ZOOLOGY FOR EVERYBODY

A Series of Lectures

by

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(M.D. Vienna)

3rd AND 4th LECTURES

MAMMALS

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Introductory Note

Dr. Kolisko intended to write a book on Zoology, incorporating the material contained in his series of lectures given in 1932. This was not accomplished in his brief life.

Soon after his death, Mrs. L. Kolisko published the first two lectures. In 1944 she suggested sketches which might illustrate Lectures 3 and 4, on the Mammals. She was very occupied at the time, with the preparation of the first edition of "Agriculture of Tomorrow" and many other tasks. Translations of Mrs. Kolisko's shorthand reports of these two lectures were only completed recently. They are presented here for the first time.

G.A.M. Knapp — Stroud, February 1979

J. Murray

List of Illustrations

ZOOLOGY III

MAMMALS
a general survey

Let us begin by looking at life as a whole in this animal group. Later on we will proceed to a more detailed study of the various species.

The mammals differ from the birds in that they are more confined to a life on the earth, on solid ground. They are the most perfect animals. When speaking about "animals" we always have the mammals more or less in mind. They are the most characteristic feature of the animal kingdom. The name "mammal" indicates the special peculiarity which distinguishes this group, that is the method of reproducing and feeding their offspring. This group comprises all the warm-blooded animals with the exception of birds; that is all the animals which do not lay eggs, but produce living young ones, which they nourish by suckling. This is a special way of producing and caring for the young, and we will begin with this part of animal life, studying it from a wider point of view than is customary.

The way in which birds reproduce their species, by laying eggs, is a process strongly connected with the outside world. The egg is laid by the female bird and is hatched from the outside. I wish to mention once again that the lower we descend into the animal world, the more we find conditions similar to those of the plant kingdom. In the plant world outer factors contribute to the phenomenon of producing seeds, from which new plants develop. The forces of the sun and those of the earth, of the surrounding soil, contribute to the process of reproduction in plant life. We find similar phenomena in the lower animals. In the

fishes we see that the forces of the sun must help in the ripening of the eggs, in bringing the next generation to full development. The reptiles and snakes also need the direct action of the sun for the hatching of their eggs. Here the forces of the cosmos must always play a prominent part in the regeneration of animal life. This is not possible from within the animal organism, without such assistance from outside.

The birds have a greater inner strength than the fishes and the reptiles. Birds, after having surrounded their eggs with shells of lime, and then laying them, can hatch the eggs with their own bodily warmth. The hatching is done with the warmth of their blood.

This "hatching" process becomes more and more an internal one in the case of the mammals till living young ones are born which have developed inside the female body so in the various species of mammals, we find that this process becomes more and more an inner one. The production of young ones enters more and more deeply into the maternal organism, into the blood organisation. It would be possible to show, in mammals, a process leading gradually to an intensification of the inner life.

There are some animals, the Australian Marsupials, which are considered to belong to the mammals because they suckle their young ones. They are born incomplete, and finish their development in a pouch, which is formed inside the skin of the female. They represent an intermediate development between animals which hatch their young ones and those which give birth to living young animals. In Australia especially we find a rich fauna of animals which develop their young in a pouch. On this continent animals have only reached the stage of pouch-bearing species, like the Kangaroo. There are many species of animals in Australia, but they all appear in this typical form. There is a pouch-wolf, a pouch-rat and a fox-like species. We can find nearly all the various animal species, but in an edition of pouch-bearers. We are impressed that the forms which are produced by the animals seem to be independent of the material from which they have to be built. This is an important fact; the forms are independent of the material. We are sorry that this idea has not yet entered into the study of our present zoology and botany.

FIG. 1 *Kangaroo and young*

For example, when studying the plant kingdom, we may observe that a certain species exists in the form of a tree, a tree such as we are accustomed to find in our forests. But exactly the same tree-form may be found in the sea, as free floating seaweed, like a movable tree which floats in the sea. We may study various mosses and there again find minute forms which are similar to trees and bushes. At various levels we find, again and again, the same form built from different materials.

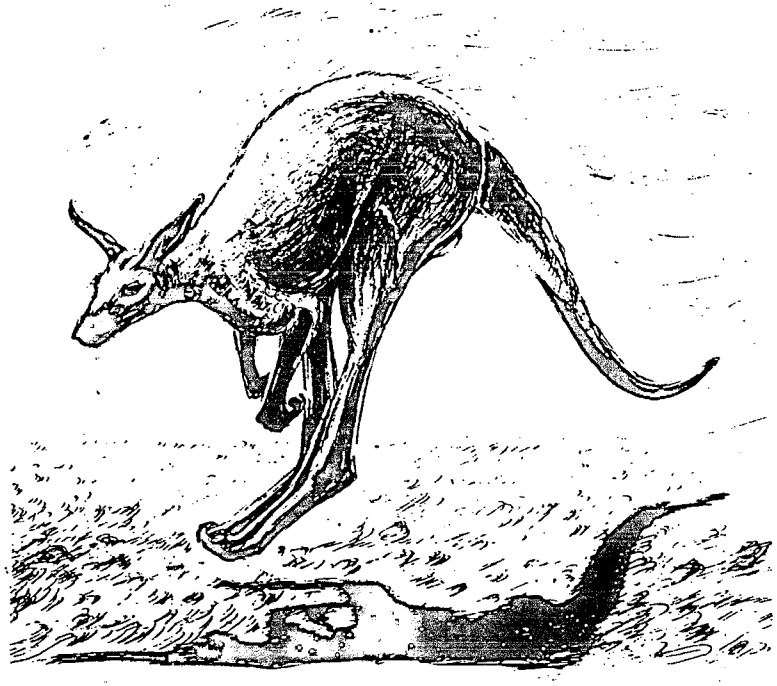

FIG. 2 *Kangaroo jumping*

FIG. 3 *Duck-billed Platypus on land*

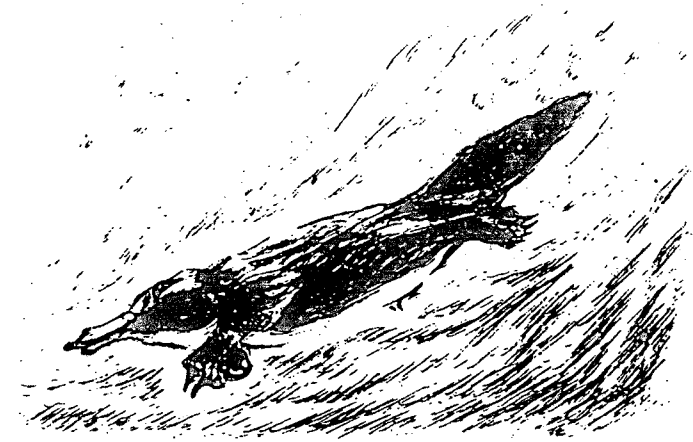

FIG. 4 *Duck-billed Platypus swimming*

This is also true for animals. Thus we find a complete range of mammals, but all on the level of pouch-bearers. The process of reproduction is not yet so far developed into the interior of the animal; it stops at an intermediary stage between bird and mammal. These animals cannot fly but they can jump. We have an intermediate condition between laying eggs, hatching the young ones, and a more internal development. The Australian continent has been separated early in world evolution from the other continents. This is the reason why we do not find the higher mammals in Australia.

For example, there is a peculiar animal, the Duck-billed Platypus. It has a hairy coat, a fur-like covering like a beaver, to which it is similar in size. It has a beak like a bird. It lays eggs, and later on, suckles the young ones. Here we see that all the phenomena meet in one animal species. It is really an intermediate form of animal. It lives only in Australia, *the continent of intermediate animal species.*

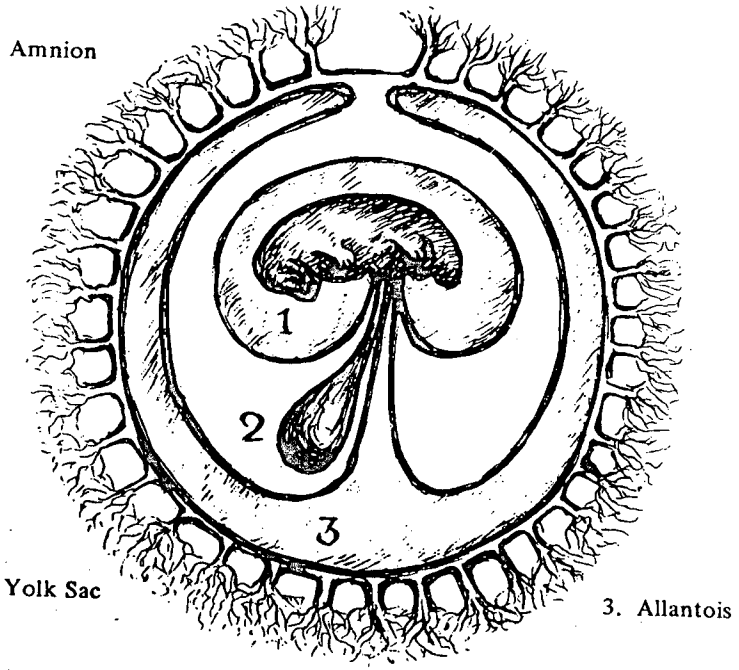

FIG. 5 *Diagram of Placenta of Mammal*

The true mammals, if we exclude the strange animal world of Australia, are those which can produce completely developed young ones inside their organisms, which can be born alive. After birth, they are suckled. The process of milk excretion begins in the mother; blood is transformed into milk. This is a very subtle inner process and in the animal world the process is found only in mammals.

