DOWNLOAD PDF TERRESTRIAL VERTEBRATES

Chapter 1 : Terrestrial Vertebrates

A terrestrial vertebrate is any organism that possesses a spinal column or vertebra and lives predominantly on land. However there are exceptions to every rule such as in the case of birds.

Insects, spiders and crustaceans phylum Arthropoda Snails, clams and squid phylum Mollusca Starfish and sea urchins phylum Echinodermata The invertebrates are worth mentioning because they represent the evolutionary history of the vertebrates. Some people find it intriguing that, of the invertebrates, our closest relatives are starfish and sea urchins. The vertebrates are actually a subphylum within the phylum Chordata. Chordates are characterized by having a nerve cord running along the length of the back. Interestingly, not all vertebrates have backbones â€" or skeletons â€" made of bone. More primitive forms, like sharks and rays, have skeletons made entirely of cartilage. How have vertebrates evolved? When scientists describe vertebrate evolution, they most often frame it as a transition from water to land. Once on land, the vertebrates are described as evolving to occupy diverse habitats and live very active lifestyles. What are some of the adaptations that made these transitions possible? The earliest vertebrates in evolutionary history are the fish. The earliest fish had no jaws â€" they sucked and rasped flesh of their prey rather than biting it. These fish include hagfish and lampreys. Fish that arose later, including the sharks and the bony fish, have jaws. Jaws represent a much more efficient and effective mode of capturing, feeding on, and swallowing prey. In order for vertebrates to succeed on land, they had to be able to breathe and move around. These adaptations are first seen in a primitive group of fish, of which a living example exists â€" the lungfish. Although they take in oxygen primarily through gills, they also have lungs. Their fleshy fins are supported by bone, and they can walk around in their habitats. The amphibians are thought to have evolved from fish like this. Watertight skin and eggs: To live exclusively on land requires the ability to avoid water loss. The next adaptations in vertebrate evolution included skin that acts as a watertight barrier. Evolving from amphibians, the reptiles are the first vertebrate group to show this adaptation. Reptiles also have what is called an amniote egg. Amniote eggs contain their own water supply and are surrounded by a leathery or hard shell. Birds, which are known to have evolved from reptiles, also have amniote eggs. Their feathers are actually modified scales. Endothermy permits a degree of independence from environmental conditions. With this adaptation, birds and mammals have further evolved to possess diverse ways of feeding, avoiding predators, finding suitable habitats, and reproducing. In the video, Dr. Douglas Zook noted an important idea. From common ancestors, each group branched into their own successful lineages. The most primitive living fish is just as successful in an evolutionary sense as the most recently evolved mammal â€" the human being.

Chapter 2 : Vertebrate land invasion - Wikipedia

Introduction. This page discusses terrestrial vertebrates and other vertebrates that bear limbs with digits rather than fins. The muscular limb characteristic of this clade generally has well-defined joints and digits (fingers and toes) and is called a chiridium.

