Largest phylum of kingdom animalia

Wayne's Word Zoological Trivia For November 2001 This survey of the animal kingdom is dedicated to Dr. Nancy M. Jessop (1926-2001), respected colleague, zoologist incredible and dear friend as I spent many hours exploring tropical ecosystems. [W.P.A.] The following phyla of multicellular animals (called metazos) is usually included in general biology courses. Remember that the botanical counterpart of a phylum is called a division. Single-celled animals (called protozoa) are usually located in the realm of Protista along with divisions of single-celled and multicellular algae. Real multicellular animals are usually without cellulose cell walls and photosynthetic pigments, and they form diploid embryos that develop from a blastula stage. The blastula is a hollow, fluid-filled sphere bounded by a single layer of cells that surround a central cavity or blastococcal. Blastula develops from a spherical cluster of cells called a morula. In addition, animals are capable of movement or body movement with the help of contractile muscle tissue. In a cross-sectional view, animal embryos consist of an outer layer called ectoderm, an intermediate layer or mesoderm, and an internal layer or sothopical that surrounds the digestive cavity. Multicellular animals are heterotrophic when ingesting food in a body cavity (coelom) that is completely fed by the mesoderm. Primitive phyla without a true coelom includes Porifera and Coelenterata (Cnidaria). Animal phyla is classified according to certain criteria, including type of coelom, symmetry, body plan and presence of segmentation. Sponges (Porifera) have a primitive cellular level of organization and lack tissue and symmetry. They rely on a stream of water through the body to obtain food. Cnidaria and comb jelly (Ctenophora) have radial symmetry and a saclike body consisting of two tissue layers derived from bacterial layers ectoderm and endoderm. Cnidaria usually develops a polyp body plan (e.g. Hydra) or a medusa body plan (e.g. jellyagus), or they alternate between these two forms (e.g. Obelia). In species with both polyp and medusa, the polyp is the assexual form while medusa contains the genitals. Flatworms (Platyhelminthes) and band worms (Nemertea) have tissues and organs derived from a third bacterial layer called mesoderm. They have the organ level of organization and are bilaterally symmetrical. Planaria are free-living predators, but flukes and tapeworm are adapted to a parasitic lifestyle. Flatworm (planarian) is an acoelomate because it does not have a coelom in its mesoderm layer. Its crucily cavity is surrounded by the ensermic layer. Rundorms (Nematoda) and rotifers (Rotifera) have a body cavity (coelom) where organs are found and that can serve as a hydrostatic skeleton. Their coelom is called a pseudocoelom because it is not completely fed by mesoderm. Roundworms are non-segmented worms that include many common parasites. The rundormen is a because it does not have a complete coelom in its mesoderm layer. In other words, coelom is not completely fed by mesoderm layer (blue). All complex animals have a real coelom, including molluscs, annelids, arthropods, echinoderms and chordates. They have a real coelom that is completely fed by mesoderm made. The internal organs of a true coelom are more complex, and they are kept in place by mesentaries. (annelid) is a coelomate because it has a true coelom in its mesodermlag. In other words, coelom (white) is completely enclosed in the mesoderm layer (blue). Coelomates have more complex internal organs and a muscular intestine (intestines) derived from mesoderm. Phyla with a true coelom and digestive system is divided into two groups, protostomas and deuterostomes. As the hollow sphere of cells known as a blastula develops, an invagiation produces an opening called blastopore. In protostomer, blastopore becomes the mouth. In deuterostomer, blastopore becomes an anus, and only later forms a new opening mouth. Coelom also develops differently in the two groups. In protostomas, the mesoderm occurs from cells located near the embryonic blastopore, and a splitting occurs that produces coelom, called a schizocoelom. In deuterostomer, coelom occurs as a pair of mesodermic bags from the wall of the primitive intestine. The bags are enlarged until they meet and merge, forming an enterolom. Protostomes include phyla Mollusca, Annelida and Arthropoda. Deterostomer includes phyla Echinodermata, Hemichordata and Chordata. Gastrulation in protostome and deuterostomembryos. In protostomas, the first place of ingrowth or invagation (blastopore) becomes the mouth. In deuterostomer becomes the first place of ingrowth or invagiation (blastopore) anus. There are more than one million animal species in at least 30 phyla, more species than all the other kingdoms combined. Only 21 phyla is outlined on this short page. More than half of all animal species are insects (800,000 species), and beetles (300,000 species) make up the largest order of insects. In fact, a fifth of all the 1.5 million species of plants and animals on Earth are beetles. If all species of plants and animals on earth were lined up randomly, every fifth species would be a beetle! See The remarkable world of beetles Multicellular