We observe that some mammals can produce many young ones at the same time. For example, mice are very prolific. But there is a limit to the number of young ones which can be produced simultaneously. More than twenty-four can never be produced at the same birth. Mammals with a long gestation period have smaller litters. Those needing six months or more for the embryo to develop are usually limited, on the average, to one young one. Here again there is a certain limit.

A special organ, characteristic for these species, is created to provide for the nutrition of the embryo over a long period. This is the placenta, from which the embryo can be supplied with blood. It is a round flat organ within the uterus which establishes communication between mother and child, by means of the umbilical cord. The placenta is a circular mass and from its centre are radiating blood vessels entering the embryo. The uterus in the animal kingdom is an organ found only in the mammals. What has been acting from outside in the lower animal kingdom has now entered into the interior of the mother's organism. It is interesting to observe these radiating vessels entering into the embryo. As we do so, we are reminded of a picture of the sun and the moon. This is not astonishing because, in a way, the placenta acts as the sun does in the kingdom of the lower animals. Similar forces must be hidden within this inner organ, the placenta. We follow the development of the embryo in mammals by calculating in moon-months. It is warmed by the blood streaming through the peculiar, circular, radiating organ, the placenta. We may suppose that the same forces which act from outside in the reproduction processes of the lower animals are here acting, but from within the maternal organism.

Reproduction is always linked to the moon rhythm; fructification is also connected with the moon. Ripening of fruit depends on the forces of the sun. In mammals we observe the develop-

ment of an embryo, and the formation of the placenta. Furthermore, we notice that the more highly developed mammals are, the more intimate is the connection between placenta and uterus. The more closely these are connected, the more difficult birth becomes. We can notice this when we study the apes.

A much stronger connection still is found with the placenta or "after-birth" in the human organism. There is an immense difference in this respect between human beings and the other mammals. The process of birth becomes more and more an internal one, but at the same time it also becomes more complicated and more painful. There is a much stronger organic connection between the maternal organism and the child, as well as a soul-connection between them.

In other mammals the link is not so strong. The lower down in the animal kingdom, the less the connection becomes, until finally the organ ceases to exist altogether. We can really observe how the whole process of regeneration comes from outside, and enters more and more deeply into the organism. It enters completely into the blood of the mother. We might even compare this strange connection between uterus and placenta in mammals and human beings with something else: that is, with another building process, that of the heart in a living being. A specific extension of the blood circulation is created towards the embryo. The whole process is taken over by the blood. What has been achieved before, from outsids, through the cosmos, in the kingdom of the lower animals, contracts towards the inside in mammals.

If we look from such a view point at these processes, it will be clear to us that such important phenomena as the birth of higher mammals brings into action forces from within, which otherwise are spread out in the universe. We shall never acquire a real understanding of the process of reproduction, least of all of occurrences in embryonic development, if we study them only from an earthly standpoint. Also this process cannot be understood only from the interaction of the two sexes. Special organs have to be created which are able to attract the forces from the periphery and gather them inside the maternal body. The female organism has a very strong connection with cosmic forces, which are united with the development of the embryo.

This process becomes a more and more inner one, and is taken over by the human blood, or we could say: by the human heart.

It is important to study these things carefully. It is not sufficient to look at the difference in the soul-part only of animals and human beings. There are corresponding facts entering deeply into the organic structure. Human beings have a peculiarity for which there is no comparison in the animals. This is the difficult process of human birth. This is because the organic connection is so strong; Man is born out of the mother's womb with the greatest difficulties. This also explains the different relationship of mother and child after birth, compared with the relationship between animal mothers and their offspring.

The process of milk production in human beings is much more subtle and more intimate, right down to the chemical constitution of the substance produced.

Here we have the distinguishing characteristic of the mammals: the nutrition of the embryo by the blood, and, later on, the feeding of the young ones with milk produced from the blood. At first the placenta pours blood into the embryo from below, as nourishment. Later on, after the birth and the first breath, the young one is fed by milk. The organs for milk production are placed higher in the body of the mother, the higher the development of the mammal. In the ruminants, the milk-producing organs are situated deep down in the body. In other mammals they are placed higher, until we see a great difference in position when we arrive at the human being. The lower connection is the more intensive one; the upper is lifted more above the purely organic. The differences between human being and animal are very great in this sphere.

Blood contains iron, not so milk. Milk has been produced out of the blood, but it has been transformed enormously and has changed from an animalic liquid to one more plantlike. Milk is a food which can nourish all the various organs, whereas other foods nourish only certain ones. That is the great difference between milk and any other food. Each animal species has a different milk, which has a quality belonging only to that species.

Thus the distinguishing characteristics of the mammals are: a true embryonic development which is prolonged as the perfec

tion of the species progresses. Secondly, we find that the blood circulation branches off and enters into the reproduction process. Finally, we come to the production of milk, as a complete transformation of the blood. In the mammals, blood plays an important part. In the birds it is not so. The mammals are really formed out of the blood organisation. In them it becomes so important for in it are hidden all the various characteristics of the species. This is not so much the case with the other animals.

The lower we go in the animal kingdom, the more we find that the blood loses its characteristic red colour, and changes into a colourless liquid: the lymph. Blood evolved late in animal evolution, as it does also in embryonic development. The same is true for the formation of the heart, which also evolves relatively late. Ernst Haeckel was aware of this fact. The blood is young in comparison with the rest of the organism. It is a kind of mother-substance for other organs. It is constantly in the process of "becoming." Out of the blood arises the placenta, which is a kind of heart situated lower down in the body. It is as if the blood creates a peripheral heart. The placenta can be considered a peripheral heart enveloping the embryo, a heart which is turned inside out, and within which the embryonic heart finally evolves.

In Man, the heart only reaches its completely human form, with its four chambers, at the first inhalation after birth. Only at the very moment when the child is born is the heart completed. It is the last organ to become complete. At the moment when the peripheral heart (the placenta) ceases to function, the whole process is turned towards the centre of the newly-born being, and from then on is activated by the human or animal heart. It is as if the system of blood circulation is rebuilt in the embryo.

We speak of a bird-embryo, but this is not a true embryo. If we examine an egg, we find that the yolk is underneath the baby-bird. The bird-embryo has the same relationship towards the egg yolk as the mature bird has towards the earth: *it flies away from it*. The embryo is outside, and it absorbs the egg yolk into itself from outside. The mammals use the egg yolk from inside, and quickly change over to placentary circulation. The latter forms the real embryo, and the yolk sac is soon destroyed. We see clearly how differently embryonic development proceeds in the birds and the mammals. The difference is still more obvious in

Man. It is an inner process, right from the beginning, enacted from the forces of the heart and spirit of Man. The embryonic development is achieved with an immense intensity from his innermost being.

The bird embryo however cannot be considered a true embryo, like that of the mammal.

Mammals are strongly linked with the blood; they are, as it were, creatures of blood. The birds are creatures of air rather than of blood. In them the periphery takes a more active part. Birds are more permeated with the air element. Their breathing is rapid and they fly. Both these processes are linked to the breathing system. The bird is strongly influenced by the outside air. In mammals it is the blood within them that is the important factor. The blood is active in the forming and configuration of the animal.

In most cases, with a few exceptions, mammals have a hairy covering. What is the difference between a hair and a feather? A feather is a skin-horn product, which has been modified by light and air, and therefore acquires beautiful colours of metallic lustre, with interesting markings on them. These qualities are derived from the outside forces, though, of course, hereditary forces also play their part. The feather is, as it were, a hair which has been lifted out of the metabolic process. A hair may develop into a bristle. Then it may branch off in various directions. Just as a plant, growing under the influence of the sun forces, produces a stem from which leaves appear, so an animal organism, which becomes governed by light and air will tend to develop a coat of feathers. Among the Ostrich Family for instance there are some rather grotesque species, there is the bird with bristles: the Kiwi. When it is very young, this strange bird is covered with hairs. All the running birds have a tendency to be affected more by the earth. Their metabolism is stronger and their feathers tend to change into hairs.