Bring fact-checked results to the top of your browser search. Specialized chemosensory structures Many invertebrates have chemoreceptor cells contained in discrete structures called sensilla that are located on the outside of the body. Each sensillum consists of one or a small number of receptor cells together with accessory cells derived from the epidermis. These accessory cells produce a fluid analogous to vertebrate mucus that protects the nerve endings from desiccation and provides the constant ionic environment necessary for nerve cells to function properly. In some animals the sensillum and accessory cells form a physical structure around the receptor cells. Chemicals in the environment reach the receptor cells through one or more pores in this protective covering. In some invertebrates sensilla are found all over the body, including on the legs, cerci, and wing margins. In polychaetes the sensilla are often borne on tentacles. The number of chemoreceptor cells in nematodes is very limited. Caenorhabditis elegans, a small soil-inhabiting species, has only 34 chemosensory cells arranged in eight sensilla near the head. This organism also has four sensory cells in the tail, although it is not known whether these cells function as chemoreceptors. Despite the small number of chemosensory cells, nematodes are capable of responding to many different chemicals, including water-soluble and lipophilic chemicals. As in all other animals, much of their chemoreceptor capability depends on having appropriate receptor proteins in the receptor cells. However, because the number of receptor cells is limited, some of the cells must express more than one type of receptor protein. The nature of the connections made by the receptor cells with other components of the nervous system then determines the behaviour that a particular chemical will elicit. Animals with separate taste and olfactory systems Arthropods Arthropods e. Similar to nematodes, arthropods have a continuous layer of cuticle covering the outside of the body that separates the epidermis from the environment. For chemoreception to occur, the chemosensory cells must be exposed to the environment, and this is achieved through small pores in the cuticle. Most commonly the pores are in hairlike extensions of the cuticle that enclose the outer ends dendrites of the receptor cells. Two basic types of structure are recognized: These types are associated with the senses of taste and smell, respectively. Taste receptor sensilla of arthropods occur mainly on feeding appendages associated with but located outside the mouth. They often occur in groups. In addition, many arthropods have taste receptors on the legs, especially on the ventral surfaces of the tarsi feet , where they come into contact with whatever the animal is walking on. In some species similar receptors are scattered over the surface of the body and may also be present on egg-laying apparatus. It is common for four taste receptor cells to be associated with each hair; however, unlike the taste receptor cells of vertebrates, these cells have axons that extend directly, without any synapses , to the central nervous system. Arthropods are segmented animals and have a nerve ganglion in each segment, although the ganglia often become fused together. In most plant -feeding species the four cells within a hair may respond most actively to sugars, amino acids, inorganic salts, and a range of compounds produced by plants that generally inhibit feeding. These four categories roughly correspond to the human sweet, sour, salt, and bitter modalities. Bloodsucking insects have receptor cells that are sensitive to adenine nucleotides adenosine diphosphate [ADP] and adenosine triphosphate [ATP] , and some insects, such as mosquitoes and blowflies , have cells that respond to very low salt concentrations. Apart from bitter-sensitive cells, these cells usually respond to only limited ranges of compounds, even within the class of chemicals to which they are sensitive. For example, a cell may respond to glucose and sucrose but not to fructose , and amino acid-sensitive cells respond to only some amino acids. However, different cells may be sensitive to different groups of these compounds, providing many insects with the capacity to distinguish between suites of amino acids or, sometimes, different sugars. This presumably reflects the occurrence of different receptor proteins in the cell membranes, but little is known about this in insects. In the black blowfly there is evidence that the receptor cells responding to sugars have two receptor proteins, one that recognizes glucose and sucrose and another that recognizes fructose. Since both types of sugar stimulate receptors on the same cell, the fly is unable to distinguish them; a similar arrangement probably occurs in humans. If the receptor proteins were on different cells, the insect would be able to distinguish between the two types of sugar, and this is the case in some insect species. Some plant-feeding insects that feed on only one or a few closely related plant species have taste receptor cells specialized to perceive chemicals specific to the host. For example, plants in the cabbage family crucifers are characterized by a class of compounds called glucosinolates, and some crucifer-feeding insects have cells that respond only to glucosinolates, often exhibiting greatest sensitivity to the specific glucosinolates that occur in their normal hosts. Adult butterflies and adults of some plant-feeding flies may have similar receptor cells on their tarsi, facilitating the recognition of host plants on which to lay eggs. Thus, this response is not concerned with indicating the nutritional status of a plant; rather, it provides the insect with a stimulus indicating that the plant is taxonomically appropriate. Some insects also have receptor cells in their taste hairs that recognize pheromones on the surface of other members of the species. Because perception of these chemicals may have nothing to do with feeding in relation to insects , this type of perception is usually referred to as contact chemoreception rather than taste. Insects can perceive chemicals on dry surfaces. In this respect, their sense of taste differs from that of vertebrates, which generally perceive compounds in solution. Chemicals on the surface of another insect or on the surface of a leaf are not in solution and are probably conveyed from the insect or leaf surface by carrier proteins in the material covering the nerve endings at the pore. Olfactory receptors in arthropods are largely restricted to feelerlike structures at the front end of the animal. In crustaceans most multiporous hairs are on the antennules, and in insects they are on the antennae. However, in arachnids multiporous hairs occur in different positions in different groups. The olfactory receptors of scorpions are found in structures called pectines that project from the ventral surface of the second segment of the opisthosoma, and in sunspiders they are found in small flaps of cuticle called malleoli that