animals have a dominant diploid life cycle (diplontic cycle) with haploid generation reduced to eggs and sperm. Sexual reproduction can involve monoecious species where members of the population are bisexual (hermaphrlic) with sperm-bearing testicles and the egg-bearing ovaries of the same person. Hermaphroditic species are capable of self-fertilization, but most species exchange sperm by cross-fertilization between different individuals. Some of the different phyla of worms contain hermafrodic species. Most animal species are dioecious with populations containing unisexual male and female individuals. See Diplontic Human Life Cycle Fertilization in Animals may be external or internal. In case of external fertilization, eggs and sperm are released outside the animal's body, usually in water where fertilization occurs. In internal fertilization, the sperm is deposited during copulation in the female reproductive canal where fertilization later takes place. Multicellular animals have three variations at the site of embryo development and source of nutrition. Embryonic development occurs externally in oviparous animals regardless of the place of fertilization (e.g. many aquatic invertebrates, most insects, all birds). In ovovipivarous animals, fertilization and embryonic development occur internally, but the female does not contribute nutrients to the embryo during development (e.g. some insects, lizards and snakes). Fertilization and embryonic development also occur internally in viviparous animals; But the female (mother) contributes nutrients to the embryo during development (e.g. most mammals). In placental mammals, the developing embryo and fetus are attached to the mother's uterine wall by a placenta. In, the small embryos crawl out of the mothers' vagina and into a bag (marsupial) containing pacifiers. Nourished by the mother's milk, they complete their embryonic development in. There are several methods of gender determination in animals. In most dioecious mammals are determined by the father's X-bearing and Y-bearing sperm. Birds, some fishes, caddisflies and lepidopterans (moths and butterflies) have a similar method, except that the female (hen) determines the offspring's sex because she produces X-bearing and Y-bearing eggs. In this case, the woman has the outstanding pair of sex chromosomes, while the male has the matching pair. [Note: Some references use different letters to express the male and female chromosomes of domestic birds.] Males of some insects (such as locusts and true bugs) have X-carrying sperm and X-less sperm without an X chromosome. If X-less sperm unites with an X-carrying egg, the resulting offspring will be a man with one X chromosome. Female offspring (XX) develop from X-carrying eggs fertilized by X-carrying sperm. In many hymenopterns (including honey bees and wasps), haploid (n) males develop parthenogenetically from unfertilized eggs, while diploid (2n) females develop from fertilized eggs. Haploid men have only one set of chromosomes and lack genetic variation of diploid females. All the genes of men are expressed, regardless of whether they are dominant or recessive properties. Class OfAnimal Fertilization Site Of Embryo Development External Internal Oviparous Ovoviparous Viviparous Fish Yes No Yes No No Amphibians Yes No Yes No No Reptiles No Yes Yes Yes No Birds No Yes Yes No No Mammals No Yes Platypus No Yes Insects No Yes Yes No Aphids reproductive patterns in vertebrates and insects. Animal Male Male Human 44 Autosomes + X & Y Chromosomes 44 Autosomes + Two X Chromosomes Domestic Bird 16 Autosomes + Two X Chromosomes 16 Autosoms + X & Y ch romosomer Locusts 22 autosomes + one X chromosome 22 autosomes + two X chromosomes Honey Bee Drone (n = 16) Worker (2n = 32) Four methods of gender determination in animals. A. Invertebrates Phyla Parazoa: Simple animals without digestive cavities. Simple multicellular animals that spend their lives anchored to a rock or seabed; they are mostly marine, but some species live in freshwater; sponges have radial symmetry with a cylindrical, globose or irregular body containing an internal skeleton of minutespcules made of calcium carbonate, silica or a fibrous collagen protein called spongein; the surface contains many pores that connect ducts and chambers fed by flagellated collar cells (choanocytes); sponges are filter feeders, taking in microscopic plankton of miniature currents created by choanocytes; sponges are divided into three classes: Class Calcarea (chalk sponges) with calcareous spicules; Class Hexactinellida (glass sponges) with siliceous spicules; and class Demospongiae (horn sponges) with a skeleton of spongeine or none; Calcareous and siliceous sponge spicules often become components of tropical beach sand. Two examples of marine sponges. The surface contains many pores associated with ducts and chambers fed by flagellated cells called choanocytes. Sponges are filter feeders, taking in microscopic plankton of miniature currents created by choanocytes. Enterozoa: Animals with digestive cavities or intestinal tract. Radiata: Radial symmetry, lacking the central nervous system. Marine and freshwater animals with radial symmetry; This phylum has two different body shapes: a solitary or colonial polyp and a