The pelts of animals are much more strongly permeated with blood. Feathers are an important part of a bird's organism. Strip a bird of its feather covering, and it looks grotesque! If a feather could be drawn more into the interior of an organism, and more fully supplied with blood, then we should arrive at the hair. Hairs are rooted more deeply into the blood system than feathers.

FIG. 6 *Kiwi*

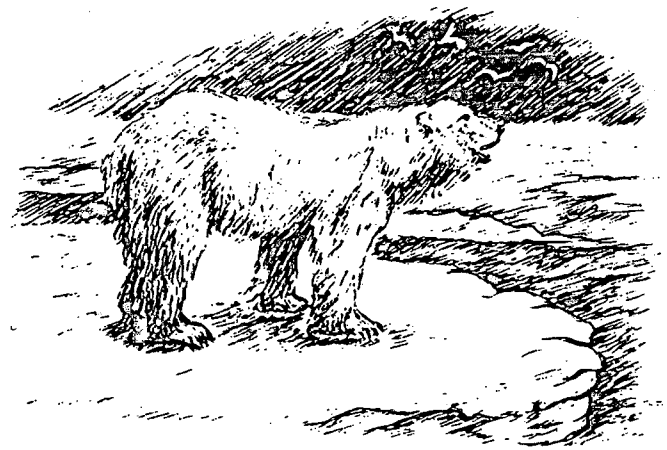

FIG. 7 *Polar Bear*

As far as hair is concerned, Man is again very different from the animals. What is spread out all over the animal's body, contracts in Man and appears mainly only on his head. It is interesting that red hair has a greater percentage of sulphur, whereas black hair contains more iron.

Let us now study the various colours appearing in mammals, and compare them with the colours found in birds. All mammals have brown mixed into their colours. Mammals living in Arctic regions, or in snow-covered countries become white. Others are black, or reddish, or yellowish, but mingled with all these colours somehow brownish tints appear. Brown is, in a way, the colour of the earth itself. Most animals are adapted to the earth colour because they must protect themselves. This brown is produced by the interference of the blood; the pigmentation is derived from the blood.

The colours of birds are different. They resemble more those we find in flowers. Still more, they are similar to the brilliant tints we find in butterflies. Glowing, metallic colours are dusted upon their wings from outside. These do not have a strong connection with the blood, nor are these tints related to the blood chemically.

Colours vary according to the climate in the case of animals. This is not due to direct influences from the surroundings. It is not true to say, for instance, that the Polar Bear becomes white because it lives in a snowy landscape. The pigment is produced from the blood, out of the inner organism, in correspondence with the environment. If we understand that what is outside mammals enters into their blood, then it is apparent how such phenomena as changing colour in summer and winter appear. These changes are produced by a reaction in the blood, which adapts itself to the changing outer conditions of the seasons. As long as we do not understand that the cosmos enters into mammals, as it were, then we can never explain these various processes. It is exactly the same with the colour of skin or fur; what is outside, has entered into the animal. For example, if we breed fishes in an aquarium which is standing on a white surface, then the fish become white because of a transmission via the nerves-and-senses system. This phenomenon does not occur if we blind the fish. The effect from the outside surroundings is transmitted through the nerves. In mammals it is through

the blood, not through the nerves, that colours are produced. It is the blood stream which is responsive to the conditions in the various regions of the earth. These animals are formed by the earth, into which cosmic influences radiate and then stream out again.

That fruits ripen in autumn is due to the fact that sun forces, active during the summer, are then reflected back from the earth. In the case of animals it is the same in a more organic way.

The whole of embryonic development is based on the fact that something is reflected from the inside, which otherwise only acts from without.

By studying the embryonic development of mammals, and also the production of their coverings of skin and fur, we gain a real understanding of them. It is the blood-circulation which makes the animal have insignificant greyish or white fur during the winter. Each winter the animal becomes "old" and its hair becomes white; each summer it becomes young again! Man is different from the animals. His hair, confined to the head, corresponds to the complete fur coat of the mammal. Man has a definite individual hair colour, which lasts until he becomes grey in old age. In animals, we find that the colour ceases to change with progressing age. Finally the winter colour becomes permanent.

In animals, mating and breeding is entirely dependent upon outside circumstances, on changes in the seasons; it is different for the various species. The animal is responsive to outside influences. Man has emancipated himself from these and has his own rhythm. It is by freeing himself from direct cosmic influences that he becomes Man. If he comes under certain cosmic influences again, it is a form of illness.

Having studied the various effects due to the action of the blood, we will now proceed to study the skeleton. The skeletons of mammals consist of more or less the same bones as those of a human being. One characteristic feature of the mammals is in the formation of the teeth, with the exception of the Marsupials, the sloth and the duck-billed platypus, which are "intermediate" animals, not completely mammals.

The mammals have a certain fixed number of bones. A snake has many vertebrae and ribs. There the number of bones is not

yet fixed, because we may find in one and the same species animals with more or less vertebrae. Also in fishes the number is not yet constant. Even in birds we find variations. The vertebral column in Man consists of a given number of vertebrae, and it is a very rare event to find that a human being has a vertebra too many or that one is missing. In Man it is characteristic that the number of his bones is fixed. This fact is slightly indicated already in the mammals. For example, all mammals have seven vertebrae of the neck, the same number as Man. But there is no consistency in the number of tail vertebrae. The whale, the mouse and the giraffe each have seven cervical vertebrae. The difference is only that those of the giraffe are very long and those of the mouse very small, but there are always seven. The bones of the skull are also equal in number. It seems as if a normalising influence starts from the head. In the chest region the differentiation begins. We find still more differences in the number of bones in the limbs. In mammals the fixation sets in from the head and becomes loosened the more we approach the tail. The bones in the skull are limited to the definite number, and certain bones always appear, however different the form of the skull may be. We are reminded of Goethe's publications about the intermaxillary bone. The whole animal physiognomy is determined by the formation of this bone. In the human skull it seemed to be missing. Goethe formed the opinion that this could not be so, and at last discovered the existence of this bone in the human skull. In the animal skull the incisor teeth are in the intermaxillary bone. It has a specific form, for example, in the hippopotamus, in a tiger, a beaver, a monkey, and it also has a definite form in man. It is only a peculiar fact that in the human being this bone has withdrawn and melted into the maxillary bone. It cannot be found outwardly. Goethe had the courage to assert: "Even if the intermaxillary bone cannot be found in Man, it still must exist, only it is so much withdrawn that it disappears into the maxillary bones." If, in the human being, this bone protruded, an animal physiognomy would appear. Man has the same structural plan as the mammals, but it is arranged in a different way. The intermaxillary bone is an important part of the facial bones, and man must have it, but he withdraws it into the interior. The incisor teeth are also not so prominent in the human being, as in the animals. Man withdraws them, too, and

FIG. 8 *Hippopotamus*

builds an harmonious semi-circular arrangement of teeth. He builds a human jaw. He does not allow the incisors to prevail, as the rodents do, nor the canine teeth as the predacious animals do, nor the molars as in the case of the ruminants.

The development of nerve-anatomy resulted in wiping out, more or less, the differences between animal and Man. It is, of course, important that the same bones may be found in animals and in Man. But it is of still greater importance that they are arranged in a different way.

To a certain extent the skeletons of animals are determined and fixed, but, on the other hand, the proportions vary exceedingly. Thus the giraffe has long cervical vertebrae, the mouse tiny. The number is fixed, but the form varies. Only in man is complete stability achieved, and it seems quite natural to us that he has seven cervical vertebrae, twelve pairs of ribs, twelve pairs of thoracic vertebrae, five lumbar, five sacral and four coccygeal. Man has a proportioned organism in contrast to the unproportioned animal body. This fact becomes immediately clear if we observe the following animals: the hippopotamus, which has a characteristic form which seems distorted and

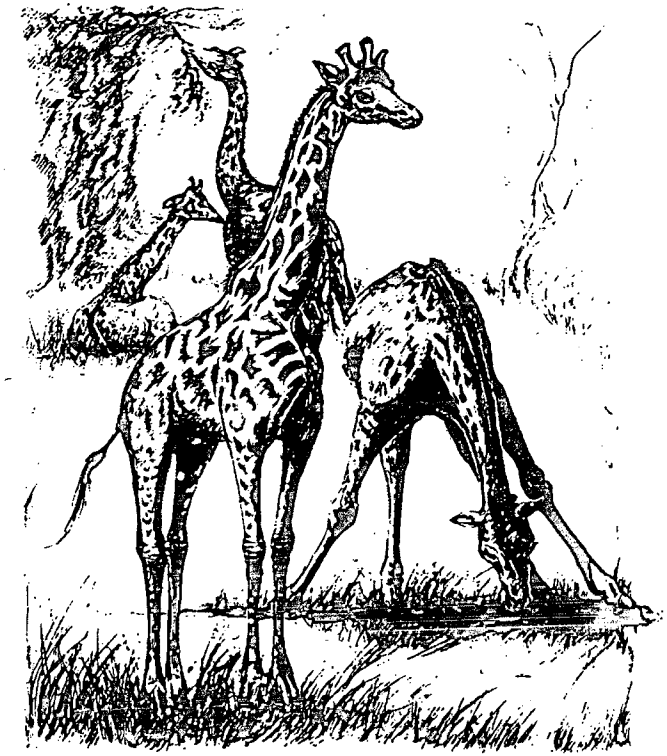

FIG. 9 *Giraffe*

FIG. 10 *Ibex*

unbalanced. Then the ibex has parts which appear to be elongated. All the animals which have antlers seem to have parts of their bodies disproportionately elongated. In the tiger, by contrast, everything is compact, parts seem to have contracted and shortened.