hang beneath the basal segments of the legs. However, whip spiders and whip scorpions have the first pair of walking legs modified to form antenna-like structures that are extended in front as them as they move. Multiporous hairs are present on these antenniform legs. Some spiders are known to have a sense of smell, but the receptors have not been identified. In insects the length or complexity of the antennae is a reflection of the numbers of multiporous sensilla. In insects requiring increased sensitivity, the antennae are branched, providing a larger surface area on which more sensilla can be accommodated. The featherlike plumose antennae of some male moths , compared with the slender antennae of females of the same species, provide a high degree of surface area and thus a high degree of sensitivity. For example, in the polyphemus moth a male with plumose antennae has over 60, multiporous sensilla on one antenna, whereas a female with slender antennae has only about 13, sensilla on a single antenna. Each of the multiporous hairs contains the dendrites of two or more olfactory receptor cells, and the total number of receptor cells may be very large. An adult male cockroach can have as many as , olfactory receptor cells on one antenna, and an adult male tobacco hornworm moth may have from , to more than , receptor cells on one antenna. Some crabs have similar numbers of olfactory receptor cells on their antennules. The axons from the olfactory receptor cells run to the central nervous system, where the axons from all the cells with similar sensory properties converge to a single glomerulus, similar to vertebrates. The position of the clusters of glomeruli forming the olfactory lobe varies in the different groups of arthropods according to the body segment on which the multiporous receptors occur. In insects and crustaceans the glomeruli clusters are in the brain, but in arachnids the clusters occur in more-posterior parts of the central nervous system. In addition, the number of glomeruli varies between species. A mosquito has about 10 glomeruli on each side of its brain, whereas a grasshopper has about 1, glomeruli in total. A male cockroach has about glomeruli, and a male tobacco hornworm moth has about 60 glomeruli. On average, about 1, axons from olfactory receptor neurons converge on each glomerulus in the cockroach, and about 5, axons converge on each glomerulus in the moth. These average convergences are high, but much lower than in vertebrates 25, axons per glomerulus , although some individual glomeruli in insects may connect with many more axons. For example, in the male tobacco hornworm moth, about 60, olfactory receptor cells respond to one component of the female pheromone. The axons of all these cells converge on one large glomerulus, called a macroglomerular complex, resulting in roughly 60, axons connecting to a single glomerulus. Each olfactory receptor cell in arthropods seems to express only one type of receptor protein, similar to vertebrates. As a result, each cell responds to a specific chemical. This is best illustrated by cells that respond to sex pheromones, in which a difference in the position of a double bond between two carbon atoms can be distinguished. Many arthropods are able to respond to and differentiate between a wide range of chemical compounds, including pheromones and food-related odours. Many terrestrial species can perceive a range of common compounds with six or seven carbon atoms that are produced by all green plants as metabolic by-products. Bloodsucking insects and some plant-feeders have cells that respond to carbon dioxide , which in blood feeders can provide an important cue to the presence of a host. The characteristic odours of many plants can be perceived and, depending on the insect species, may cause an insect to be attracted to or repelled by the plant. Arthropods also perceive a wide range of odours that have no obvious direct relevance to their lives. Fish Similar to other vertebrates, fish have discrete taste and smell systems; however, since they live in water, the taste system is not confined to the oral cavity. For example, taste buds occur on the lips, the flanks, and the caudal tail fins of some species, as well as on the barbels of catfish. Regardless of where the taste buds occur on the body, they are connected to neurons in the same three cranial nerves facial, glossopharyngeal, and vagus as the taste buds in the oral cavity. In addition to the taste buds, isolated solitary chemoreceptor cells are scattered over the surface of fish. Although these cells are isolated from each other, they may occur in densities as high as 4, cells per mm2. The olfactory system of fish is independent of the respiratory system , which is unlike that of terrestrial vertebrates. Gas exchange in fish occurs via the gills , which are bathed in a continual flow of water coming through the mouth. The nasal olfactory cavities of sharks elasmobranchs are pits, one on each side of the ventral surface of the snout, located just in front of the mouth, whereas in bony fish teleosts the pits are usually on the dorsal side of the head, in front of the eyes. Each pit opens to the exterior through anterior and posterior nares; there is no connection with the oral cavity. Water flows into the nasal cavity through the anterior nares and out of the nasal cavity through the posterior nares. In garfish and puffer fish , the flow is maintained by the action of cilia on accessory cells in the olfactory epithelium. In contrast, in rockfish and some other benthic fish, the volume changes produced in the mouth by respiratory movements compress and expand accessory chambers that are associated with the olfactory epithelium, causing water to move into and out of the nasal cavity. The frequency of coughing increases in the presence of food odours, suggesting that this behaviour may be analogous to sniffing in terrestrial vertebrates. The floor of the nasal cavity is composed of folds lamellae that often form a rosette, with the lamellae radiating from a central point. The effect of the lamellae is to increase the surface area of the olfactory epithelium that lines the nasal cavity. As with terrestrial vertebrates, the number of olfactory receptor cells may be very large, up to 10 million. The axons of olfactory receptor cells run back to glomeruli in the olfactory bulb of the brain. Terrestrial vertebrates appear to have fewer glomeruli than fish. Zebra fish , commonly used in laboratory studies, have about 80 glomeruli in each olfactory bulb, and the mitral cells, which synapse with the axons of receptor cells in the glomeruli, have axons extending to several glomeruli, whereas in mammals the main connection of each mitral cell is with one glomerulus. Axons from the olfactory bulb form two main tracts, and these may reflect functional differences that in terrestrial vertebrates become separated as the olfactory and vomeronasal systems. Terrestrial vertebrates In terrestrial vertebrates the taste receptor system is generally confined to the oral cavity.