bell-shaped, free swimming medusa; both polyps and medusae are often frayed with stinging tentacles; tentacles carry rows of prickly cells or cnidoblasts, each of which contains a prickly organelle known as a nematocyst; some coelenterates (Obelia) have both polyp and medusa stages in their diplontic life cycle; coelenterates are divided into three classes: Class Hydrozoa (hydroids), including freshwater hydra, Obelia and colonial Physalia (Portuguese warman) with stinging tentacles and a bladder-like air float; Class Scyphozoa (jellythes); and class Anthozoa (sea anemones and corals); in real corals, the individual tentacle-bearing polyp lives inside a lime chamber that it secretes; extensive, contiguous colonies of coral polyps form massive calcareous reefs in shallow tropical waters; coral reefs support entire animal communities that rely on photosynthetic activity of single-celled zooxanthellae that live within coral polyps; no ecosystems other than the tropical rainforest rivals coral reefs in terms of complexity and productivity. Zoology textbooks often include a fourth grade of cnidarians as box jelly boxes (class Cubozoa). These jellysish have a characteristic squarish medusa. The class Cubozoa includes the deadly Australian sea wasp (Chironex fleckeri). If the deadliest poison is measured by how long it takes a person to die, then this species is certainly one of the world's deadliest. Depending on the extent of envenomation, the sea wasp can inflict unbearable stings that can cause death within five minutes. Ingenious Australian swimmers and snorkelers have developed a complete nylon body suit made from two pairs of panty snake, one set in the usual way; and the other put on above hands, arms and torso, with a slit for the head. Strangely, the deadly nematocysts of Chironex do not stick through the panty snake, but watch out for the run! The toxin of jellythesis nematocyster is a complex mixture of proteins, enzymes, polypeptides and tetramine. Pain and local histamine release of some jellyatric stings is attributed to 5-hydroxytryptamine, one of the ingredients in the stinging trichomes of nettles. The mechanism that causes cardiac and respiratory failure in sea venom is unclear. It can be caused by blockage of nerve impulses at synaptic junctions, similar to the action of curare. A marine rocky coral depicting the many lime chambers that were once occupied by tentacle-bearing polyps. Colonies of rocky corals are important reef builders in warm, tropical waters. Reef corals can form (1) fringing reefs that extend out to 0.4 kilometers from land; (2) barrier reef separated by a lagoon of considerable width and depth from a beach; and (3) atolls or circular reefs that surround a lagoon of water and do not envelop an island. A wide variety of marine invertebrates, including sponges, jellyfish, sea anemones, corals, gastropods and turbellarians harbor in them golden spherical cells called zooxanthellae. The photosynthetic activity of these symbiotic algae cells is essential for the survival of the individual coral animals and the entire reef ecosystem. Zooxanthellae includes several species of single-celled algae in the order Zooxanthellales within the algae division Pyrrophyta (also spelled Pyrrhophyta). The term zoochlorellae refers to several species of symbiotic single-celled green algae of the division Chlorophyta. Along the Pacific coast of North America, zoochlorella produces the green color in sea anemacetles. A pristine tidal pool along the Oregon coast in North America. A. Purple sea urchin, B. Blood Starfish, C. Coralline red algae, D. Six-rayed starfish, and E. Sea anemone. Tentacles of sea anemone contain zoochlorellae, symbiotic green cells of the algae division Chlorophyta. Small, colorful fish called damselfish or anemone fish have developed a mutually symbiotic association with large sea anemones. A mucous, mucous coating on the body of the fish somehow inhibits the release of nematocysts along the tentacles of the sea anesthetic. These small fish get protection from predators by swimming down Tentacles. The anemon benefits from the movements of the symbiont, which loosens silt and attracts other fish into the deadly thickness of tentacles. A sea anemone and its symbiotic anemone fish. See the infamous Air Fern Go to algae divisions Single marine animals with transparent biradially symmetrical bodies; externally, there are eight plates of molten flickering hair resembling long combs; rows of ciliated battle leaves are used for movement; most of the body consists of a jelly-like material called mesoglea; digestive cavity (gastrovascular) has branched ducts; unlike coelenterates, comb jelly does not have nematocysts; an Atlantic coastal species (Mnemiopsis) shows bioluminescence, release of light by organism or population of organisms. This phenomenon involves oxidation of luciferin in the presence of ATP and the enzyme luciferase. Examples of bioluminess include dinoflagellates that cause red tides, lightning bugs (beetles), glowworms (beetle larvae) and deep-sea fisherman fisherman. Three comb jelly (ctenophores). Comb jelly resembles small hot air balloons (the size of a walnut or smaller) with eight rows of melted flickering hair (match leaves) stretching down the sides. They