

CHAPTER XVII

PHYLUM CHORDATA — PART IV

SUB-PHYLUM VERTEBRATA. CLASS VI — MAMMALIA

General Characteristics. Many of the Mammals surpass all other animals in supremacy over nature. The very name of the group, given by Linnaeus, carries with it reference to a phenomenon which is in no small sense responsible for the higher development of these forms. This is the process of nourishing the young by milk produced by the *mammary glands* of the mother. Related with this is the fact that there is a vital connection between the young and the mother within the latter's body from the time of egg fertilization to birth of that offspring. The helpless newborn are not only at first nourished by food formed in the body of the mother, but are later watched over by the mother and trained in the ways of life. Mammals are also distinguished by the presence of hair on the surface of the body. The temperature of the blood is about 98° F. and is quite constant, *i.e.*, independent of temperature changes in the external world. This insures, on the whole, a continuous condition of activity, shared in only by the birds. This makes it possible for mammals and birds to conquer the temperate and cold regions of the earth. Feathers and fur are an aid to this end.

Mammals are four-legged animals. They have a neck and a tail. The skin possesses oil glands and sweat glands. A muscular partition, the diaphragm, separates the heart and lungs from the viscera and is important in respiration. The cerebral hemispheres are very prominently developed and in some forms possess a convoluted cortex which permits the possession of a greater number of nerve cells. Posteriorly there is one opening for the intestine, *i.e.*, the anus, and a second opening for the urino-genital systems. The heart is four-chambered as in birds. The lungs consist of a multitude of little air sacs or alveoli connected with respiratory

ducts which in turn are connected with the trachea. The ureters from the kidneys carry urine into the bladder from which a duct, the urethra, carries it to the outside. Ovaries are small and eggs are very small. In many, the testes of the mature male occur in a sac outside the body. The red blood cells lose their nuclei before they are set free in the circulation. The Mammalia are divided into three sub-classes.

Sub-Class I — Prototheria, or Monotremata, are the simplest of mammals. An example is *Ornithorhynchus* (Fig. 267), the duck-bill or duck-mole. The animal is about eighteen inches long.



FIG. 267. — *Ornithorhynchus* — Duck-bill.

The head has a flat horizontal horny beak and the eyes are small. There is no external ear. The legs are short and the animal is 'squat-like' in appearance. The front feet are webbed and the tail is flat. Only the young have teeth, these being replaced by horny pads. The reproductive apparatus and habits are similar to those of reptiles and birds.

Oviducts open into a cloaca,

as do also the intestine and urinary apparatus. The eggs, which have a leathery shell, are incubated in shallow grass nests. The female has small *mammary glands* whose secretions are discharged among the overlying hairs of the abdomen. The young obtain nourishment at these places. The temperature of the body is lower than that of other mammals and is more variable. The body is fur-covered. In many respects the Prototheria are the most primitive of mammals. *Ornithorhynchus* is found in South Australia.

Sub-Class II — Metatheria. These are the opossums (Fig. 268) of America and the kangaroos (Fig. 269) and other less familiar forms, most of which occur in Australia. They are more commonly known as *Marsupials* for the reason that there is a pouch or marsupium on the ventral surface of the abdomen. In this pouch are nipples or teats containing ducts from the mammary or milk glands situated between the skin and the ventral muscular wall. Fertilization is internal since copulation takes place. The eggs

are small with no shell or yolk and develop in the lower end of the oviduct (uterus) of the female. In only eight days, in case of Dasyurs; in two weeks, in the case of the opossum, and five weeks, in the case of the kangaroo, the young are "born." They are "foetus"-like in their immaturity but are carried around in the marsupium of the mother, where each is fastened to a teat and is fed upon the milk from the mammary gland. At first the milk is forced by maternal breast muscles into the foetus. The young develop in the marsupium for about eight weeks. The opossum may breed three times a year and each female may produce more than thirty young annually. It is a tree-dwelling form and is used as food. Most of the 39 living marsupial genera occur only in the Australian region. Evidences indicate that about the time of marsupial evolution and migration, the land connection between Australia and South America disappeared. The marsupials left in Australia were confined to a restricted area. The Metatheria elsewhere were largely



FIG. 268. — *Didelphys virginiana*. — Opossum. (Amer. Mus. Nat. Hist.)