Chapter 3 : Dinosaur - Wikipedia

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This is an archived version of a Tree of Life page. For up-to-date information, please refer to the current version of this page. Terrestrial Vertebrates Michel Laurin This tree diagram shows the relationships between several groups of organisms. The root of the current tree connects the organisms featured in this tree to their containing group and the rest of the Tree of Life. The basal branching point in the tree represents the ancestor of the other groups in the tree. This ancestor diversified over time into several descendent subgroups, which are represented as internal nodes and terminal taxa to the right. You can click on the root to travel down the Tree of Life all the way to the root of all Life, and you can click on the names of descendent subgroups to travel up the Tree of Life all the way to individual species. To learn more about phylogenetic trees, please visit our Phylogenetic Biology pages. The position of Whatcheeria follows Lombard and Bolt The position of the poorly known Devonian taxa those in which the presence of digits is uncertain: Elginerpeton, Metaxygnathus, Ventastega, and Hynerpeton follows Ahlberg Temnospondyls are often thought to be early amphibians. However, notice that in this phylogeny, they are not closely related to lissamphibians. Sarcopterygii Introduction This page discusses terrestrial vertebrates and other vertebrates that bear limbs with digits rather than fins. The muscular limb characteristic of this clade generally has well-defined joints and digits fingers and toes and is called a chiridium. This group includes about extant species and a probably much greater number of extinct species. Tetrapods are only one of the several groups of chiridium-bearing vertebrates see the section on classification below. Terrestrial vertebrates have a worldwide distribution. The earliest members of this group were moderately large The oldest known skeletal remains of terrestrial vertebrates were found in the Upper Devonian of East Greenland Clack, The presence of Lower to Middle Devonian trackways in Australia has led to suggestions that this group may have originated in the Lower Devonian, at least million years ago Warren et al. The largest group of terrestrial vertebrates is Tetrapoda see the section "Classification of Terrestrial Vertebrates", below. Tetrapoda means "four feet", and the group was so-named as its members primitively had four limbs, as opposed to fins. This taxon includes about extant species of amphibians frogs, salamanders, and caecilians and approximately extant species of amniotes mammals, reptiles, and birds. The number of extinct species of tetrapods is of course unknown, but about half of the currently known species of tetrapods are extinct Carroll, Tetrapods originated no later than the Mississippian about million years ago , the period from which the oldest known relatives of living amphibians are known. Relatives of amniotes must have been present at that time, but they have not been found so far. The fossil previously reported Smithson et al. Stegocephalians see section on classification below for a definition of this group originated no later than the Upper Devonian. Tetrapods range from 9. They have a worldwide distribution and inhabit all major habitats. Most are terrestrial, but several have returned to the aquatic environment in which our distant ancestors lived. Aquatic tetrapods include various salamanders sirenids, cryptobranchids, proteids, etc. Some tetrapods are capable of flight birds and bats , while others glide, such as flying squirrels, dermopterans sometimes called "flying lemurs", even though they are not primates , and the flying dragons Draco volans. The page Life History of stegocephalians contains information on this complex topic. The main breathing organ of most stegocephalians is the lung, but other respiratory organs exist in many groups. More detail is available on the Breathing in stegocephalians page. Many stegocephalians have a tympanum for hearing high-frequence, air-borne sounds, and a lateral-line organ is found in many aquatic amphibians. For more information, see the Hearing in stegocephalians page. Characteristics Stegocephalians have an extensive fossil record Carroll, Phylogenetic studies have revealed several derived characteristics synapomorphies of stegocephalians: Loss of several cranial bones. In panderichthyids the group of sarcopterygians most closely related to stegocephalians , the skull was rigidly linked to the shoulder girdle by several bones that disappeared early in the evolution of terrestrial vertebrates. The loss of these bones also allowed the appearance of a mobile neck that allows the head to be moved relative to the trunk. This decoupling allows the head to remain relatively stable while walking. Loss of the opercular bones that cover the gill chamber in bony fishes. The operculum was no longer needed in early choanates because they had lost the internal gills of their early ancestors. However, the operculum may have disappeared before the internal gills Coates and Clack, A reduction of the notochord and a rigid spine. The vertebral centra of osteolepiforms are thin and surround the notochord a rigid rod present in all chordates and that persists in man as the intervertebral disks without constricting it greatly. In stegocephalians, the centra are thick and they constrict the notochord. Special articulatory surfaces the zygapophyses link the neural arches to each other. A shorter notochord that does not extend into the braincase. The notochord of osteolepiforms extended up to the vicinity of the pituitary. Four muscular limbs with discrete digits fingers and toes. Osteolepiforms had fleshy fins with elements homologous to the humerus, radius, ulna, intermedium, ulnare, femur, tibia, fibula, and fibulare, but the homology of more distal limb elements is uncertain, and no digits were present. A sacral rib connecting the axial skeleton the spine to the pelvic girdle the hip. This allows the weight of the body of tetrapods to be transmitted to the hind limb. There was no bony connection between the pelvic girdle of osteolepiforms and their axial skeleton. The loss of dermal fin rays the modified scales that support the fins. This simply represents the elimination of a structure that was no longer needed and may even have been harmful on land. These characters did not appear simultaneously and suddenly. The oldest known stegocephalians, such as Ichthyostega and Acanthostega, possess intermediate conditions for some of these characters and lack others. For instance, Ichthyostega retained a subopercular, a bone that was part of the opercular complex that covered the gill chamber of osteolepiforms. Acanthostega retained an anocleithrum, which is one of the elements that linked the shoulder girdle to the skull in osteolepiforms Coates and Clack, The notochord of Ichthyostega and Acanthostega extended deeply into the braincase, and most of its caudal vertebrae lacked zygapophyses Jarvik, The connection between the sacral rib and the pelvic girdle of Acanthostega was still poorly defined. Finally, both Ichthyostega and Acanthostega retain lepidotrichia in the tail, indicating that these taxa still had a caudal fin. The previous list includes only skeletal characters because all the earliest groups of stegocephalians are extinct, and soft anatomical characters can only be studied in extant taxa. The following characters are found in tetrapods, but not in other extant vertebrates: A layer of dead, horny cells that reduces evaporative water loss. This layer is present in amniotes and in most lissamphibians. A well-developed muscular tongue with glands. However, some lissamphibians have only a primary tongue, like fishes. A primary tongue is simply a fleshy fold on the floor of the mouth that lacks intrinsic muscles and with limited mobility. A parathyroid gland involved in controlling the level of calcium in the blood. A Harderian gland located anterior to the eye. This gland secretes an oily liquid that lubricates the eye. This olfactory organ is located in the palate and is probably used to smell the food in the mouth. The loss of the internal gills. The external gills present in many aquatic and larval lissamphibians are new structures and are not homologous with the internal gills of fishes. It is difficult to determine exactly when these characters appeared because they are not preserved in fossils, except for indirect clues about the internal gills, and the closest known relatives of tetrapods are extinct. However, these characters are not found in lungfishes the closest extant relatives of tetrapods. Acanthostega, a Devonian stegocephalian, still had internal gills Coates and Clack, , but no other stegocephalian is known to have had them. Therefore, internal gills were probably lost early in the evolution of stegocephalians, in the Devonian or the Mississippian about million years ago , and no tetrapod ever had internal gills. Classification of Terrestrial Vertebrates In the past, most terrestrial choanates were included in Tetrapoda Gaffney, Recently, Tetrapoda was formally defined as a crown-group Gauthier et al. A crown-group is a clade that includes the last common ancestor of two or more extant taxa, and all its descendants. In this case, Tetrapoda was defined as the clade that includes the last common ancestor of lissamphibians and amniotes, and all its descendants. According to Gauthier et al. Therefore, only a few very early terrestrial vertebrates, such as Ichthyostega and Acanthostega, were excluded from Tetrapoda. The choanate phylogeny presented here suggests that temnospondyls, embolomeres, gephyrostegids, and seymouriamorphs are not part of the crown-group. If it is accurate, these taxa are not tetrapods and the origin of the "tetrapod limb" predates the origin of Tetrapoda. In the first versions of this page, all sarcopterygians bearing digits were simply called terrestrial vertebrates because no formal phylogenetic taxonomy of this whole clade had been proposed. Such a taxonomy was recently published Laurin, a. The taxon Stegocephali that included for a long time all the vertebrates bearing a chiridium, except for lissamphibians and amniotes was defined as all choanates more closely related to Temnospondyli than to Panderichthys the closest relative of tetrapods known to have retained paired fins. Therefore, Stegocephali includes all taxa that bear digits, and a few Elginerpeton, Metaxygnathus, Ventastega, and Hynerpeton that may retain paired fins. Contrary to the old usage of this term, Stegocephali now refers to a clade. The term stegocephalian will be used below because it does not convey the hypothetical and probably somewhat erroneous interpretation that all digit-bearing vertebrates are terrestrial.

Chapter 4 : 5 Vertebrate Groups | calendrierdelascience.com

i CHECKLIST OF THE TERRESTRIAL VERTEBRATES OF THE GUIANA SHIELD Tom Hollowell and Robert P. Reynolds, editors (TH) Biological Diversity of the Guiana Shield Program.