Teeth, which are a part of the bony system, are extremely characteristic for the animals. Once it was customary to learn the various formulae for teeth formation. It is possible to learn much about the whole character of the animal by studying its tooth arrangement. It may tell us something about the skull formation. An animal may develop the molars and have a gap in front, like the ruminants. The main stress may be laid on the development of the incisors, as in the rodents. The teeth may be formed as in the horse. The horse skull has very little development in breadth. It is completely adapted for the forward direction. The horse can run in a certain direction and also looks towards a certain point; it has to have blinkers. You need only study the head of a horse to know much about the whole character of this animal. It is formed perfectly, but in a one-sided manner, and is terribly hardened. The tiger has powerful canine teeth. The skull structure shows that there is much room for the prey he devours. The skull of the hippopotamus shows an extraordinary wide, uncouth, but powerful formation.

The formation of the bones is so characteristic in animals. We may study the skeleton of a cat and find the seven cervical vertebrae, then twelve pairs of ribs followed by a great number of lumbar vertebrae. Each cat has a different number of vertebrae of the tail. Wherever in nature we find variability in numbers, it is a sign that there are still vegetative characteristics existing. Plants also have no fixed number of leaves. The back part of the animal is indefinite, the front is determined. In the front part of the animal formative forces are acting which vanish towards the back.

We do not find this phenomenon in human beings. By turning from the horizontal direction, still kept by the animals, into the vertical line, and thus becoming upright, Man reaches a certain perfection and completion. However the coccygeal vertebrae in human beings still vary in number. These, and the last rib are examples in Man which can still show variations. If we find additional ribs in a human being, we call these "signs of

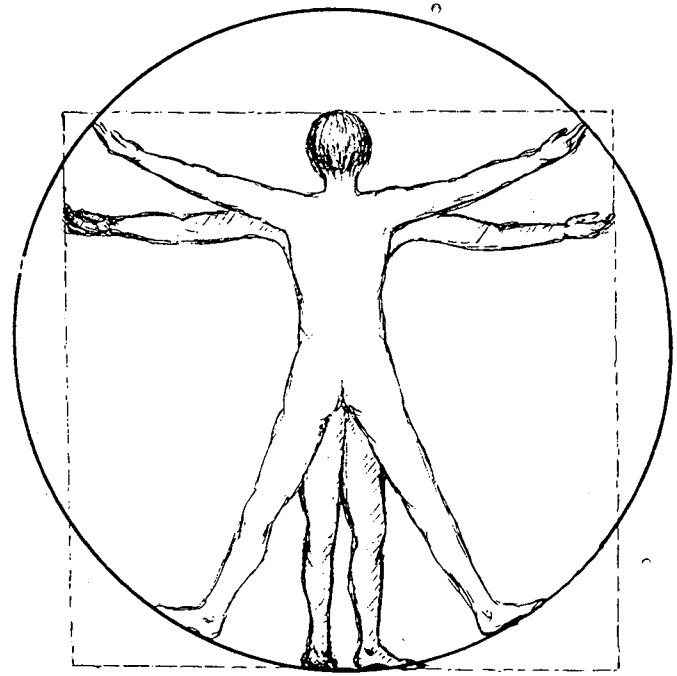

FIG. 11 *Proportions of human figure in relation to circle and square*

degeneration." It is a returning to former conditions. These atavisms are present that we may conquer them. It is very important that we find that there is a definite law which lifts Man out of the animal kingdom, still a very tiny tail is preserved. That is very interesting, that Man has conquered everything, but with one little exception. During embryonic development we also find a kind of tail which disappears again, later on. Only the coccygeal bone remains and enters into the human form.

Man has certain rhythms of numbers inscribed into his skeleton. It is not mere chance that by placing man in this position, a complete circle can be described, connecting head, arms and feet. This could not be done with a horse!

If we take the measure of the hand, we find that the arm is exactly the length of three hands. The leg is four times the measure of the foot. The length of the vertebral column of the

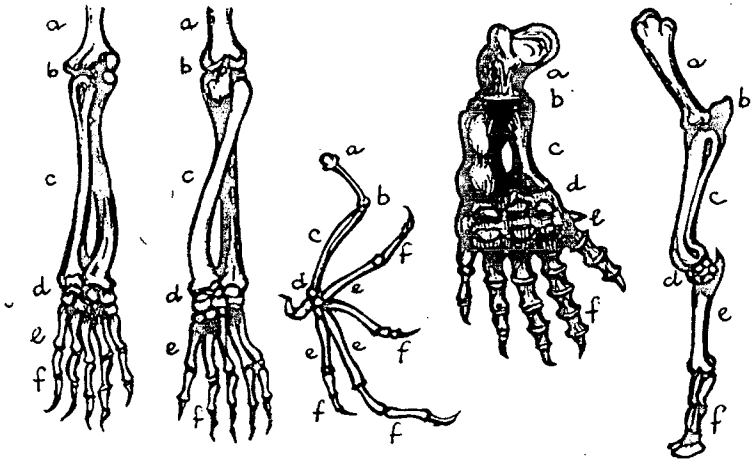

FIG. 12 *Fore-limbs of Mammals*

A. Man B. Gorilla C. Bat D. Whale E. Sheep

a. upper arm – or equivalent
b. elbow
c. lower arm
d. wrist
e. palm of hand
f. fingers

adult is the same length as that of the new born child. The length of the spine is the original length of the human being. To this, during his life, is added the length of his head and the legs. The hand can be used as a kind of measure for the various proportions in Man. For example, the hand is exactly as long as the human head without the jaws. If you turn the hand, horizontally, it is just the measure for the jaw. This interesting law has been found by Professor J. G. Carus; he introduced the hand as a measure for the proportions of the human body and called it a "module." The hand is one third of the spine.

We never find such proportions in the animal organism. For example, if we examine a bat we see that it has extremely long fingers. In a horse everything is more or less concentrated on the development of the long thigh bones. The human skeleton is completely balanced, harmonised.

The animal has the same bones in its skeleton as the human being, but they are not in the same proportions. The animal skeleton is fixed in the front, but indefinite at the back. Above we find the form principle, and below we find the material matter. The vertebrae of animals are indefinite in number. The part of the animal organism which is variable is, at the same time, the part which enables the animal to adapt itself to its specific life conditions. For example, if an animal flutters about, as bats do (they do not fly properly), then it is possible for that animal to extend its skin over the fingers, and with this colossal surplus strength it acquires the possibility of fluttering. Other animals develop other parts in an excessive way.

Rodents develop their front limbs in a special way. They possess an immense adaptability in their tails and extremities. These parts are variable in length, adaptable to their environment. In those times of earth evolution when the bony part of animal organisms was not yet quite solid, the form could adapt itself to the necessities of the surroundings.

The human being preferred to be less adaptable. He withheld his development in this direction, and fixed his limbs, his periphery in the skeleton; but he has reserved for himself adaptability for the spirit. He has withdrawn his faculty of adaptation from the limbs, whereas the mammals have kept it in this realm. Therefore the mammals are true limb-system

FIG. 13 *Squirrel*

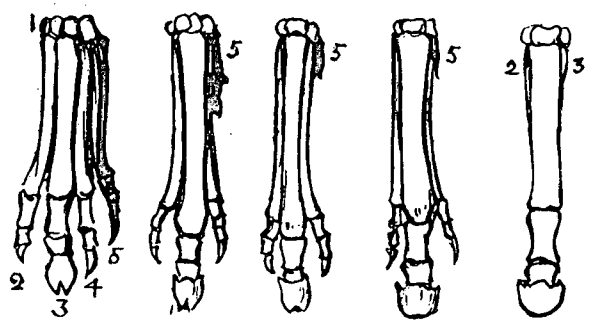

FIG. 14 *Development of Horse's Hoof*

Front feet of 5 predecessors of the modern horse, showing reduction from five toes to one.

A. Hyrocotherium
B. Mesohippus
C. Miohippus
D. Hipparion
E. Equus (Horse)

creatures. The squirrel has wonderful, nimbly-built fore-limbs. They are built for the purpose of holding a nut between them. The nut is already there spiritually, as it were. The beaver has its organism adapted to the faculty of building its wonderful architectural dam. Other mammals are adapted for the function of climbing or running.

