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The Animal Kingdom

A Computer Database & Handbook

MENUS (OF THE SOFTWARE VERSION)

- The Major Groups of Animals
  - Protozoans: Single-Celled Animals
  - Sponges
  - Coelenterates: Jellyfish, Sea Anemones, Corals, etc.
  - Flatworms
  - Roundworms, or Nematodes
  - Mollusks: Snails, Clams, Octopods, etc.
  - Segmented Worms, or Annelids
  - Arthropods: Spiders, Crabs, Insects, etc.
  - Echinoderms: Starfish, Sea Urchins, Sea Lilies, etc.
  - Vertebrates: Animals with a Backbone
    - Fishes
    - Amphibians
    - Reptiles
    - Birds
    - Mammals
- Identifying Animals (especially by Comparing the Structures of Animals) *(Automated in Software Version)*
- Comparing the Functions of Animals *(Automated in Software Version)*
  - Motion
  - Digestion
  - Respiration
  - Circulation
  - Excretion
  - Coordination
  - Reproduction
- Alphabetical Index to Animals

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    - Classes Agnatha, Placodermi, Chondrichthyes, and Osteichthyes [Fishes]
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SAMPLE ENTRY

21) CLASS MAMMALIA

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Approximate Number of Known Species Worldwide

4,000

Organisms

Egg-laying mammals: Platypus and spiny anteater.

"Marsupial" [pouch-bearing] mammals: opossum, kangaroos, bandicoot, koala, wombat, Tasmanian devil, Tasmanian wolf (extinct in recent times), etc.

Placental mammals: insectivorous mammals, including shrews, moles, hedgehogs, tree shrews, and flying lemur; bats (comprising about one of every seven known species of mammals, many of which, however, are endangered); primates, including lemurs, tarsiers, monkeys, apes, and people; carnivorous mammals, including cats, mongooses, hyenas, dogs, weasels, skunks, otters, raccoons, bears, seals, and walruses; mammoths (extinct) and elephants; sea cows; odd-toed ungulates, including horses, tapirs, and rhinos; even-toed ungulates, including hogs, peccaries, and hippos as well as camels, deer, cattle, sheep, goats, and antelope; armadillos, sloths, and South American anteaters; aardvark; cetaceans, including whales and porpoises; rodents (the most diverse and numerous mammals), including squirrels, rats, mice, beavers, and Guinea pigs; rabbits and hares; etc.

Environments

Marine, freshwater, terrestrial, and aerial (Although some small mammals glide, bats truly fly.).

Description

The body of mammals typically bears hair (evolved from reptilian scales, still present on the tails of some rodents and primitive species); however, hair is almost entirely lost in whales (insulated by blubber, a large size, and

surrounding seawater). There are four occasionally modified legs, typically mounted not outward (as in lower "tetrapods") but downward, for efficient locomotion. There is a strong-jawed mouth with bony specialized teeth (The adults having a "permanent" set), a tongue, and a "secondary palate" [the roof of the mouth, allowing breathing while continuously eating]. The eyes have lids and tear glands. There is a well-defined neck and an often short tail.

Mammals must be no smaller than the smallest shrew: If these "warm-blooded" creatures (See below) were any smaller, they would lose precious body heat so quickly that they would die (hence, a rapid metabolism—constantly replenishing lost body heat—for shrews).

Egg-laying mammals have some reptilian scales (as on the tail of the "duckbilled" platypus), a "cloaca" [a single chamber for the exit of the urinary, digestive, and reproductive tracts], and a habit of laying eggs. Milk is secreted through the skin of the female, not through "nipples" (as in higher mammals).

Marsupials have a "marsupium" pouch on the underside of the female, in which the very young —after climbing out of the "uterus" [womb]— develop, attached to nipples. Marsupial mammals are found mostly on Australia, which drifted away from the other continents before the evolution of advanced, "placental" competitors (below): In fact, the evolution of marsupials on Australia is similar to the evolution of placental mammals elsewhere (For example, the bandicoot fills the same sort of environmental "niche" as a rabbit; a kangaroo grazes and leaps like an antelope; and the extinct Tasmanian wolf was much like a placental wolf.).

Placental mammals develop even more fully within the uterus of the mother—there is no pouch (let alone external eggs).

Primates have five fingers and toes, usually with "opposable" [grasping] thumbs and finger- and toe-nails. The usually large eyes face forwards (for 3-D vision, important in their native treetops), and the snout is usually small.