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The following characters are found in tetrapods, but not in other extant vertebrates: A layer of dead, horny cells that reduces evaporative water loss. This layer is present in amniotes and in most lissamphibians. The keratin helps maintain layers of lipids which reduce water loss keratin itself has poor water-proofing properties. A well-developed muscular tongue with glands. However, some lissamphibians have only a primary tongue, like fishes. A primary tongue is simply a fleshy fold on the floor of the mouth that lacks intrinsic muscles and with limited mobility. A parathyroid gland involved in controlling the level of calcium in the blood. A Harderian gland located anterior to the eye. This gland secretes an oily liquid that lubricates the eye. This olfactory organ is located in the palate and is probably used to smell the food in the mouth. The loss of the internal gills. The external gills present in many aquatic and larval lissamphibians are new structures and are not homologous with the internal gills of fishes. It is difficult to determine exactly when these characters appeared because they are not preserved in fossils, except for indirect clues about the internal gills, and the closest known relatives of tetrapods are extinct. However, these characters are not found in lungfishes the closest extant relatives of tetrapods. Acanthostega, a Devonian stegocephalian, still had internal gills Coates and Clack, , and Ichthyostega may have retained them too, but no other stegocephalian is known to have had them. Therefore, internal gills were probably lost early in the evolution of stegocephalians, in the Devonian or the Mississippian about million years ago , and no tetrapod ever had internal gills. Classification of Terrestrial Vertebrates In the past, most terrestrial choanates were included in Tetrapoda Gaffney, Recently, Tetrapoda was formally defined as a crown-group Gauthier et al. A crown-group is a clade that includes the last common ancestor of two or more extant taxa, and all its descendants. In this case, Tetrapoda was defined as the clade that includes the last common ancestor of lissamphibians and amniotes, and all its descendants. According to Gauthier et al. Therefore, only a few very early terrestrial vertebrates, such as Ichthyostega and Acanthostega, were excluded from Tetrapoda. The choanate phylogeny presented here suggests that temnospondyls, embolomeres, gephyrostegids, and seymouriamorphs are not part of the crown-group. If it is accurate, these taxa are not tetrapods and the origin of the "tetrapod limb" predates the origin of Tetrapoda. In the first versions of this page, all sarcopterygians bearing digits were simply called terrestrial vertebrates because no formal phylogenetic taxonomy of this whole clade had been proposed. Such a taxonomy was recently published Laurin, a. The taxon Stegocephali that included for a long time all the vertebrates bearing a chiridium, except for lissamphibians and amniotes was defined as all choanates more closely related to Temnospondyli than to Panderichthys the closest relative of tetrapods known to have retained paired fins. Therefore, Stegocephali includes all taxa that bear digits, and a few Elginerpeton, Metaxygnathus, Ventastega, and Hynerpeton that may retain paired fins. Contrary to the old usage of this term, Stegocephali now refers to a clade. The term stegocephalian will be used below because it does not convey the hypothetical and probably somewhat erroneous interpretation that all digit-bearing vertebrates are terrestrial.

Chapter 5 : Terrestrial Vertebrates of Pennsylvania

Tetrapod-like vertebrates first appeared in the early Devonian period. These early "stem-tetrapods" would have been animals similar to Ichthyostega, [30] with legs and lungs as well as gills, but still primarily aquatic and unsuited to life on land.