In geology, we can follow, to a certain extent, the development of animals. For example, at the beginning of Atlantis, or according to geological terminology, the Tertiary Epoch, we find horses with five toes. Slowly, during the ages, horses have developed with only four, then three, then two toes. Finally, as at present, the horse has only one toe, the hoof. Only one bone is left, still we find the other toes in a rudimentary form. We can see them especially in the horse embryo. There the horse starts with five toes. As the embryo develops it gradually loses one toe after another until it finally acquires the well known hoof.

We must consider that during the evolution of our planet earth, only gradually has the surface hardened and become solid, until it was a sufficiently firm foundation upon which a

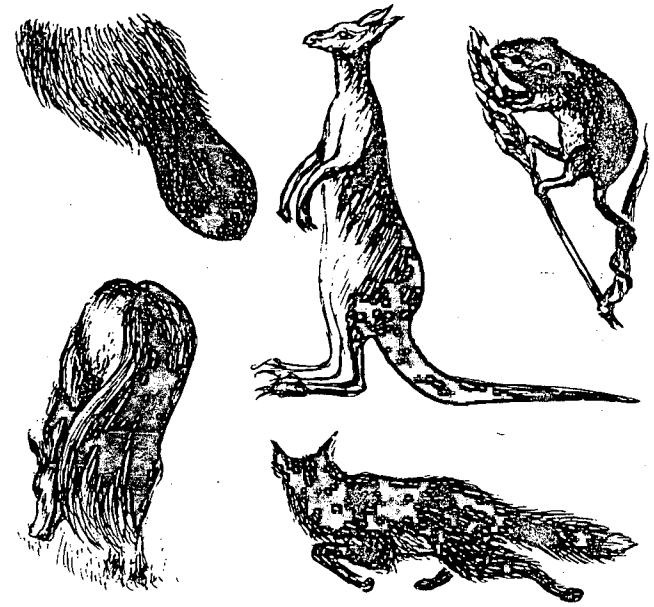

FIG. 15 *Tails with different uses: Female Beaver, Kangaroo, Harvest Mouse, Horse, Fox.*

hoof could tread. Everything in the organism of a horse fits together, from its hardened, but splendidly functioning hoof, to its skull. The four legs are completely skeletonised, transformed into a kind of hard, horny substance. The outstanding characteristics of the horse are: its skull, which is so structured that it needs blinkers, and its extensively hardened limbs. We can study how such a one-sided development arose. As the earth gradually became more and more solid. an animal organism was developing, which became increasingly hardened, until a species with hooves evolved.

At the beginning, the animal forms were not fixed. They did what the earth demanded of them, what the trees demanded, what manifold nature asked of them. They adapted their limbs to the surroundings. Man is very badly adapted to nature. He must replace this lack, by learning. The mammals adapt their extremities to the conditions on earth and become really a truly limb-system animals. From their skeleton they acqu

these skilled limbs. In a way, the teeth also can be considered extremities. The versatile limbs and the type of teeth for each species fit into each other like lock and key. What vibrates around the mobile and sensitive finger-organisation of a squirrel corresponds to its incisors. The teeth formation of an animal is a part which is fixed, and this is connected with the continuously mobile limb skeleton. This fact can also be studied in the formation of animal tails. A tail may be rolled, turned, used for climbing, and it may be used as a kind of fifth limb. Monkeys especially have very versatile tails.

Tail-less apes come nearer to Man but do not reach him. Man achieves wonderful proportions in his organism, which the apes can never attain.

In mammals there is a kind of totality, and yet a certain one-sided development, in the adaptability of their extremities to the earthly surroundings. The skeleton is a product of the mode of life. It we look back into previous epochs of evolution, when the bony structure was not yet so hardened as it is today, then living beings could have great changes in their organisms. The scientist Lamarque said, "The requirements create the organism. If a giraffe needs a long neck, then the animal will acquire it." But what about the animals living at the present time? They cannot change as the creatures of long ago could do. This is no longer possible. When studying Lamarque's system, we find that he says: "The requirements create the organisms . . . and heredity preserves them." He is perfectly right, but he is speaking as though he were living in the past. His ideas are as versatile as animals' organisms were in primeval times. His ideas had to be considered "unscientific" because they conflicted with our present-day experience; they do not apply to the present-day animals. The animal organism is now fixed, and the creature is the slave of its limbs. It must do what the inherited skeleton demands. It is restricted by the form of its extremities; the limbs and the teeth. It is instructed by its organs. Man governs and instructs his organs. Animals descended to the planet earth earlier than Man, when their organisms were at an earlier stage of development. Man appeared later and he himself rules and teaches his organism.

It would be possible to show similar phenomena in the senses. Mammals were the first creatures to develop the senses more

fully, but they are always one-sided and unbalanced. The dog has a strong sense of smell, the cat hearing. The predatory animals have a splendid sense of hearing and touch, but their sight is not so good. This group, to a certain extent, does achieve a greater totality in sense perception than most of the other mammals or the birds. But they do not reach the totality of Man; they are unbalanced and one-sided, as far as the development of the senses is concerned.

Man alone achieves totality of the sense perceptions, and he can unite them with spiritual activity. He reaches a more balanced result, in comparison with the mammals.

Mammals acquire their formative forces through the blood, and this determines their structure. They are a product of heredity and adaptability. Not so Man; he adapts himself to nature in a different way. He lifts himself out of external adaptation by learning. He also rises above heredity; although he is bound to it, he overcomes it continuously. To a certain extent he is subject to the laws of heredity, but he constantly conquers them. He is a contrast to the mammals in his conquering of heredity and adaptation, to which the mammals are completely committed. Notwithstanding these facts, the mammals represent a higher development than all the other species of the animal kingdom. Within the organisms of the mammals, is gathered together the whole kingdom of the lower animals, as it were.[1] That is when we look at the mammals from one point of view. Looking at them from a different angle, we may see the mammals grouped around Man, each species expressing a different aspect of the human being. So we have the strange fact that although the mammals are completely different from Man, yet they may be grouped around him. But we must understand this properly, then we will never under-estimate the animals, but also never under-estimate Man.

We look upon those peculiar differences in that world of the MAMMALS grouped around Man; that world which can never be thought of without Man; that world which, in reality, is ONE-SIDED-MAN.

1. See Zoology for Everybody: No. 1. Introductory. The Snailshell and human ear; worms and intestines, etc.

ZOOLOGY IV

VARIOUS TYPES OF MAMMALS

An important fact about the mammals is that these were the first animals to develop a separation between the upper and lower parts of the body. The diaphragm, a muscular, membranous partition, divides the thorax from the abdomen. This produces a separation between the chest organs, that is the heart and lungs, which are concerned with the blood circulation and breathing; and the organs of metabolism, reproduction and excretion: those of the abdomen.

If we consider this division into chest and abdominal organs, we enter a sphere where we find many radical differences between the various species of mammals.

We will now study in greater detail the various types of mammals. They can be divided into two main groups. This is stated as an assertion at the beginning. Later it will be possible to prove it, giving the facts.

Usually we discriminate between many types of mammals. They can really be reduced to two main groups, according to the separation of the body into two parts by the creation of the diaphragm. These two groups are the predatory animals and the ruminants. These represent the main mammals; the rest may be grouped around them.

The predators distinguish themselves by their specific mode of life, and also by the structure of their bodies. We will begin with those parts of the organism which we found characteristic for the various species: the skeleton and the dentition. Predatory animals, such as the tiger, develop the middle or canine teeth most prominently. With these canine teeth they tear their prey to pieces. These animals have only a few molar teeth; the jaw is

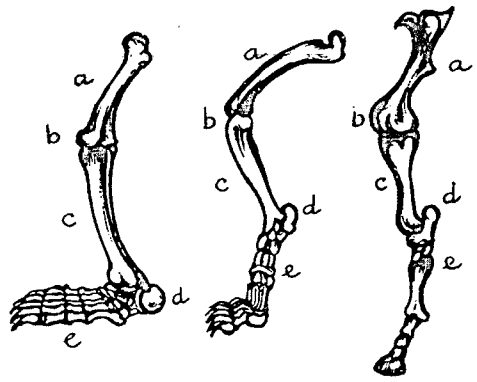

FIG. 16 *Hind-limbs of Mammals*

A. Bear B. Wolf C. Horse

a. thigh
b. knee
c. leg
d. heel
e. foot

short, and the upper teeth overlap the lower ones. It is quite obvious that the formidable canine teeth are the most developed in the tooth formation of the predatory animals. All beasts of prey, such as the lion, the leopard and the cat develop canine teeth strongly.