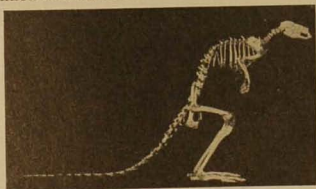


FIG. 269. — Skeleton of Kangaroo — *Macropodus*.

superseded by more dominant Eutherian mammals since their evolution was favored by a larger range and more varied conditions. However, evolution of a sort took place among the marsupials of Australia, for

among them are found bear-like, wolf-like, rabbit-like, mole-like and mouse-like types.

Sub-Class III — Eutheria. The third sub-class of Mammalia are the *Eutheria* or *Real Beasts*. They are viviparous and are sometimes called the *Placentalia* or *Placental Mammals* because the embryonic form of nutrition is by means of a structure called the *placenta* (Fig. 270). This is partly embryonic and partly maternal in origin. It assumes various forms in different orders.

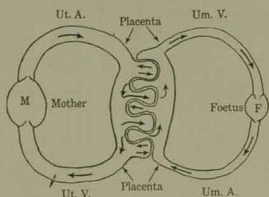


FIG. 270. — Scheme of foetal circulation. Ut. A. — uterine artery; Ut. V. Uterine vein; Um. A. Umbilical artery; Um. V. — Umbilical vein.

It is formed against the inner wall of the uterus of the female. A long stalk, the *umbilical cord*, consisting of connective or supporting tissue and arteries and veins, connects the blood vascular system of the embryo to the placenta. Within the placenta is a system of large, thin-walled, expanded capillaries or sinuses. Some of these are connected with the circulatory system of the foetus. Others, dovetailing with the first, are connected with the circulatory system of the mother. The blood stream of the mother passes therefore in *close juxtaposition* to that of the foetus, but not directly into it. The blood of each system is separated from that of the other by a thin membrane. The red and white corpuscles and any foreign bodies, as, for example, bacteria, that may possibly be present in the blood stream of the mother *do not pass* into the blood stream of the foetus. However, dissolved food and salt compounds, water, oxygen and probably vitamins and hormones present in the mother's blood do diffuse through into the foetal circulation. In the reverse direction, carbon dioxide and other wastes of metabolism diffuse from the foetal circulation back into the blood stream of the mother, who excretes them in addition to her own wastes. For the time being, the embryo or foetus is practically a parasite living at the expense of the mother.

The offspring is helpless and dependent for a time after birth. Prenatal and postnatal care of the young reduce mortality during this period and are important factors in the dominance of the Mammalia. The eggs are very minute, containing very little

reserve food. The posterior ends of the oviducts are fused, forming in Apes and Man the posterior single vagina and the more anterior single uterus where the foetus develops (Fig. 271). Because of the longer period of intra-uterine development, there is a reduction of the period of nutrition from the mammary glands as compared with the marsupials.

The temperature of the body is higher than that of the two lower sub-classes and is more constant. It varies from 35° C. to 40° C. in different mammals. The cerebral hemispheres become relatively larger and more convoluted among the higher groups. We find that

these higher Mammals are adapted to live in diverse environmental conditions and that structural modifications accordingly occur. For example, the rabbit is a typical *terrestrial* mammal; horses and cattle are *cursorial* and adapted to swift running over the ground; dogs and cats are *terrestrial* forms, but not as completely *cursorial*, as they still use the limbs for other purposes; the sloth is adapted to life in trees, or *arboreal*; the mole to burrowing in the ground or *fossorial*; the porpoise to swimming life or *natatorial* and the bat is an *aerial* — or flying mammal.

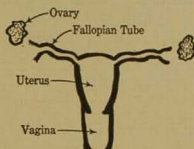


FIG. 271. — Female reproductive organs of man and apes.