"Catarrhines" [Old World monkeys, apes, and people] have a large brain, an at least partly hairless face, nostrils that are close together and pointing downwards, two "premolar" teeth, and never a "prehensile" [grasping] tail.

Old World monkeys (such as macaques, baboons, and mandrills) walk on all fours but often sit on the hard, often colored pads on their rump. Their teeth are often used for grinding tough foods; but there are large pointed "canine" teeth, used for defense.

Apes (the gibbon, the gorilla, the orangutan, and the chimpanzee) have large brains (even larger than in other animals of their large body size). Although tailless, apes are well-adapted to a life in their native forests, with grasping feet and long-fingered hands, long arms, and broad chests for swinging through trees. The powerful skulls and muscular jaws of apes are especially adapted for chewing plants and other coarse foods, although there are large, pointed "canine" teeth, for defense.

Human beings have feet, legs, and a curved backbone adapted for an upright stance and a "bipedal gait" [that is, we can walk]. Our skull is less massive than that of apes (or of extinct "ape people")—we often soften our foods by cooking them over fire (whose power has been harnessed only by human beings). We use our grasping hands to fashion all sorts of tools, with which we have made even more complicated tools, including such weapons as knives, guns, and nuclear weapons—we have smaller canine teeth than apes. And—pound for pound—we have the largest and perhaps most complex brain in the Animal Kingdom (Only the brain of dolphins is perhaps more complexly folded.). Although "racial" differences between human beings may look significant and although cultural differences do exist, there is more genetic variation *within* so-called races of human beings than *between* so-called races of human beings: Genetically speaking, there are no such things as races of human beings—we are all of the same subspecies, *Homo sapiens sapiens* (Other subspecies of human beings, such as *Homo sapiens neanderthalensis*, are long extinct.).

Feeding Habits

Scavenging, filter-feeding (as for "whalebone" whales), herbivorous, and carnivorous (Human beings, in particular, are "omnivorous"—we can eat almost anything edible.).

Motion

The muscle system of mammals is very complex and coordinated.

Unlike lower "tetrapods" [four-legged vertebrates], such as amphibians [18], whose walking motion resembles the squirming swimming motion of fish [17], mammals have legs mounted underneath the body, for more efficient running (important for both would-be predators and would-not-be prey).

Although all mammals have specialized legs (such as those bearing claws or hoofs), the legs of some mammals have been greatly modified by evolution, producing such specialized limbs as the wings of bats, the flippers of seals, and the arms (with hands, bearing opposable thumbs) of us primates.

The tail of mammals is often reduced in size, although it may be grasping in "arboreal" [tree-inhabiting] species or finlike (as in whales).

Digestion

Mammals have a very efficient gut, to get the most out of their food for their typically active lifestyles. Cattle and other "ruminants," which consume low-calorie, hard-to-digest grasses, have a four-chambered stomach, in which bacteria help digest the food and from which food is occasionally regurgitated (as "cud"), for re-chewing.

The jaw of a mammal is typically very powerful, fundamentally different in design (and development and evolution) than that of lower vertebrates.

Unlike most lower vertebrates, a mammal has a set of specialized teeth—biting "incisors" up front, then pointed "canines," followed by

tearing or grinding "premolars" and "molars" (In addition, food is "predigested" by "enzymes" in the "saliva" within the mouth of mammals.). Groups of mammals are often identified by their "dentation" [arrangement of teeth]. For example, carnivores and herbivores have very different types of teeth; elephants have incisors modified into long tusks (and a nose and upper lip modified as a handy trunk); and although rodents and rabbits at first appear to be of the same group, rodents have just one pair of gnawing "incisors" in each jaw, whereas rabbits have two pair in the upper jaw (a small pair behind the front). The largest whales have no teeth but instead have horny "whalebone" (growing down from the upper jaws), which filters enough tiny "plankton" [microscopic plants and animals] from seawater to support their over 100 tons of weight (making them the largest animals ever to have evolved on Planet Earth).

Respiration

In mammals, gases are inhaled and exhaled through nostrils (with the "hard palate" [roof of the mouth] allowing breathing while the mouth is full) and are exchanged across the extensive infoldings in the lungs. A muscular "diaphragm," under the lungs, controls breathing.

Speech and other mammalian sounds are made possible by vibrating "vocal cords," found in the "larynx." The larynx is the airway found in between the "pharynx" (coming from the mouth and nasal passages) and the "trachea" [windpipe] (leading to the two "bronchi", entering the lungs). An "epiglottis" covers the larynx when the mammal swallows, so that food goes down the esophagus, not the windpipe.