The limbs of nearly all these animals terminate in claws. They are very lithe creatures, which accounts for the characteristically slinking movements of their bodies. Their limbs are very mobile; many of them are inclined to be bow-legged. The whole body of a cat, a lion or a tiger is supple, and the middle part of the skeleton is extremely well built. In the skull, too, it is the middle which is prominent; the upper and lower parts are comparatively insignificant.

In a lion, as in other animals of the predatory type, the thorax and the ribs, the middle part of the body, is that which is strongly developed in the bony skeleton. Both the limbs and the claws are inclined to be curved. This characteristic is reminiscent of the ribs. It is as though this curved character of

the ribs is continued into the limbs and claws. We could consider the limbs to be transformations of the ribs. An interesting fact is that, in the skeleton, the bones of the arm are just the same length as the rib bones. In the predatory animals, the whole skeleton has more the character of ribs, and this tendency extends right into the formation of the claws. In other types of mammals this tendency has been lost, especially in those animals with straight vertical legs, such as the horse.

If we watch a cat trying to catch its tail, we see how it can roll itself into a complete ball. The cat is built so that it can easily do this, because its body is so supple. A horse could not achieve this! I only want to show how differently all the animals are built. Because of their lithe, supple bodies, the predators can form themselves into a complete circle, a ball.

Furthermore, we find very well developed muscles in beasts of prey, especially in the chest region. The senses of hearing and sight are very alert in these animals. They need these in order to catch their prey.

It is interesting to consider how the whole character and mode of life of these predatory mammals has become associated with certain qualities, which, in Man, we would describe as emotions or soul qualities. We use the phrases: "lion-hearted" or "bold as a lion"; "fierce as a tiger"; "sly as a fox." Comparisons with these animals are used to express qualities in Man fluctuating between courage and cowardice. The hyena is associated with cowardice. The predators attack other animals, devour them, nourish themselves with the blood of their victims; thus they are "bloodthirsty."

The middle part of the body, whatever is connected with the thorax, is especially developed in this group of animals. The characteristics of this middle part penetrate even into the limbs. How insignificant is the back of the animal in comparison! The intestines are not very long in carnivorous beasts. The digestion is rapid, especially as far as albumen is concerned, which is dealt with in the fore-part of the bowels. It is a very intensive process, designed to incorporate nourishment into the blood quickly, and make the animal ready again for fresh food. Not much time is spent on digestion. It is an intensive, not an extensive digestive process.

The most characteristic animals of this group as have been mentioned are the cat-like species: the tiger, leopard, panther and the cats. One special animal expresses the characteristics particularly clearly: the lion. Its impressive mane, which ends abruptly, covers the head and chest, and gives the specific "lion" character. It does not look like a head, there is no proper forehead, the head as such is not overwhelmingly developed, but it looks so marvellous because the mane envelopes the whole breast. A lion looks so grand and imposing from the front, and so incomplete and insignificant from the back. It is most impressive that a lion looks so majestic in front, and does not "live up to expectations" at the back. He develops the middle part of the organism prominently.

The lion's voice; that deep, roaring sound, comes from the depths of his thorax. The lion's roar deeply affects all other animals; they are terrified of the lion's voice. This is not because they fear what might happen to them. They do not understand, but the roar goes through bone and marrow, because the whole blood organisation of the animal revolts when this thundering roar is heard. If the animal had to "think" about it, as you sometimes find it stated in textbooks, then the effect would not enter so deeply into its organism. The cry of an ostrich is much louder; it is much more noisy than the roar of a lion, yet it does not strike terror into the hearts of the other animals, as does the roar of the lion. There is a clever exposition in one text book about the cause of the incredible impression the lion makes. The author thinks that the other animals know, on hearing the sound, that something is going to happen to them. It is the whole character of the lion's roar, streaming from the depths of his chest, which impresses itself on the other animals.

The lion has immense strength, but it is confined to the moment, and is not maintained for a longer period. Everything in the lion is designed for quick action. The leap is mighty, and the capacity for elasticity in the jump is born from the chest organisation. Not all the parts of an organism are elastic. Where do we find elasticity in Man? In the middle part of his body, the ribs are elastic. The predatory animals have developed this quality still more than human beings. Their sinews are very well formed; these represent the intermediate state between muscle and bone. The sinews take part in the intensity of the jumping

movement. The whole organism of the predators is imbued with elasticity. This is especially apparent in the lion.

The blood circulation of the lion is very quick; this makes it possible for his whole body to be, more or less, an expression of the movement of the blood. The digestion is very rapid too. It is strange how these animals have inscribed into their bodily structure such a longing for a connection with the blood of other animals.

It is also very interesting that the habitat of the lion is limited to localities with certain sun conditions. He is at home in areas where there is intense heat and dryness; in the deserts the lion thrives best. Certain definite countries, with strong sun influences satisfy his requirements. Africa, where there is an immense reflection of sun forces from the earth, offers the lion a climate necessary for his well being. The desert is his real home. He is the most representative of the predatory type of animal.

Around the lion are grouped the other cat-like species, such as the tiger and panther. There is also another species of predatory animals, in character like the wolf; the wolf still hunts its prey. But the predatory characteristics are expressed much less intensively in the dog, which was derived originally from the wolf. Other beasts of prey are like the fox; such animals may be very small, and live in trees and bushes, like the marten and the weasel. All kinds of intermediate forms exist, which lead us slowly away from the predatory types towards another group, the rodents. Beginning with the fox as a type, and passing on to the marten and the weasel, we come to the smaller animals, which become more and more mobile and have the tendency to climb. Of course, this is also expressed in some of the true predators, in their suppleness and elasticity. With their lithe bodies and capacity for leaping, they are not fixed firmly to a life on the solid earth.

We find certain extremes, certain contrasts among the beasts of prey. The hyena is a complete contrast to the lion. The hyena is not so keen on fresh blood, and likes to eat decaying corpses. It is a cowardly beast with a peculiar organism. The body is sloping; the form of the head is also strange. The whole body seems to withdraw, there is discord in its organisation; it is a degenerate lion nature. There are great contrasts in other ways. The tiger is not so generous in its nature as the lion; it is more

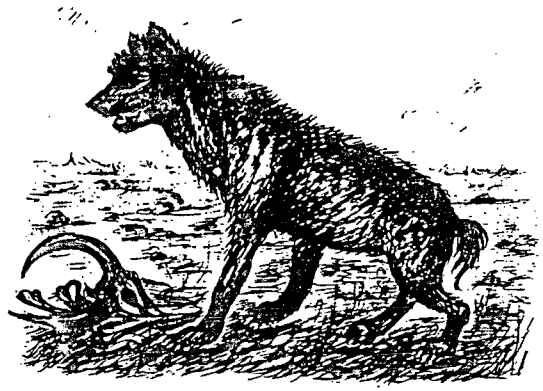

FIG. 17 *African Spotted Hyena*

cruel and bloodthirsty. It would be possible to demonstrate all kinds of variations, leading from the lion to other animals. In the fox a cunning nature appears, leading to smaller, more mobile animals. There are also other types of digression.

The bear is different from other predators. It not only eats meat, but it also likes honey, which seems strange. The bear walks on the soles of its feet, and comes more deeply down upon the earth than most predacious animals. It tries to get into an erect position, standing on the soles of its feet. It is rather clumsy. It is an intermediate form, leading from the predatory animals to those heavy creatures which rest solidly on the earth. Everything about the bear is in an intermediate position. In a way it is grotesque. There is something awkward and clumsy about it; at the same time it is amusing. We always find that there is something comical when an intermediary form is created. It is so with the penguin, which cannot decide between two types of form. Some of the apes, too, are similar in this respect. They are grotesque because they are not fully adapted to their own type. They do not represent a certain idea fully and completely. A cat is not grotesque because, as a cat, it is in itself complete and perfect. A bear is comical because it still unites a cat's nature with some other characteristics which are more coarse and are nearer to the earth.

The bear has a special way of overpowering its prey. It approaches like a fond lover, embraces its victim and, at the

same time, crushes it. The bear easily learns to dance, which again is rather quaint. This shows that it is not quite rightly fitted for the earth. It can neither run nor jump properly, consequently it makes these peculiar intermediate movements. The intestines in the bear are longer than in any other predatory animal. The fact that it walks on the soles of its feet, and that it also develops the intestines, the metabolic system, and the hind legs more fully, shows that it is more solidly down on the earth than other predators.

So we can study the various phenomena which lead us away from the truly predacious mammals, towards those more down on the earth, such as the bear, and those climbing into trees, such as the marten and weasel.