Orders of the Eutheria

Order I. Insectivora. These are regarded as the most primitive members of this sub-class. They are small mammals with a pointed nose. Most of them feed on insects and worms. The body is covered with soft fur, as a rule. The moles (Fig. 272) (*Talpa*) are burrowing animals with the forefeet adapted for burrowing (fossorial) habits; no external ears and only rudimentary eyes are present.



FIG. 272. — *Talpa* — Mole. (Amer. Mus. Nat. Hist.)

Order II. Chiroptera (Wing-like Hands). These are the bats (Fig. 273). The forelimbs are modified for flying. The bones of the forelimb and especially of the fingers are elongated. A fold of skin extends across them and alongside the body to the

hind limb to form a flying organ. The thumb is short and clawed. The hind limbs are short and weak. Bats are active at night.



FIG. 273. — Brown Bat. (Amer. Mus. Nat. Hist.)

Order III. Sirenia (Fig. 274). An example is the sea-cow, an aquatic, sluggish, heavy-boned herbivorous mammal. The hide is thick and possesses little hair. They

have flipper-like forelimbs and no hind limbs. They live in rivers or near river-mouths. The Florida manatee is now very rare. It has been suggested that the idea of 'sirens' arose from sailor's yarns 'inspired' by seeing sea-cows.

Order IV. Cetacea.

These are the whales (Fig. 275), porpoises and dolphins. They are truly aquatic and natatorial with fish-like bodies, and have lost the hair so characteristic of the mammals. The forelimbs

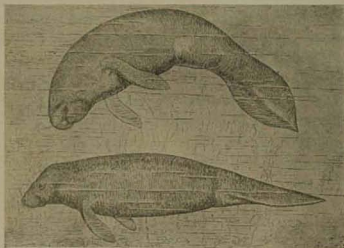


FIG. 274. — Manatus — Manatee. (U. S. Bureau Fisheries.)

have become paddles, the hind limbs are gone, the tail is flattened horizontally into a *fluke*. There is usually a middle dorsal fin. A thick layer of fat or blubber under the skin aids in maintaining

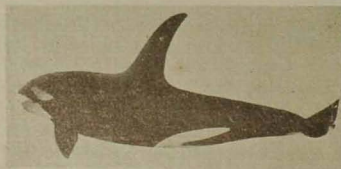


FIG. 275. — Killer whale — Orca. (Amer. Mus. Nat. Hist.)

the high constant temperature, even in ice-cold waters. The body is torpedo-shaped. There are no external ears. The larynx is long and meets the internal nostrils so that there is a continuous passageway for air

from external nostrils to lungs. Cetacea do not breathe as often as other mammals. In expiration, the animal *blows*. This leads to the wrong impression that in expiration these animals spout a column of water. All are *carnivorous*. Many of them live in groups.

One group of Cetaceans possesses teeth. These are the dolphins (*Delphinus delphis*), porpoises (*Phocaena communis*), killer whales and sperm whales. Sperm whales seventy-five feet long have been found.

True whales do not have teeth, but possess plates of baleen or whalebone which hang from the palate, filling the mouth like a sieve. They take in great quantities of water which passes through this whalebone sieve, retaining all small animals, which are used as food. The largest of all living animals, the sulphur-bottom whale, belongs to this group. It occurs in the Pacific Ocean. Some specimens taken were nearly 100 feet long and had a weight of nearly 150 tons.

Order V. Edentata.

These animals have poor teeth or no teeth at all. The existing forms, found for the most part in South America, are but a few survivors of more numerous ancient types. Survival was insured by adaptive modifications in structure brought about by adoption of various modes of life. Some are *fossorial*, some are *arboreal* — some have their bodies covered with a strong protective armor. The Nine-banded Armadillo is found in Southern Texas. Anteaters are found in South America. Sloths (Fig. 276) also inhabit the forests of South America. They live almost entirely among the branches of trees and eat fruits, leaves and young buds. The front legs are longer than the hind legs, and the animals hang suspended from branches and crawl along this way, attaching themselves by means of the long, curved toe nails. The body is covered with long, shaggy hair. Edentates are thought to have originated in South America.