run their mouths first of the eight rows of fighting. Ctenophores superficially resemble miniature medusae (phylum Cnidaria); However, most medusae asexually arise from a polyp generation and ctenophores have no polyp stage in the life cycle. Tentacles extending from the mouth contain glue cells or colloses containing spiral strands that snare small fish and crustaceans with an glue-like material. With the exception of a species, ctenophores do not have prickly organelles (nematocysts) of jellyfish and sea anemones. During the day, ctenophores flash prismatically as their ciliary plates break light; at night they are often bioluminescent, glowing like small lamps. Bilateria: Bilateral symmetry, with central nervous system. Note: Phylum Echinodermata with radial symmetry. Acoelomata: No body cavity (coelom). The body flattened, leaf or ribbon-like, bilaterally symmetrical; digestive tract branched and without anus, or absent in parasitic forms; this phylum is divided into three classes: Class Turbellaria (free-living flatworms); Class Trematoda (flukes); and class Cestoda (tapeworm). The life cycle of a human tapeworm: 1. A man eats a poorly boiled piece of beef containing the encysted bladderworm (tapeworm cyst) in the skeletal muscle tissue. The young tapeworm attaches to the man's intestinal wall at its smaller, anterior end called scolex. Scolex anchors the bende worm to the host's intestinal wall with four suckers. Note: Some early diet pills actually contained a tapeworm cyst enclosed in a gelatin capsule, before they were banned by the Food & Drug Administration. You can take the pill and eat as much as you want without gaining weight! Of course, you were actually feeding a large tapeworm that can be Dangerous. Tapeworm grows by sprouting as scolex produces flat segments called proglottids. A human tapeworm can contain hundreds of proglottids and be several feet in length. Tapeworm competes with the host for nutrients. Large tapeworm can prevent the food passage, and if their scolex penetrates into the intestinal lining, bacterial infection can occur. 2. Tapeworm is hermafroditic and each mature proglot time contains a complete male and female reproductive system. Self-fertilization can occur, or cross-fertilization between proglot times of different worms can also occur. A single ripe proglottid can contain more than 100,000 eggs. The annual production of a worm is about 500 million eggs and the worm can continue this production for 20 years or more. Proglottids filled with embryonic eggs (containing embryos) break off and are released with human feces. 3. If human sewage is released on pasture land, embryo-bearing, bendelormegg can be consumed by cattle while grazing. Within cattle, the larva hatches into a six-heked oncosphere stage that penetrates into the intestinal wall and eventually ends up in striated muscle tissue where it encysts. In the cyst, the larva develops into bladderworm, a miniature tapeworm complete with scolex and attachment structures. If striated muscle tissue (poorly cooked beef) is eaten by another person, an encysted bladder worm can take up residence in the new person's intestine. There are literally hundreds of different species of tapeworm, and they infect cattle, sheep, dogs, cats, pigs, fish and many other animals. 4. Much more serious than infection with an encysted bladderworm is the intake of tapeworm eggs directly. If the eggs are swallowed, oncosphere larvae migrate through the body not only skeletal muscles, but also into the heart, brain and other organs. Larvae of the dog's tapeworm (Dipylidium caninum) live inside the bodies of fleas and lice. If eggs from this dangerous tapeworm are entred, the worm can invade vital organs such as the brain. The habit of kissing the lips and tongue of a dog is somewhat questionable, especially considering their habit of biting fleas and licking themselves and other dogs in anal-genital regions. Another story to gross you out involves a loving cat who liked to rub against my arms while patting her. One day I noticed a small flat object on my elbow that happened to be a fresh proglottid from a tapeworm inside the intestine. Human tapeworm can be several meters long. In fact, a reported case at a medical clinic in San Diego County is astounding. One man noticed a long white ribbon in his stool and thought he had swallowed his pajamas during the night. The white tape turned out to be a tapeworm! Is this a (1) wet pajamas draw string, (2) a long noodle, or (3) a human tapeworm? The answer is (3), a 20 inch (50 cm) human tapeworm. The small head or scolexet from which the segments (progot times) arise is clearly visible in The presence of a scolex is good evidence that the entire worm has been discharged from the host's intestine. Each proglot time contains a complete male and female reproductive system. In fact, a proglottid can contain literally thousands of eggs. Enlarged view (30X) of the human tapeworm shown in the image above showing the front end or scolex. Scolex carries four circular suckers that firmly anchor tapeworm to the host's intestinal wall. Scolex produces proglottids at budding, which gradually enlarges as more segments are formed. Free-living marine worms with a distinctive eternal proboscis