Most whales and other "cetaceans" have the nostrils modified as a "blowhole," atop the body.

Circulation

Mammals have a heart with four chambers—two "atrias" (one for receiving blood from the veins, the other for receiving blood from the lungs) and two "ventricles" (one for pumping blood to the lungs, the other for pumping blood out into the arteries)—there is no inefficient mixing of "oxygenated" and "de-oxygenated" blood, as in amphibians [18]. This system, and a relatively high blood pressure, helps mammals lead their typically very active lifestyle.

Mammals are "endothermic" [so-called "warm-blooded"]—biochemical reactions release heat, carried by the blood throughout the tissues, producing a relatively high and constant temperature within the body (insulated with hair or blubber), thus helping to maintain our "high metabolic rates" [our relatively active lifestyles]. In addition, such behaviors as shivering, panting, or sweating help us mammals maintain a relatively constant body temperature; and certain mammals undergo a complex "hibernation" overwinter, reducing their metabolic activity, although not becoming truly "cold-blooded" [unable to exert any biochemical control over their body temperature].

Excretion

Nitrogen-rich and other wastes [as in our urine]

are cleansed from the blood by the many tubules within a pair of kidneys and are excreted (via a urinary bladder) through the "urethra," of the urinary system (Unlike other vertebrates, however, there is no "cloaca" chamber, receiving outputs from both the urinary and digestive system: Instead, the cloaca divides during development into the urethra and the "rectum," of the digestive system.).

Terrestrial vertebrates typically secrete less of the precious water from their kidneys than aquatic species do.

Coordination

Genetic.

Hormonal: The females of most placental mammals are sexually active only during certain times of the year, whereas the females of primates periodically shed the lining of their uterus and are sexually active year-round—both processes are under hormonal control.

Nervous: The complex lifestyles of mammals require much coordination. For example, various bats can navigate in dark caves and find flying moths as prey at night by means of "echolocation" [a natural sonar]—the bat emits "ultrasonic sound waves" [silent to the human ear]; and the echos returned are deciphered by the brain of the bat to judge the size, distance, and direction of travel of foreign objects. Various whales and other cetaceans also have such abilities (In addition, the large sound-generating organ in their "forehead" can probably produce shock waves in the water, to stun fish for eating.).

Higher thought processes evolved in higher vertebrates, as the upper, "cerebral cortex" of the brain enlarged and became more complicated (as evidenced by its complex infoldings). In particular, we mammals rely heavily upon behavior learned when young and remembered into adulthood; and primates and cetaceans are the most emotional, aware, coordinated, communicative, and intelligent of all animals.

Social Control: The instinctive herding behavior of various mammals helps protect individuals, especially by confusing predators (some of which, such as packs of dogs, are well-coordinated hunting teams); the families and extended groups of mammals, often with well-established "hierarchies" of dominant individuals, are noted for generally taking excellent care of their young; and human societies coordinate the behavior of individuals over space and time by such means as artificial languages (The beginning of a civilization is generally dated from its invention of writing.)—correspondingly, ours has become the most dominant single species on the planet. Additionally, as evidenced by the fossils of prehistoric "Neanderthal" people, human beings have always tended to care for the sick or old amongst their numbers; and even after the death of loved ones, most people have naturally shown a concern for the well-being of others, as by providing burial grounds and ceremonies for an "afterlife."

Reproduction

Mammals reproduce sexually, with the sexes separate; and as terrestrial vertebrates (or as species descended from them), mammals "copulate" [mate with physical contact]. The fertilized eggs of primitive, egg-laying mammals are typically laid in aquatic environments (and sat-upon during "incubation" [the period before hatching]).

The fertilized eggs of higher mammals are borne within the "uterus" [womb] of the female. In marsupial mammals, the developing "embryo" is nourished by a "milk" secreted within the uterus; and after being born at a very early age, the embryo crawls up to the "marsupium" pouch of the mother, in which it suckles on nipples and develops. In most mammals, however, external membranes of the embryo merge with the lining of the uterus to form a "placenta," through which food and oxygen are delivered to the embryo (developing into a "fetus") and wastes and carbon dioxide are taken away. The "mammary glands" [breasts] of female mammals produce milk, delivered through nipples, to nourish the young, after birth. Typically, mammals have longer "childhoods" (even after sexual maturity) than any other animals—undoubtedly to learn the extremely complex ways of mammalian life on Earth.