FIG. 276. — Two-toed sloth — *Choloepus*.
(Amer. Mus. Nat. Hist.)

Order VI. Rodentia. These are gnawing animals — mice, rats, chipmunks, squirrels, rabbits, woodchucks, beavers (Fig. 277) and porcupines. The incisor teeth are long and chisel-like. With



FIG. 277. — Colony of Beavers — Castor. (American Museum of Natural History.)

persistent use the teeth are kept sharp. They also grow continually. There are no canine or eye teeth. Most rodents are small forms and most of them are terrestrial. There are more species of Rodents than of any other order of mammals. Most



FIG. 278. — Bison. (Specimens presented to American Museum of Natural History by Buffalo Bill, W. F. Cody.)

of them are vegetarians. Carnivora feed largely on rodents. Beavers live in the water. The hind feet are webbed, and there is a broad, flat tail which is used as a trowel in plastering mud in the construction of dams, which are made across a stream. Trees are gnawed and felled for this purpose. In the

pond thus made they build their nests or houses — the entrance being under water. It is a castle with a moat about it.

Order VII. Ungulata. These are hooved animals and include a heterogeneous collection. They are *terrestrial, herbivorous* and use all the four limbs in locomotion. They do not walk on the soles of the feet as is usually the case, but upon the toes. The

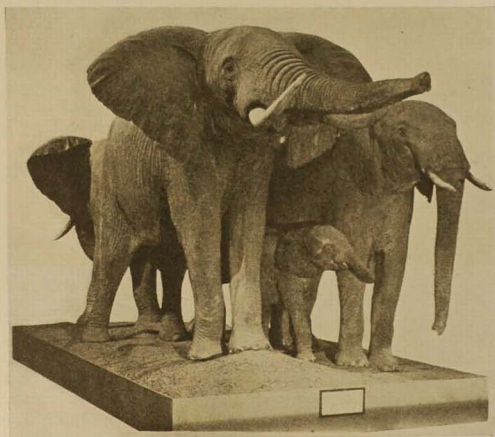


FIG. 279. — Elephas — African elephant. (Mounted by Carl Akeley at American Museum of Natural History.)

canine teeth are small or absent. The ungulates are divided into several sub-orders.

The *Artiodactyla* are cattle, pigs, peccaries, camels, hippopotami, giraffes, antelopes, sheep, goats, elk, moose, bison (Fig. 278), deer, etc. They are even-toed animals, the third and fourth toes being large and equally developed while the other toes do not develop. Millions of bison in great herds roamed the western plains of America about fifty years ago. Wholesale slaughter and the settlement of the country has caused their extinction as free, wild animals.

The *Perissodactyla* are horses, asses, zebras, tapirs and rhinoceroses. The middle or third toe of each foot is highly developed and used to bear the weight of the body. Rhinoceroses are large, fierce animals and also vegetarians.

The *Proboscidea* are the elephants (Fig. 279). The nose is prolonged into a proboscis or *trunk*, which is a tool with many uses. One pair of upper incisors form long tusks composed of ivory. There are five toes on each foot. When standing, the elephant has the appearance of a great mass supported at each corner by a straight column. Nevertheless the elephant can travel at great speed. Notwithstanding the small brain, they are quite intelligent.

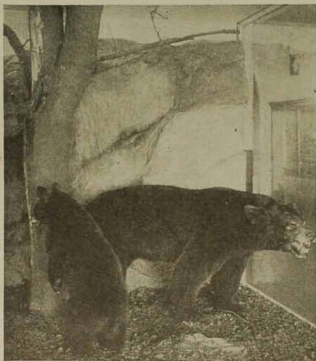


FIG. 280. — Black bears — *Ursus*. (Amer. Mus. Nat. Hist.)

Order VIII. Carnivora. These are flesh-eating animals. They are mostly ground-dwelling, coursing forms. There are usually four toes on each foot and the toes are supplied with claws. The limbs have other uses beside locomotion. They are used in striking down the prey, in fighting, and in holding the food while the animal tears it apart with its teeth or vice versa.