consisting of a long, hollow tube; the unsegmented body is covered with flickering hair; As flatworms, pilworms are acoelomates (without coelom), but they have a complete digestive system. Pseudocoelomata: Coelom incomplete. Rotifers are common microscopic animals that live in freshwater, especially among plants and debris; The rotating flicker hairs at the front end resemble the head of an electric shaver. Microscopic aquatic animals similar to rotifers, but with a more flat body; they are planktonic organisms that live among algae and debris. The adults are very long, thin, hair-like worms that live freely in water; the immature (larva) stage is usually parasitic on insects; people once thought that dark hair from a horse's tail on a waterhole miraculously came to life; these so-called hairs were actually horsehairworms. A large phylum of worms, often called round worms or thread worms; free to live in soil or water, with many parasitic forms on plants and animals, including hookworms (Necator & Ancylostoma), pinworms (Enterobius), human ascaris Ascaris lumbricoides and trichinose worm Trichinella; hookworm larvae dig into the skin between the toes and eventually migrate into the intestines; the disease trichinosis is caused by eating undercooked meat (especially pork) containing microscopic cysts of larval Trichinella spiralis; if inlet larval cysts can eventually migrate into skeletal muscle tissue; elephantiasis is caused by minute filariale worms of the genus Wuchereria that invade lymphatic vessels; filarial worms prevent the flow of lyphatic fluids that cause body extremities to swell to enormous proportions; microscopic filarial larvae that cause elephantiasis are spread by bloodsucking female mosquitoes; Other feared parasitic worms in the phylum include guinea worm (Dracunculus medinensis) and the giant kidney worm (Diocese kidney). Root-Knot Nematode: A Serious Pest Of Horticultural & Field Crops Small round worms that are intestinal parasites of vertebrates, usually with crustaceans or insect as an alternative host in young stages of their life cycle; a proboscis on the front end is covered with hooks for attaching to the wall of the intestine. Eucoelomata: Body with a true coelom. Bryozoans form coral-like colonies in the ocean and freshwater; they are often called moss animals because their delicate branched colonies; each animal has an edge of tentacles around its mouth, occupying a separate chamber similar to the individual chambers of coral polyps; Freshwater bryozoans produce disk-shaped, chitinous reproductive organs called statoblasts that are sometimes very abundant are wolffia samples. Green Wolffia Plants & Brown, Disk-shaped Statoblasts Protostomia: Blastopore forms mouth, schizocoelom present. Tardigrades belong to a remarkable phylum of minute multicellular animals. They are adapted to extreme conditions, some of which are more serious than any earth environment. Does their origins defy natural selection? Tardigrades are microscopic, water-dwelling, segmented animals with eight legs. Depending on the species, they range in size from 0.1 to 1.5 mm long. They are called water bears, in reference to their stumpy legs tipped with claws, and especially their lumbering gait. More than 1,000 species have been described. They occur all over the world in some of the most inhospitable places, from high peaks in the Himalayas (over 20,000 feet) to boiling water near heat vents on the seabed, and from the Arctic tundra to large ice fields in Antarctica. Under severe environmental conditions that would kill most creatures on Earth, tardigrades roll up into small dehydrated balls called tuns where they survive for extended periods of time. This hibernation is called cryptobiosis (or anabiosis). Their ability to survive in this desiccated state for long periods of time largely depends on high levels of non-reducing sugar depletion that protect tissue and DNA. Tardigrade physiology has led to the discovery of dry vaccines that do not require cooling and thus can be delivered and stored at room temperature. Some species can survive temperatures near absolute zero (-273 ° C) where liquids and gases freeze firmly; someone can survive temperatures up to 151 ° C (304 ° F); someone can live without water for 10 years; some can survive 1,000 times more gamma radiation than other animals (tardigrades can withstand 570,000 rads of X-ray radiation while 500 rads would kill a human); Some withstand pressures up to 6,000 atmospheres (more than the deepest ocean ditch), and some can actually live a while in a vacuum. In fact, tardigrades were taken into Earth's orbit on the Russian robotic spacecraft FOTON-M3 and survived 10 days in space. When they returned to earth and hydrated, many actually laid eggs that hatched normally! Lateral (side) display of the exoskeleton of an aquatic tardigrade (Hypsibius sp.) containing 5 eggs. There are 4 pairs of stout, stumpy legs, each tipped with several slender claws. The name water bear refers to its deliberate pawing kind of movement. Thomas Huxley, English naturalist and good friend of Charles Darwin, gave tardigrades this name in 1869. Photographed with a Sony W-300 digital camera through an Olympus laboratory-grade composite microscope (400x magnification). Advocates