highly unstable

yearling - a one-year-old individual in its second year of life

yeast - a single-celled fungus that reproduces by budding

yellow-band disease - a coral disease characterized large rings or patches of bleached, yellow tissue on Caribbean stony corals, although tissue loss is minimal (cm/yr). It affects the star corals, *Montastraea annularis* and *M. faveolata* and is widespread throughout the Caribbean region. No pathogen has been isolated. For more information and illustrations, see: http://www.coral.noaa.gov/coral_disease/yellow_band.shtml

yolk - nutritive material of an ovum, consisting of protein and fat, stored for the nutrition of an embryo or early larva

yolk cell - in a telolecithal egg (an egg in which the yolk is not distributed evenly, but concentrated in one region), the yolk cells are the cells formed when cleavage reaches the yolk region

yolk sac - a vascularized extra-embryonic membrane of amniote embryos that forms around the yolk of the egg cell in birds and reptiles. In mammals, the yolk sac membrane grows out around the empty blastocoel (blastula cavity) formed within the inner cell mass in the cleaving embryo. The blastocoel is renamed the yolk sac. In birds and reptiles, the blood vessels in its walls transport yolk nutrients to the embryo. In mammals, these vessels still form even though they don't supply nutrients to the embryo. They remain to form blood vessels in the digestive tract

yolk-sac larva - a fish larva which has already hatched from the egg but has not yet started feeding and still absorbs the yolk in the ventrally-attached yolk sac

zeitgeber - a periodic environmental signal that entrains a biological rhythm. For example, a cycle for a circadian rhythm, but may also be a temperature or even social cycle

zoanthid - an anemone of the family Zoanthidae, usually found in intertidal areas and coral reefs . In some species the polyps separate from each other almost completely after budding, while in other species, the polyps are all interconnected by a common mat of tissue

zoarium - the form of a bryozoan colony

zoea - a free-swimming larval stage of various crustaceans



A zoea larva. (Photo: Marine Ecology Laboratory, Shimoda Marine Research Center, University of Tsukuba)

zonate - divided by parallel planes, e.g., zonate tetraspores, found in certain species of red algae

zonation - the occurrence of single species or groups of species in recognizable bands that might delineate a range of water depth or a range of height in the intertidal zone

zone - a large-scale physical feature within the ecosystem. Reef zones are determined by currents, wave surge, exposure to sunlight and water depth, and may be comprised of a number of habitats

zoecium - the skeleton of a bryozoan zooid

zooid - of the distinct individuals forming a colonial invertebrate animal, such as a hydrozoan

zooidal - pertaining to a zooid, as for example, a zooidal form

zoology - the scientific study of animal life. Zoological sciences include the studies of evolution, systematics, cell biology, biochemistry, micro and macro anatomy, development, genetics, physiology, ecology, biogeography, biodiversity, behavior and sociobiology

zoonose - a disease of non-human animals that may be transmitted to humans, or may be transmitted from humans to non-human animals

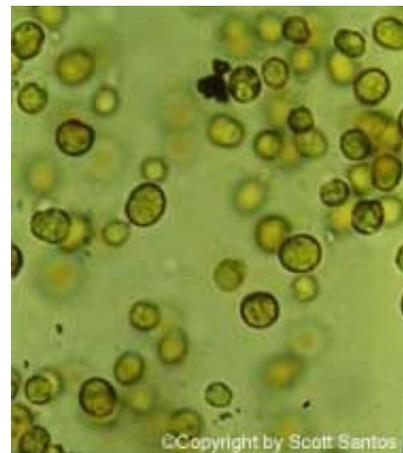
zoophyte - an invertebrate which resembles a plant in appearance or mode of growth, as for example, hard corals, sea fans, and other soft corals, sea anemones, hydroids, bryozoans, sponges, etc., especially any of those that form compound colonies having a tree-like form

zooplankton - animal component of the plankton community

zoospore - a motile, flagellated spore

zootoxin - any poisonous or venemous substance produced by an animal

zooxanthellae - a group of dinoflagellates living endosymbiotically in association with one of a variety of invertebrate groups (e.g., corals). In corals, they provide carbohydrates through photosynthesis, which are used as one source of energy for the coral polyps. They also provide coloration for the corals



Zooxanthellae. (Photo: Scott Santos)

zooxanthellate coral - a coral that has zooxanthellae in its tissues

zygote - a fertilized egg with the diploid number of chromosomes formed by the union of the nuclei of male and female gametes



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