The dentition is adapted to the type of food. Some are *omnivorous* and a few vegetarian. A prominent characteristic is the presence of long, pointed canine teeth whose uses are self-evident. Some of the teeth further back in the jaws (premolars) act on each other like scissors for cutting flesh. The stomach is simple and the intestine is short. They are fearless, aggressive, intelligent animals, keen of vision, hearing and smell, and their movements full of grace and beauty, oftentimes marred as we think by stealth and cunning.

They are divided into two great sub-orders. First, Fissipedia; second, Pinnipedia.

I. *Fissipedia*. The Fissipedia are mostly terrestrial forms. Among the familiar families are the (a) Felidae or cats, including the many varieties of domesticated house cats, the wild cat, tiger, lion, jaguar and leopard; (b) the Canidae or dogs, including the many varieties of domesticated dogs, the wolf, fox, jackal and coyote; (c) Ursidae or bears (Fig. 280), which are plantigrade,



FIG. 281. — Fur seals. (Amer. Mus. Nat. Hist.)

i.e., they rest the entire sole of the foot on the ground in locomotion. Although they appear to be clumsy, yet they move with great agility, can strike powerful, well-directed blows and can travel at great speed.

II. *Pinnipedia*. This sub-order includes sea-lions, seals and walruses. The intestine of some forms attains great length, despite the fact that they are fish-eaters. The family, Otariidae, includes the sea-lions and fur seals (Fig. 281). *Otoes alascanus*, the fur seal, is polygamous, and a breeding male may have a 'harem' of many females. Males fight for this supremacy, the unsuccessful being called 'bachelors.' The breeding grounds are on the Pribilof Islands in Alaska. Most of the year is spent at sea. It is legal to kill three-year-old seals for their pelts. The regulations were formulated and are enforced by international treaty.

Order IX. Primates. We place this order at the end of the animal series because it includes man. However, morphologically, the Primates are not as specialized as the Ungulata and the Cetacea. The lower Primates do not superficially resemble man or the anthropoid apes, but because of certain characters they are included in the order. Most Primates live in warm countries. They are, on the whole, arboreal animals and tend toward the upright position, thus changing from a quadrupedal to bipedal habit. They will eat almost any form of food although many prefer fruit and insects. The limbs, and especially the hands, tend



FIG. 282. — Varied Lemur — Madagascar. (Amer. Mus. Nat. Hist.)

to be highly specialized, and the hind legs tend to be used for locomotion, thus freeing the front limbs for a variety of other uses. The brain is, as a rule, more highly developed than that of other orders. In most cases only one young is produced at birth and that receives parental care for a time after birth. Although some prefer a solitary life, yet most exhibit some sort of loose social grouping.

Suborder 1. Lemuroidea. Family — *Lemuridae* (Fig. 282). These are the lowest.

They are small, fur-covered quadrupeds with long tails. They are very abundant in Madagascar. Their faces resemble those of foxes, but their bodies are monkey-like. They link the Primates with the lower mammals.

Suborder 2. Anthrooidea. Family — *Haplorhina* (Fig. 283). These are the small arboreal marmosets of Central and South America. The tail is long. They have prominent ears. The

big toe has a *flat nail*, but the other digits have claws. The brain is relatively large and the nostrils are rather wide apart. Marmosets are often kept as pets.

Family — *Cebidae*. These are the South American monkeys, sometimes referred to as *New World monkeys*. They are small, active and arboreal. The tail is long and prehensile, the *thumb and big toe* are *opposable*. The *digits bear nails* and not claws. The nostrils are quite wide apart. The organ grinder's monkey belongs to this group. Howling monkeys are so-called on account of the frightful noises they make to scare away enemies.

Family — *Cercopithecidae*. These are the *Old World monkeys* found in Asia and Africa. They are quadrupeds with dog-like snouts but with

the nostrils near each other. The tail is not prehensile but may be long. The macaques (*Macacus*) are common in all zoological collections. The male Mandrill (*Papio*) has brilliantly colored face and hips. The baboon (*Cynocephalus*) of Africa does not live in trees but among rocks.