It is a good idea not to cling too rigidly to the stiff classification we find in text books. Some of the animals usually included in the rodents, definitely belong to the predacious group. Examples are the shrew and those animals which feed on insects. These are predatory creatures trespassing somewhat in an upper direction. Even such an animal as the hedgehog shows such characteristics. These animals are smaller than the ones we have already described and they acquire special skills. The hedgehog and the shrew resemble, and come near, to the group of rodents. We see that the Insectivora, the insect eaters, are pre-

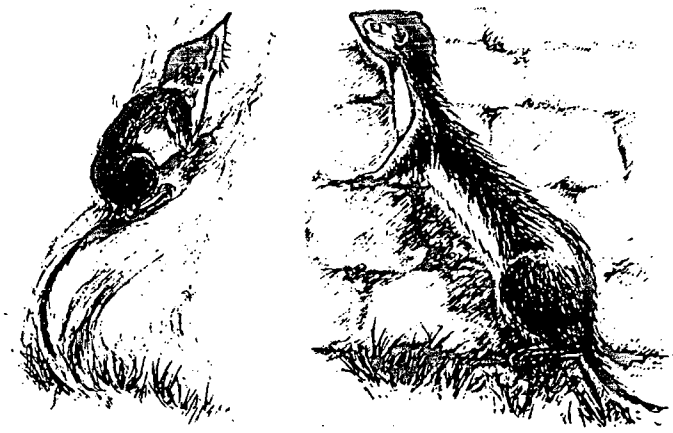

FIG. 18 *Shrew and Weasel*

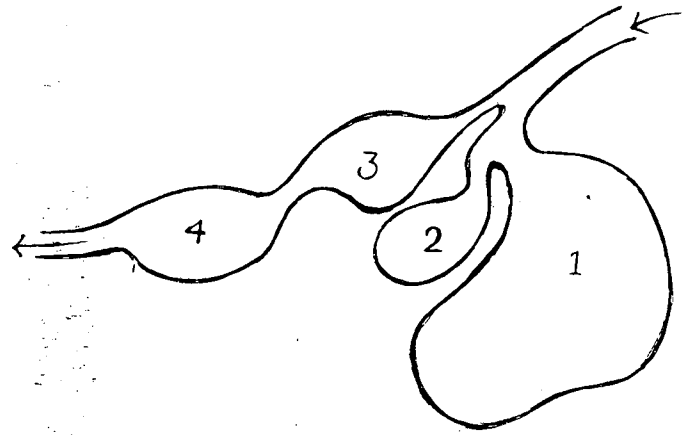

FIG. 19 *Stomachs of a Cow (diagram)*

1. First stomach (Rumen)
2. Food then passes to second stomach (Reticulum). Food then returns to mouth for chewing of cud.
3. Enters third stomach (Omasum)
4. Passes into fourth stomach (Obomasum)

dacious animals, if we examine their teeth; only their victims are small creatures. Just as there are large beasts of prey, devouring big animals, so there are small predatory animals feeding on tiny creatures, the insects. The form of these animals depends on their food. There is always a kind of parallelism between the food and the outer appearance of the animal. Of course the animal is different from its nourishment, but there is always a connection between the two. We can see how the outer appearance of the shrew is co-ordinated to its food: worms. The hedgehog develops bristles or spines, structures between hairs and feathers; it is interesting to note that its skin is less permeated with blood than is usual for animals of the mammal types.

Having studied the predators, we will now turn to the ruminants. We will begin with animals in which the characteristic qualities of the ruminants are most pronounced: the horned cattle, and the ruminants with antlers, and the camel. All these ruminate; that is they chew the cud. But there is an immense difference between those with horns, and those with antlers.

At first we will study the horned cattle. We notice that they develop the metabolic system to an enormous degree. They have four stomachs. The size of the metabolic apparatus is enormous; it fills the greater part of the body. The space allotted to the abdomen greatly exceeds that of the thorax or chest. The legs have quite a different character from those of the predatory animals. They are stiff and straight, and produce the type of real quadruped, land animal, as expressed in the cow. In these animals, the teeth are interesting to study. In the upper jaw there are only molars; the incisor and canine teeth are missing. In the lower jaw we find the incisors, then a gap, then well-developed molars. The middle part of the dentition is completely lacking, and the front part poorly developed. We find this phenomenon in all horned animals. Goethe noticed that there must be some reason why the horned animals are unable to develop their front teeth.

It is very interesting that camels are different. The molars, at the back part of the teeth formation, where the horizontal chewing and grinding takes place, are the most developed. Camels ruminate; they chew the cud.

In ruminants, the digestion is very intensive, not only in the metabolic system, but already in the upper part of the organism. These animals are exclusively vegetarians. Their legs are straight, and they have hooves; ruminants have two hooves; they are cloven-hoofed.

Now we can sum up the characteristics of this type of mammal. The legs are straight and stiff; the abdomen is enormously large; the intestinal tract is huge; the back teeth develop in a massive way; there are four stomachs. Other qualities are developed to a lesser degree. The body is not lithe and supple; the breathing and blood circulation are not so well developed as in the predators; the metabolism is enhanced. The cow needs to eat an enormous amount of food every day; because of the great quantity of food, the intestines are very long. The activity of the senses is subdued. The eye is not alert; the gaze of the cow is directed more to the inside; the animal is quiet, phlegmatic, because it is so heavily burdened with the metabolism of its body.

Then horns are produced, a rather peculiar process. The consequence for the animal is that it is less open to outside forces.

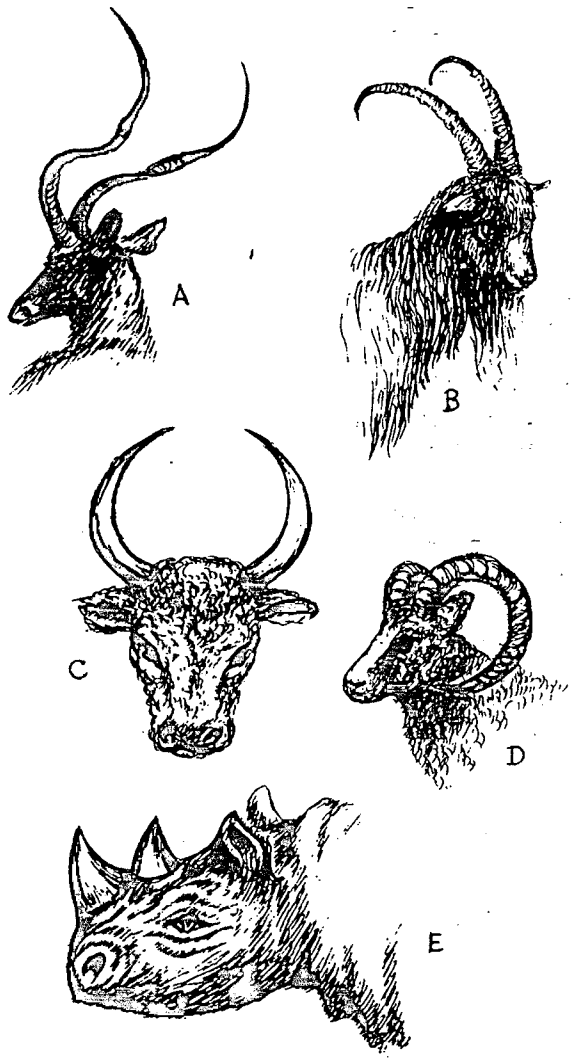

FIG. 20 *Horns*

A. Male Impala (Africa)
B. Male Goat (North European)
C. Chillingham Cow
D. Male Soay Sheep (St. Kilda)
E. Black Rhinoceros

The metabolism is reflected back into the organism, through the horn formation. Animals with horns have a dulled-down sense-activity. Their nervous activity is subdued because the stream of metabolism is reflected back into their inner organism. They produce horns on their heads and hooves on their feet, and thus concentrate the forces of their metabolism into the interior. The horn and the hoof, on the periphery of the body, act as reflectors, directing the metabolism back into the interior. Therefore the cow is not very sensitive to the outside. It is wrong to imagine that an animal is limited within the boundary of the skin. The sensitivity of many animals reaches much further than that of the cow, and other horned animals. Cats, for example, notice through their whiskers when something is happening in their surroundings. Animals show a similar phenomenon to that found in certain *mediums*. If we prick with a needle into the air surrounding a sensitive medium, we produce a sensation of pain in the medium whose sensitivity radiates into the periphery. The body is asleep, but the medium is sensitive in the area around the body, and will cry out in pain, if we move about with a needle. The sphere of sensitivity has been dislocated from the body into the periphery. This phenomenon is more obvious, in certain small animals, than it is in mediums. But we do not find it in the cow; there the sensitivity has withdrawn into the interior, into the metabolism. The cow digests with enormous sensitivity; its whole interest is centred within its organism. With the same intensity, with which other animals occupy themselves in the outside world, the cow devotes itself to its inner life processes. Its whole interest is centred upon its inner organism. The horned animals are unresponsive to occurrences around them, thus strengthening their metabolism.