intelligent design believes that tardigrades defy evolution by natural selection because they are adapted to extreme conditions, some of which are more serious than any earth environment. Creationists argue that natural selection can only choose properties necessary for immediate survival. Therefore, evolution cannot be expected to over-equip species for a variety of environments that they have never encountered. Proponents of the panspermia hypothesis believe that tardigrades had an extraterrestrial origin, although DNA sequencing data indicate that phylum Tardigrada (tardigrades) is a sister clade with phylum Arthropoda (arthropods), and both phyla (Tardigrada + Arthropoda) form a sister dressed with phylum Onychophora (velvet worms). A strong case for supporting the development of overequipped species is gene duplication in diploid organisms that greatly increases genetic variation. One of the truly remarkable examples of gene duplication is the antibody-mediated immune system of animals. Gene duplication is a plausible explanation for how organisms can produce antibodies against different antigens, even synthetic antigen proteins that animals have never been exposed to. Using this model, animals would not need separate genes for every antigen they will ever encounter. This mechanism goes far beyond the simple development of adaptations based on Darwin's theory of evolution using natural selection. See Mechanism of immune antibody production An aquatic tardigrad of the genus Hypsibius. Its length is about 184 microns (microns), about the same length as the hair follicle mite Demodex brevis. It is much smaller than a grain of communal table salt (NaCl). The image was enhanced with Photoshop to get details out about the claws. Magnification 400x. Primitive marine bivalve animals attached to rocks of a fleshy stem; brachiopod shells are abundant in the fossil record, dating back to the Cambrian period (500 million years ago). There are about 280 species of living brachiopods, only a fraction of the 30,000 described fossil species that flourished during the Paleozoic and Mesozoic eras. My college invertebrate paleontology textbook contains a long chapter dedicated to Brachiopoda, with literally hundreds of illustrations of extinct brachiopods. Although superficially similar to bivalve molluscs, they are actually quite different. In brachiopods, the two valves envelop the body dorsalt and ventrically instead of lateral as in molluscs. The bivalve shells can be hinged (articulated) or without hinges (inarticulate). In addition, the ventral valve is usually larger than the back case, and is usually attached to the substrate directly or using a wire-like stem. Left. Mesozoic rock from Arizona shows many brachiopods, evidence of a shallow sea along a continental shelf. Right. An articulated (hinged) brachiopod. Body soft with bilateral symmetry, often covered by a cloak that secretes a calcareous usually with an anteria head and a ventral muscle foot for movement; divided into five classes: Class Amphineura (chitons); Class Scaphopoda (toothshell); Class Gastropoda (univalve molluscs including snails and limpets); Class Pelecypoda (bivalve molluscs); and class Cephalopoda (squid and squid). Gastropods shells (cowries and cone shells) from the South Pacific island of Moorea and Tetiaroa Atoll in French Polynesia. The lower right shell is from a country snail. The usual garden snail (Helix aspersa). This snail was introduced in California in the 1850s by European immigrants for use as food. It turned out to be a poor substitute for the edible snail (escargot) served in French restaurants (Helix pomatia). It has since become well established and a major nuisance in California gardens. Homeowners spend more money to eradicate this creature than all other ingrained together. The head has two pairs of retractable tentacles. The longer, the upper tentacles have each eye on the tip. The shorter, lower tentacles carry chemosensory organs (corresponding to taste and smell). The ventral side contains a mouth with a rasping tongue (radula) for feeding. This snail is hermafrodic (bisexual) with both male and female genitalia. Although it is capable of self-fertilization, the normal method is cross-fertilization between two mating partners. The snail moves by gliding the impact of its large muscular foot. Mucus is excreted from the mucous glands of the foot providing a lubricant to facilitate movement, leaving a silvery mucus path. Snail mucus is used in snail cream cosmetics. The cream is used to treat damaged skin and as skin moisturiser. Body elongate and consists of many segments, each segment with nice bristle-like setae for movement; divided into three classes: Class Polychaeta (clamworms); Class Oligochaeta (earthworms); and class Hirudinea (leeches). The formidable bloodworm (Glycera), a predaceous intertidal worm (phylum Annelida) with four chop-thinking jaws on the front end (red arrow). The hollow fangs inject poison from poison glands into the prey. The elongated body consists of many segments, each segment with fine bristle-like setae for movement. This interesting worm lives in tubular gallaries constructed in muddy bottoms. Lying on the nap in the tube, the worm can detect the surface movements