The major groups of vertebrates include fishes, amphibians, reptiles, birds, and mammals. How many of you remember the Brady Bunch episode in which Peter was studying for a biology test? He asked Marcia for help, and she taught him the mnemonic: Although the vertebral column is perhaps the most obvious feature in vertebrates, it was not present in the first ones, which probably had only a notochord flexible rodlike structure which plays a role in the development of the nervous system. The vertebrate has a distinct head, with a differentiated brain and three pairs of sense organs nasal, optic, and otic [hearing]. The body is divided into trunk and tail regions. Several groups of vertebrates inhabit planet Earth. Fishes whale sharkA whale shark Rhincodon typus and a snorkeler off the coast of Australia. Today, there more than 30, species of fishes found in the fresh and salt waters of the world. Living species range from the primitive, jawless lampreys and hagfishes through the cartilaginous sharks, skates, and rays to the abundant and diverse bony fishes. Fishes range in adult length from less than 10 mm 0. Fish reproduction methods vary, but most fishes lay a large number of small eggs that are fertilized and scattered outside of the body. The eggs of pelagic open ocean fishes usually remain suspended in the open water, while many shore and freshwater fishes lay eggs on the bottom or among plants. The mortality of the young and especially of the eggs is very high, and often only a few individuals grow to maturity out of hundreds, thousands, and in some cases millions of eggs laid. Amphibians European tree frog E. There are three living groups of amphibians caecilians, salamanders, and anurans [frogs and toads] that, collectively, make up more than 7, amphibian species. One similar tendency among amphibians has been the evolution of direct development, in which the aquatic egg and free-swimming larval stages are eliminated. Development occurs fully within the egg capsule, and juveniles hatch as miniatures of the adult body form. Most species of lungless salamanders family Plethodontidae , the largest salamander family, some caecilians, and many species of anurans have direct development. In addition, numerous caecilians and a few species of anurans and salamanders give birth to live young. Frogs and toads display a wide variety of life histories. Some deposit eggs on vegetation above streams or ponds; upon hatching, the tadpoles drop into the water where they continue to develop throughout their larval stage. Some species create foam nests for their eggs in aquatic watery , terrestrial land-based , or arboreal tree-based habitats; after hatching, tadpoles usually develop in water. Other species deposit their eggs on land and transport them to water, while marsupial frogs are so called because they carry their eggs in a pouch on their backs. A few species lack a pouch and the tadpoles are exposed on the back; in some species, the female deposits her tadpoles in a pond as soon as they emerge from eggs. They have internal fertilization, amniotic development in which the embryo develops within a set of protective extra-embryonic membranesâ€”the amnion, chorion, and allantois , and epidermal scales covering part or all of their body. The major groups of living reptilesâ€”the turtles, tuataras, lizards and snakes, and crocodiles account for over 8, species. Reptiles evolved from amphibians during the first part of the Pennsylvanian subperiod million to million years ago and retained many amphibian structural characteristics. While most reptiles feed on other organisms, a few are herbivorous e. As cold-blooded animals, reptiles tend to be limited to temperate and tropical areas, but, where they occur, they are relatively common; however, they are not as large or conspicuous as birds and mammals. Most reptiles are terrestrial, but a few are aquatic. They move about by creeping or swimming in a fashion similar to amphibians. Some reptiles, however, can lift the body from the ground and run rapidly either in a quadrupedal or bipedal fashion. Reptiles lay relatively large, shelled eggs. In a few instances, the eggs and young are cared for by the female; in others, the young are born alive. Birds In the fynbos of South Africa, the nectar-eating Cape sugarbird Promerops cafer has coevolved with the king protea Protea cynaroides. The sugarbird derives sustenance from the flowers of the protea, and the plant depends on the birds for pollination. Birds begin nesting as soon as the proteas begin to bloom. The flowers provide nectar for the adult birds and also attract insects, which adults capture and feed to their chicks. As a sugarbird sips nectar from the blooms, the feathers on its forehead are dusted with pollen, some of which is dislodged when the bird visits the next inflorescence. They are warm-blooded vertebrates more related to reptiles than to mammals. They have a four-chambered heart as do mammals , forelimbs modified into wings a trait shared with bats , a hard-shelled egg, and keen vision. Their sense of smell is not highly developed, and their auditory range is limited. Although most are capable of flight, others are sedentary, and some are flightless. In a manner similar to their relatively close relatives the reptiles, birds lay shelled eggs. The young are usually cared for in a nest until they are capable of flight and self-feeding, but some birds hatch in a well-developed state that allows them to begin feeding immediately or even take flight. Nesting activities similar to those of some birds are seen in the crocodilians. The origin of birds, feathers, and avian flight have long been hotly debated; the evolution of birds from reptilian ancestors is universally accepted, however. While it is known that the critical period in avian evolution and flight took place during the Early Cretaceous Mammals Okapi Okapia johnstoni. Mammals differ from other vertebrate animals in that their young are nourished with milk from special mammary glands of the mother. Mammals are distinguished by several other unique features. Hair is a typical mammalian feature, although in many whales it has disappeared except in the fetal stage. The mammalian lower jaw is hinged directly to the skull, instead of through a separate bone the quadrate as in all other vertebrates. A chain of three tiny bones transmits sound waves across the middle ear. A muscular diaphragm separates the heart and the lungs from the abdominal cavity. Mature red blood cells erythrocytes in all mammals lack a nucleus; all other vertebrates have nucleated red blood cells. The oldest known animals classified as mammals evolved near the boundary of the Triassic and Jurassic Periods, some million years ago. This group of vertebrates ranges in size from tiny shrews or small bats weighing only a few grams to the largest known animals, the whales. Most mammals are terrestrial, feeding on both animal and vegetable matter, but a few are partially aquatic or entirely so, as in the case of the whales or porpoises. Mammals move about in a great variety of ways: Reproduction usually involves the young developing inside the uterus, where nutritive materials are made available through an allantoic placenta or, in a few cases, a yolk sac. In placental mammals, young have a longer developmental period within the uterus. Monotreme mammals that is, the platypus and echidna differ from other mammals in that they lay eggs which hatch.

Chapter 6 : Chemoreception - Specialized chemosensory structures | calendrierdelascience.com

Terrestrial Invertebrates - Introduction Invertebrates, or animals without backbones, are a diverse group occupying marine, freshwater, and terrestrial habitats.