Family — *Simiidae*. These are sometimes called *anthropoid apes* because of their resemblance to man. They include the gibbon, orang-utan, gorilla and chimpanzee. The breast bone is short and broad. Arms are longer than legs, there is no tail and they tend to walk with the feet turned in, a most convenient position in climbing trees.

The gibbon (*Hylobates*) is found in southeast Asia and the East Indies. They are mostly arboreal and omnivorous. They can



FIG. 283. — Marmosets. (Amer. Mus. Nat. Hist.)

walk erect. The orang-utans (*Simia*) (Fig. 284) are at home in Borneo and Sumatra in swampy regions. They assist themselves in walking by placing the knuckles on the ground. They live in nests in trees and are vegetarian.

The gorillas (*Gorilla*) (Fig. 285) live in equatorial Africa. They are the largest anthropoid apes and heavier than man although not as tall. They may weigh five hundred pounds and are powerful animals. They also use the knuckles when walking. They



FIG. 284. — Orang-utans. (Amer. Mus. Nat. Hist.)

have been described as ferocious and at times are, although Carl Akeley states that this is not the usual mental state. Gorillas have been successfully 'tamed' by Miss Cunningham of England, who found that the animals she dealt with showed evidences of considerable intelligence and affection.

The chimpanzee, rightly named *Anthropithecus*, inhabits equatorial Africa. It lives in trees and among other things eats fruit. The chimpanzee has somewhat shorter arms than the gorilla and is not as large. It is more active and quite intelligent. They are easily tamed and are easily taught to dress, smoke, eat at table, ride a bicycle and ape man in a great variety of ways.

Family — *Hominidae*. This family contains but one genus and one species, *Homo sapiens*. Man differs anatomically from other Primates in the great development of the brain. The brain of the gibbon of all other animals is most like that of man in appearance but not in size. Man has an erect posture, is bipedal. The hind limbs are longer than his arms. In locomotion, the soles of the feet are flat on the ground, the great toe (hallux) is not opposable and his heel is better developed. With upright posture and head erect he has a greater view of his environment, the voice mechanism is better developed and language becomes a mighty instrument of power over nature. Social organization, of course, far surpasses anything of the sort found among other Primates.

But his anatomy in many respects resembles the type pattern of the generalized Vertebrate, while some other forms are more specialized, as for example, the sulphur-bottom whale, which may weigh as much as a hundred ton ship, has *no hind legs* at all and its

fore legs are comparatively small flippers, yet it is 'at home' in the vast expanse of the ocean. The human digestive tract is more generalized than that of the Ungulata. In limb plans, man is more like a frog than are the horse, cow and whale.

But it is brain, voice and hand that have become most specialized. The body has less hair than most Primates, the forehead more prominent, the face less extended, the canine teeth are small. The brain is used more than the teeth, in fact the use of the brain means less use for teeth and long jaws. The chimpanzee and man are anatomically more similar than the chimpanzee and monkey.

Although zoologists classify man as belonging to one species, one genus and one family, yet three races are *recognized*, namely, (a) the Negroid, (b) the Mongolian and (c) the Caucasian.



FIG. 285. — Gorilla — 'John Daniel.'
(Amer. Mus. Nat. Hist.)

Selected References

- Beddard, F. E. *Mammalia*. Macmillan Co., London.
- Beddard, F. E. *A Book of Whales*. G. P. Putnam's Sons, N. Y.
- Flower, W. H., and Lydekker, R. *Introduction to the Study of Mammals*. A. & C. Black, London.
- Hegner, R. W. *College Zoology*. Macmillan Co., N. Y.
- Ingersoll, Ernest. *The Life of Animals*. Macmillan Co., N. Y.
- Osborn, H. F. *Age of Mammals*. Charles Scribner's Sons, N. Y.
- Parker and Haswell. *Text Book of Zoology*, Vol. II. Macmillan Co., N. Y.
- Stone and Cram. *American Animals*. Doubleday, Page & Co., N. Y.
- Thomson, J. A. *Outlines of Zoology*. D. Appleton & Co., N. Y.