of prey by changes in water pressure. It moves slowly to the opening of its cave and then grabs its prey, such as small crustaceans and other invertebrates, with its proboscis. Proboscis can be expanded to about a fifth the length of the body. When withdrawn, the proboscis occupies approximately the first 20 body segments. During the capture of prey, proboscis is everted with explosive force, and the four poison fangs appear at the tip. Body slim, gourd-shaped; anterior end retractile, with short hollow tentacles around the mouth. Peanut worms (phylum Sipunculoidea) are named after the shape when for example when handled. These interesting worms live in burrows under rocks in the intertidal zone. They are sometimes very abundant in tunnels they carried in coral-line rocks, reportedly up to 700 per square foot in some Hawaiian reefs. The slender front end has a mouth surrounded by hollow tentacles. The body consists of head, thoracic and stomach with three or more pairs of joint bones; chitinous exoskeleton covering all body parts, melted at intervals; divided into seven major classes: Class Onychophora (walking worms); Class Crustacea (shrimp, crabs and rur); Class Insect (insects); Class Chilopoda (centipedes); Class Diplopoda (millipedes); Class Arachnida (spiders and ticks); and class Merostomata (horseshoe crabs). See an extinct Cambrian trilobite from Utah Ostracods belongs to Arthropod Class Crustacea Order Ostracoda These microscopic objects are not eggs. They are the dead, chitinous, bivalve karapaces of minute crustaceans called mussels or seed shrimp. When they were alive, a small shrimp-like animal occupied every white matter. They belong to the order Ostracoda which is considered a class in some textbooks. Another order of minute crustaceans (Conchostraca) is called clam shrimp; However, the bivalve carapace of an ostracod is more strikingly similar to a clam shell. The photo was taken along the coast of a desiccated vernal pool in the Santa Rosa Plateau in Riverside County, California. Brine shrimp belongs to Arthropod Class Crustacea Order Anostraca A thriving population of brine shrimp (Artemia monica) in Mono Lake, California. These small crustaceans belong to the order Anostraca, along with endangered fairy shrimp (Branchinecta). During the summer months, the shoreline of Mono Lake is colored pinkish-red by massive colonies of brine shrimp. Phalarope (right) swims in circles as it feeds on brine prawns. An endangered fereker in San Marcos Vernal Pools A common Southern California daisies (Scolopendra polymorpha). The name tusenfip is derived from the Latin words centi (100) and pede (foot). Centipedes belong to the class Chilopoda in phylum Arthropoda. Adult centipedes in North America may have fewer or more than 100 legs, one pair per body segment. Centipedes are the only animals with legs modified into captive poison jaws (toxicsicognaths) that inject poison to suppress and kill prey. Modified foreliries, called prehensors, lie under the head. Glands inside the prehensors release poison into ducts that lead into fangs. The last couple of legs are longer than the others. Some species use these to suppress prey or as defensive pincers. The posterior body segment with its unique pair of legs superficially resembles the head. This pseudohead found in some species can serve to confuse potential predators by misleading their attacks to a less important part of the body, thereby leaving the head free to bite the attacker. A common question that students ask is can centipedes I can personally confirm that they actually have powerful fangs and can inflict a painful bite, especially larger species shown in the following two images. Enlarged view on the underside of a centipede (Scolopendra polymorpha) showing a pair of captive poison jaws or toxic gnats (red arrow). These are actually modified foreliries that inject poison. A large Southern California millipede (probably Hiltonius pulchrus), a member of the class Diplopoda in phylum Arthropoda. Diplopoda means double-footed, referring to two pairs of legs on each body segment. The name millipede is derived from the Latin words milli (1000) and pede (foot). In fact, adult centipedes in North America can have up to 750 legs, usually two pairs per body segment. Unlike centipedes, most millipedes are harmless detritides (detritivores) and feed on rotting vegetation. The limulus polyphemus live in shallow waters along the Atlantic coast and gulf of Mexico. It belongs to the class Merostomata in subphylum Chelicerata. The horseshoe crab is a living representative of the lower class Xiphosura, a line of aquatic chelicerates dating back to ancient Cambrian seas 500 million years ago. Subphylum chelicerata is characterized by arthropods with acephalothorax, no antennae and jaws called chelicerae. In addition to the horseshoe crab, this subphylum includes the large class Arachnida (spiders, scorpions, ticks and mites). Another large subphylum, Mandibulata, is characterized by a head, thoracic and stomach, paired antennae and jaws called mandibles. It includes the class Crustacea (lobster, crabs and rur), class Insecta (insects), class Chilopoda (centipedes) and class Diplopoda (millipedes). A solar spider or solarpugid (order Solpugida), an