The other groups mentioned are, like dinosaurs and pterosaurs, members of Sauropsida the reptile and bird clade , with the exception of Dimetrodon which is a synapsid. Definition Triceratops skeleton, Natural History Museum of Los Angeles County Under phylogenetic nomenclature , dinosaurs are usually defined as the group consisting of the most recent common ancestor MRCA of Triceratops and Neornithes , and all its descendants. In traditional taxonomy, birds were considered a separate class that had evolved from dinosaurs, a distinct superorder. However, a majority of contemporary paleontologists concerned with dinosaurs reject the traditional style of classification in favor of phylogenetic taxonomy; this approach requires that, for a group to be natural, all descendants of members of the group must be included in the group as well. Birds are thus considered to be dinosaurs and dinosaurs are, therefore, not extinct. Norman, and Paul M. Barrett in suggested a radical revision of dinosaurian systematics. Phylogenetic analysis by Baron et al. They resurrected the clade Ornithoscelida to refer to the group containing Ornithischia and Theropoda. Dinosauria itself was re-defined as the last common ancestor of Triceratops horridus , Passer domesticus , Diplodocus carnegii , and all of its descendants, to ensure that sauropods and kin remain included as dinosaurs. Using one of the above definitions, dinosaurs can be generally described as archosaurs with hind limbs held erect beneath the body. Other groups of animals were restricted in size and niches; mammals, for example, rarely exceeded the size of a domestic cat, and were generally rodent-sized carnivores of small prey. While dinosaurs were ancestrally bipedal as are all modern birds , some prehistoric species were quadrupeds, and others, such as Anchisaurus and Iguanodon , could walk just as easily on two or four legs. Cranial modifications like horns and crests are common dinosaurian traits, and some extinct species had bony armor. Although known for large size, many Mesozoic dinosaurs were human-sized or smaller, and modern birds are generally small in size. Dinosaurs today inhabit every continent, and fossils show that they had achieved global distribution by at least the early Jurassic period. Although some later groups of dinosaurs featured further modified versions of these traits, they are considered typical for Dinosauria; the earliest dinosaurs had them and passed them on to their descendants. Such modifications, originating in the most recent common ancestor of a certain taxonomic group, are called the synapomorphies of such a group. Some of these are also present in silesaurids , which Nesbitt recovered as a sister group to Dinosauria, including a large anterior trochanter, metatarsals II and IV of subequal length, reduced contact between ischium and pubis, the presence of a cnemial crest on the tibia and of an ascending process on the astragalus, and many others. However, because they are either common to other groups of archosaurs or were not present in all early dinosaurs, these features are not considered to be synapomorphies. For example, as diapsids , dinosaurs ancestrally had two pairs of temporal fenestrae openings in the skull behind the eyes , and as members of the diapsid group Archosauria, had additional openings in the snout and lower jaw. These include an elongated scapula , or shoulder blade; a sacrum composed of three or more fused vertebrae three are found in some other archosaurs, but only two are found in Herrerasaurus ; [19] and a perforate acetabulum , or hip socket, with a hole at the center of its inside surface closed in Saturnalia , for example. Dinosaurs may have appeared as early as million years ago, as evidenced by remains of the genus Nyasasaurus from that period, though known fossils of these animals are too fragmentary to tell if they are dinosaurs or very close dinosaurian relatives. The terrestrial habitats were occupied by various types of archosauromorphs and therapsids , like cynodonts and rhynchosaurs. Their main competitors were the pseudosuchia , such as aetosaurs , ornithosuchids and rauisuchians , which were more successful than the dinosaurs. Rhynchosaurs and dicynodonts survived at least in some areas at least as late as early-mid Norian and early Rhaetian , respectively, [50] [51] and the exact date of their extinction is uncertain. These losses left behind a land fauna of crocodylomorphs , dinosaurs, mammals , pterosaurians , and turtles. In the late Triassic and early Jurassic, the continents were connected as the single landmass Pangaea , and there was a worldwide dinosaur fauna mostly composed of coelophysoid carnivores and early sauropodomorph herbivores. Early sauropodomorphs did not have sophisticated mechanisms for processing food in the mouth, and so must have employed other means of breaking down food farther along the digestive tract. Dinosaurs in China show some differences, with specialized sinraptorid theropods and unusual, long-necked sauropods like Mamenchisaurus. Conifers and pteridophytes were the most common plants. Sauropods, like the earlier prosauropods, were not oral processors, but ornithischians were evolving various means of dealing with food in the mouth, including potential cheek -like organs to keep food in the mouth, and jaw motions to grind food. The earliest part of this time saw the spread of ankylosaurians, iguanodontians , and brachiosaurids through Europe, North America, and northern Africa. These were later supplemented or replaced in Africa by large spinosaurid and carcharodontosaurid theropods, and rebbachisaurid and titanosaurian sauropods, also found in South America. In Asia, maniraptoran coelurosaurians like dromaeosaurids , troodontids , and oviraptorosaurians became the common theropods, and ankylosaurids and early ceratopsians like Psittacosaurus became important herbivores. Meanwhile, Australia was home to a fauna of basal ankylosaurians, hypsilophodonts , and iguanodontians. A major change in the early Cretaceous, which would be amplified in the late Cretaceous, was the evolution of flowering plants. At the same time, several groups of dinosaurian herbivores evolved more sophisticated ways to orally process food. Ceratopsians developed a method of slicing with teeth stacked on each other in batteries, and iguanodontians refined a method of grinding with tooth batteries , taken to its extreme in hadrosaurids. In the northern continents of North America and Asia, the major theropods were tyrannosaurids and various types of smaller maniraptoran theropods, with a predominantly ornithischian herbivore assemblage of hadrosaurids, ceratopsians, ankylosaurids, and pachycephalosaurians. In the southern continents that had made up the now-splitting Gondwana , abelisaurids were the common theropods, and titanosaurian sauropods the common herbivores. Finally, in Europe, dromaeosaurids, rhabdodontid iguanodontians, nodosaurid ankylosaurians, and titanosaurian sauropods were prevalent. Theropods were also radiating as herbivores or omnivores , with therizinosaurians and ornithomimosaurians becoming common. Some other diapsid groups, such as crocodilians, sebecosuchians , turtles , lizards , snakes , sphenodontians , and choristoderans , also survived the event. It is often cited that mammals out-competed the neornithines for dominance of most terrestrial niches but many of these groups co-existed with rich mammalian faunas for most of the Cenozoic. Dinosaur classification Dinosaurs belong to a group known as archosaurs , which also includes modern crocodilians. Within the archosaur group, dinosaurs are differentiated most noticeably by their gait. Dinosaur legs extend directly beneath the body, whereas the legs of lizards and crocodilians sprawl out to either side. Saurischia includes those taxa sharing a more recent common ancestor with birds than with Ornithischia , while Ornithischia includes all taxa sharing a more recent common ancestor with Triceratops than with Saurischia. Anatomically, these two groups can be distinguished most noticeably by their pelvic structure. Saurischia includes the theropods exclusively bipedal and with a wide variety of diets and sauropodomorphs long-necked herbivores which include advanced, quadrupedal groups. Unlike birds, the ornithischian pubis also usually had an additional forward-pointing process. Ornithischia includes a variety of species which were primarily herbivores.

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Chapter 7 : Life Science | Session 6

The proverbial "fish out of water," tetrapods were the first vertebrate animals to climb out of the sea and colonize dry (or at least swampy) land, a key evolutionary transition that occurred somewhere between and million years ago, during the Devonian period.

Sarcopterygian fishes , prototetrapods, aquatic tetrapods, true tetrapods, and terrestrial tetrapods. Many morphological changes occurred throughout this transition. Mechanical support structures changed from fins to limbs, the method of locomotion changed from swimming to walking, respiratory structures changed from gills to lungs, feeding mechanisms changed from suction feeding to biting, and mode of reproduction changed from larval development to metamorphosis. It is a species that endured rapid evolution during the Devonian era, which became known as the dipnoan renaissance. The Acanthostega species, known as the fish with legs, is considered a tetrapod by structural findings but is postulated to have perhaps never left the aquatic environment. Its legs are not well-suited to support its weight. The bones of its forearm, the radius and ulna, are very thin at the wrist and also unable to support it on land. It also lacks a sacrum and strong ligaments at the hip, which would be integral to supporting the animal against gravity. In this sense, the species is considered a tetrapod but not one that has adapted well enough to walk on land. Furthermore, its gill bars have a supportive brace characterized for use as an underwater ear because it can pick up noise vibrations through the water. Tetrapods that adapted to terrestrial living adapted these gill bones to pick up sounds through air, and they later became the middle ear bones seen in mammalian tetrapods. Ichthyostega , on the other hand, is considered to be a fully terrestrial tetrapod that perhaps depended on water for its aquatic young. Comparisons between the skeletal features of Acanthostega and Ichthyostega reveal that they had different habits. Acanthostega is likely exclusive to an aquatic environment, while Ichthyostega is progressed in the aquatic to terrestrial transition by living dominantly on the shores. A group of fish from the Givetian stage began developing limbs, and eventually evolved into aquatic tetrapods in the Famennian stage. Pederpes, Westlothiana, Protogyrinus, and Crassigyrinus descended from these species into the carboniferous period and were the first land vertebrates. It has a fin, but the fin has bones within it that are similar to mammalian tetrapods. It has an upper arm bone, a lower arm bone, forearm bones, a wrist, and fingerlike projections. Essentially, it is a fin that can support the animal. Similarly, it also has a neck that allows independent head movement from the body. Its ribs are also able to support the body in gravity. Its skeletal features exhibit its ability as a fish that can live in shallow water and also venture onto land. During this time, both the competitive pressures that would push species out of the water and the niche occupation incentives that would pull species onto land were slowly building. The culmination of these driving factors are what ultimately facilitated the vertebrate transition. Evolutionary pushes[edit] Scientists believe that a long period of time where biotic and abiotic factors in the aquatic environment were unfavourable to certain aquatic organisms is what pushed their transition to shallower waters. Some of these push factors are environmental hypoxia , unfavourable aquatic temperatures, and increased salinity. Other constantly present factors such as predation, competition, waterborne diseases and parasites also contributed to the transition. The extensive oxidized sediments that were present in Europe and North America during the late Devonian are evidence of severe droughts during this time. These droughts would cause small ponds and lakes to dry out, forcing certain aquatic organisms to move on land to find other bodies of water. Natural selection on these organisms eventually led to the evolution of the first terrestrial vertebrates. These were largely the niches and opportunities that were available for exploitation in the terrestrial environment, and include higher environmental oxygen partial pressures, favourable temperatures, and the lack of competitors and predators on land. The plants and invertebrates that had preceded the vertebrate invasion also provided opportunities in the form of abundant prey and lack of predators. These challenges allowed for rapid natural selection and niche domination, resulting in an adaptive radiation that produced many different vertebrate land species in a relatively short period of time. Sensory systems[edit] Depending on the water depth at which a species lives, the visual perception of many aquatic species is better suited to darker environments than those on land.

Similarly, hearing in aquatic organisms is better optimized for sounds underwater, where the speed and amplitude of sound is greater than in air. Gas exchange and water balance are highly different in water and in air. Homeostasis mechanisms suitable for a terrestrial environment may have been necessary to develop before these organisms invaded land. The stressors of the musculoskeletal system are different in air than they are in water, and the muscles and bones must be strong enough to withstand the increased effects of gravity on land. Navigation and locomotion are also highly different in aquatic environments compared to terrestrial environments. As the ancestors of early tetrapods started inhabiting shallower waters, these species had flatter skulls with eyes at the tops of their heads, which made it possible to spot food above them. Once the tetrapods transitioned onto land, the lineages evolved to have tall and narrow skulls with eyes facing sideways and forwards again. This allowed them to navigate through the terrestrial environment and look for predators and prey. In contrast, land animals use necks to move their heads so they can look down to see the food on the ground. The greater the mobility of the neck, the more visibility the land animal has. As lineages moved from completely aquatic environments to shallower waters and land, they gradually evolved vertebral columns that increased neck mobility. The first neck vertebra that evolved permitted the animals to have flexion and extension of the head so that they can see up and down. The second neck vertebra evolved to allow rotation of the neck for moving the head left and right. As tetrapod species continued to evolve on land, adaptations included seven or more vertebrae, allowing increasing neck mobility. The aquatic ancestors of tetrapods did not have a sacrum, so it was speculated to have evolved for locomotive function exclusive to terrestrial environments. However, the Acanthostega species is one of the earliest lineages to have a sacrum, even though it is a fully aquatic species. Once species moved onto land, the trait was adapted for terrestrial locomotion support, which is evidenced by additional vertebrae fusing similarly to permit additional support. This is an example of exaptation, where a trait performs a function that did not arise through natural selection for its current use. Many lost their gills, which were only useful for obtaining oxygen in water. Their tail fins became smaller. They lost the lateral line system, a network of canals along the skull and jaw that are sensitive to vibration, which does not work outside of an aquatic environment. Aspects such as reproduction and swallowing, however, have bound these species to the aquatic environment. These pre-adaptations have allowed vertebrates to venture onto land hundreds of times, but were not able to accomplish the same degree of prolific radiation into diverse terrestrial species. The commonalities to current and future invasions may then be elucidated to predict the effects of environmental changes.

Chapter 8 : Diversity of Vertebrates

Terrestrial Vertebrates of Tidal Marshes Greenberg et al. Studies in Avian Biology No. 32 RUSSELL GREENBERG, JESÃšS E. MALDONADO, SAM DROEGE.

Chapter 9 : Terrestrial invertebrates | Buglife

The vertebrate has a distinct head, with a differentiated brain and three pairs of sense organs (nasal, optic, and otic [hearing]). The body is divided into trunk and tail regions. Several groups of vertebrates inhabit planet Earth.