interesting member of subphylum Chelicerata in the class Arachnida. Unlike true spiders (order Araneae), solarpugid has two pairs of formidable, scissor-like jaws called chelicerae (red arrow). The jaws are arranged vertically instead of the only pair of horizontal jaws in most spiders. The elongated pair of front attachments are pedipalps, each tipped with a suckers used to catch prey and climb slippery surfaces. Sunpugids are extremely greedy predators, even attacking and killing other large, webless spiders, like wolf spiders. With their twin pairs of large, powerful jaws, crushes and solarpugids literally their prey to shreds. Close-up of the front end of a tarantula (Aphonopelma) showing two sharp fangs (red arrow) extending from the jaws or chelicerae. This spider is a man because the pedipalps are tipped with a sharp pointed, bulblike kopulatory organ (purple arrow). During mating, the male inserts sperm into an opening on the underside of the female with the help of the pointed coptic organs of the pedipalps. Several dense spaces, orange eyes can be seen on the front of the head (cephalothorax). Tarantula kills his prey by smashing and them with poison through their hollow fangs. Although it is a large spider, the tarantula is hunted and killed by a large black wasp with bright red wings known as the tarantulahawk (Peplis). Deuterostomia: Blastopore forms anus, enterocoelom present. Small, transparent marine worms with brushes or hooks around the mouth; they have the pair find on the main body trunk and a terminal tail find for movement; Although they are very small, they have well-developed digestive and sensory systems, and a true coelom. Close-up of several arrow worms (phylum Chaetognatha). These planktonic marine animals are only about 5-10 mm in length, about the size of duckweeds of the genus Wolffiella. They have a torpedo-shaped body with lateral and tail fins that superficially resemble the feathers of an arrow. The head is covered by a rounded hood that is pulled back when the arrowworm flows. During feeding, the pilormaints small herbivoric organisms, including copepods and other chaetognaths, with small spines or bristles around the mouth. The body is symmetrical, usually 5-parted around an oral-aboral axis; body wall with lime plates, often with outer spines; coelom includes water vascular system and external tube feet for movement; divided into five classes: Class Crinoidea (sea lilies); Class Asteroidea (starfish); Class Ophiuroidea (crazy stars); Class Echinoidea (sea urchins and sand dollars) and class Holothuroidea (sea cucumbers). Two well-preserved, fossilized echinoderms. Left: A 40 million-year-old (Eocene Epoch) sea biscuit (Eupatagus ocalanus) from Ocala limestone (Marion County, Florida). Right: A 7 million-year-old (Pliocene Epoch) sand dollar (Millitella californicus) from Baja California, Mexico. Both of these organisms belong to the class Echinoidea together with sea urchins. A small group of marine invertebrates that were once thought to have a short notochord, the supportive axial rod that characterizes phylum Chordata; hemichordates have gill openings or fearygeal ravines that are also found in chordates. Having at some stage of development an axial rod-like notocord for the support of the body; chordates also have a single back-slang-shaped nerve conduction, paired gill openings between the pharync and the exterior, and a tail behind the anus; divided into three large subphyla: Subphylum Urochordata (tunicates); Subphylum Cephalochordata (lancet); and Subphylum Vertebrata (vertebrate). B: Vertebrate: Subphylum Vertebrata With skull (skull) and spinal column consists of segmented vetebrae; skeleton consisting of cartilage or real calcareous bones; divided into eight large classes: Class Agnatha (jawless fish); Class Placoderms (armored fish); Class Chondrichthyes (cartilaginous tissue including sharks and rays); Class Osteichthyes (legfish); Class Amphibians (amphibians); Class Reptilia (reptiles); Class Aves (birds); and class mammals (mammals). Garibaldi (Hypsypops rubicundus), a bright orange fish of the shallow water coast of California. Like California's state flower (golden poppy) and state freshwater fish (gold trout), garibaldi has been chosen to be the state's official marine fish. [Photograph courtesy of Dave Randle] The following protists are often included in the zoology course they are located in Phyla instead of divisions of zoologists: 1. Phylum Sporozoa (parasitic protozoa): eg malaria 2. Phylum Ciliophora (Ciliated Protozoans): e.g. paramecia 3. Phylum Rhizopoda (Amoeboid Protozoans): e.g. amoeba 4. Phylum Zoomastigophora (Flagellate Protozoans): e.g. trypanosomes See representative images of Protozoans Barnes, R.D. 1980. Invertebrate zoology. W. B. Saunders Company, Philadelphia. Borror, D.J. and D.M. DeLong. 1964. An introduction to the study of insects. Holt, Rinehart and Winston, New York. Jessop, N.M. 1988. Zoology (Schaum's disposition series). McGraw-Hill Book Company, New York. Margulis, L., K.V. Schwartz and M. Dolan. 1994. They illustrated five kingdoms: A guide to the diversity of life on Earth. HarperCollins College Publishers, New York. Storer, T.I. and R.L. Usinger. 1957. General zoology. McGraw-Hill Book Company, Inc., New York.