The bull, once excited, butts with its horns; this only shows a lack of sensitivity. It is irritated by something and uses its horns, exactly that part of its organism which represents a lack of sensitivity. Horns and hooves reflect sensitivity towards the inside. The most beautiful horns are those curved like the crescent moon. This is the innermost tendency of the horn. Its surface is smooth and it is hollow, mounted on a bony cone. It is formed by the metabolic system, and acts as a reflector for this.

The *horned cattle* are prototypes of the ruminants; they concentrate completely on the digestive process. They excel in milk

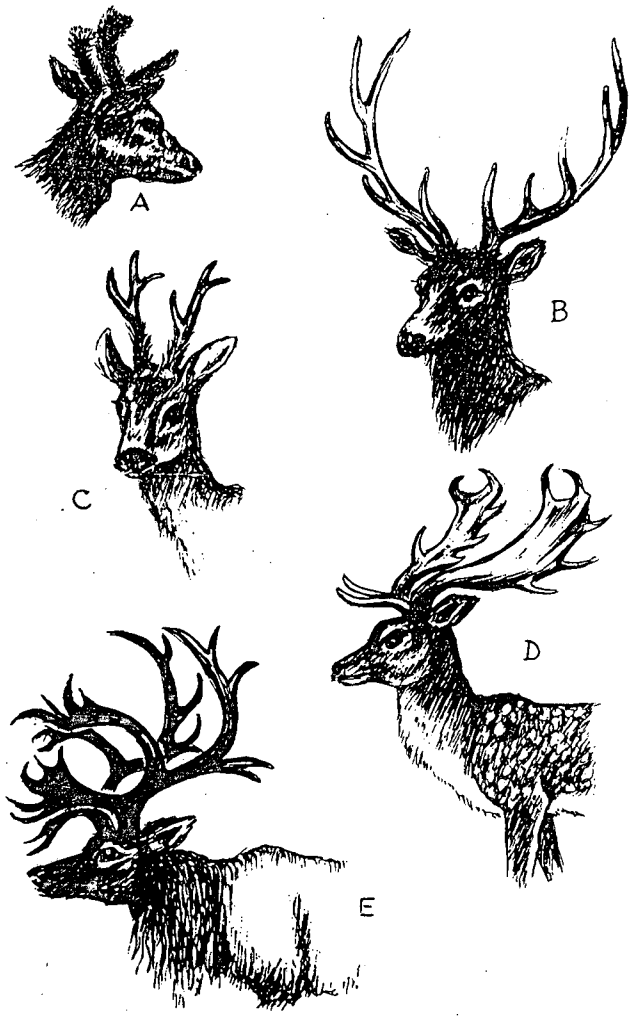

FIG. 21 *Antlers*

A. Red Deer "in velvet"
B. Red Deer
C. Roe Deer
D. Fallow Deer
E. Reindeer

production, which is a metabolic function, and it is not surprising that, in the cow, it has reached a certain perfection. Just as the hen excels in egg production, so does the cow in milk production. The cow is organised especially for the process of converting grass into milk; this is the peculiar chemistry of the cow. Sometimes one feels that this strange process of transformation is not brought about by any animal, but is the direct result of a cosmic force, which prepares this marvellous food in mammals. At the same time, something akin to a vegetative process enters into the organism of a cow. The production of milk is the most important function of this animal; it is not nearly so important in the predacious mammals. This is closely connected with the cow's insensibility to the periphery, as is its horn and hoof formation and all the other qualities characterised.

We notice that the cow does not produce fur or bristles. It is not customary to ask, "Why has a cow no fur? Why has it no bristles?" The most ruminants can manage is to make wool, which is strongly permeated with fat. Predatory animals do not produce wool; only ruminants do so.

Ruminants with antlers, such as the chamois, the deer, the antelopes are very different. Although they are ruminants, they are very sensitive. We cannot compare a horn with an antler. In the latter there is a strong radiating force. The more beautifully formed an antler is, the more strange the impression it makes upon us; something radiates from the animal. The antler looks plantlike, in form it resembles the branching of a tree. These animals, which usually live in forests, seem to have a forest growing on their heads. They are shy, very swift in their movements, and extremely sensitive. In earlier times, not so very long ago, people had a distinct feeling for the peculiar nature of these animals. There are pictures, by several artists, of a stag with a halo surrounding its head; it is called St. Hubert's stag. Then, in earlier times, people could perceive that these animals radiate something into their surroundings, there is an immense sensitivity around the head of a stag. They are very timid animals and are easily frightened. If we look into the eye of a roe, we see that it expresses a whole world of fear. A frightened roe utters a cry which is an expression of the utmost fear.

The legs of these animals are very thin, fragile and mobile. They are exactly opposite to the horned animals, in which nervous activity is blunted. Horned animals stand solidly on the ground. The animals with antlers are very delicately built. Yet they develop enormous antlers which seem to hover above their heads. The antlers are light, and are easily cast off. This is an astonishing phenomenon, that this huge growth is produced on the head, and yet it can be disposed of so easily. During the period of its growth, the antler is well supplied with blood; it is then full of life and enormously sensitive. We feel that much is happening in antlers, but that nothing happens in horns. Whereas the horn is a dead organ, reflecting everything back, the antlers are cast off and formed again. This is connected with the process of reproduction.

The animals with antlers are not confined within their bodily organism, they are sensitive and "scent" far out into the distance. The extent of their range of action is large. This is apparent in their eyes and in their sense of smell. In spite of being ruminants, these creatures develop their nerves and senses system.

We find the most varied types among the ruminants. The camel can form neither proper horns nor antlers. It can deposit fat in its body, and can then do all kinds of things with this deposit. It can eat the fat and then produce it again. This is connected with its peculiar metabolism, which is adapted to life in lands of great warmth and dryness. Camels can live in deserts for an indefinite period of time. They can nourish themselves with their own fat, deposited in the organism. They can also manage without water for a long time. They seem to have a very frugal existence, from the outside point of view. But, within their organisms, peculiarly vivid processes take place. What happens in connection with the forces which develop horns or antlers in some ruminants, takes another form in camels. They acquire the ability to deposit materials in the periphery of their bodies.

Thus we find strange and contradictory processes in the various representatives of the ruminants. Again we can trace an interesting sequence of intermediary forms from the horn to the antler. At one end we have the horn, the curved structure; at the other the antler. The horn is smooth; the antlers are rough and porous. The one is a really animalic organ, connected with the

interior of the body; the other is more plantlike and mineralised, fits only loosely, and is easily cast off. It is like an independent tree formation; whereas the horn fits closely to the head and serves the metabolism. The antlers serve as an extension of the animal into the periphery. If we take a further step from the true ruminants, we find quite a wide circle of animals linked with each other. The horse is an example of one type, in which the leg is terminated by a single hoof. The horse does not ruminate, that is, chew the cud. It has a different formation of the teeth from the real ruminants. We find incisors and molars, with a gap between them. The horse belongs to the quadrupeds living on land, but it has developed the limb system more and the metabolic system less. It has straight, stiff legs, hardened towards the hoof. It certainly fits into the whole group, even if it has not the capacity to ruminate.

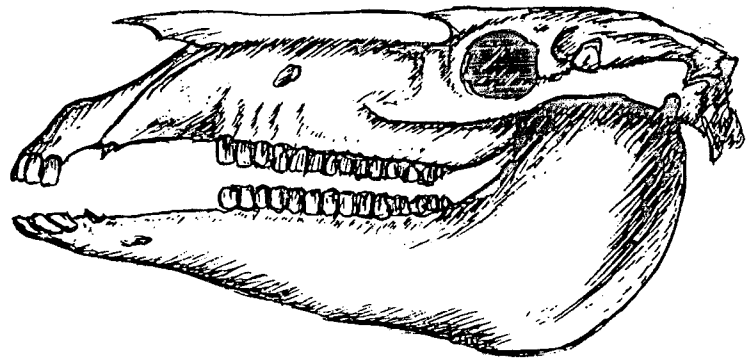

FIG. 22 *Skull of Horse (showing dentition)*

Then there is a group of animals like the pig. It has molars, incisors and canine teeth, and eats everything, all types of food. This type, like the pigs, stand in a somewhat middle position. The characteristics of the wild boar are reminiscent of the predacious animals, whilst in the domestic pig the contrasts between predators and ruminants are partly effaced. The pig is undifferentiated. Well fed pigs have the tendency to form a ball, to become quite round. Their physiognomy is somewhat deformed. The whole animal gives the impression of well-being, but

seems to have complete indifference towards the whole of the outside world. It can stand everything; its blood cannot be poisoned; pigs cannot get blood-poisoning. It is possible to operate on pigs without taking special precautions, whereas one has to be very careful with horses; more careful than with Man; a horse is very sensitive. A pig has a very robust organism and can digest anything, without damaging the metabolic system. Its vitality is so great that it can bear all this. This animal combines everything synthetically, which enables it to digest anything. It can easily be fattened, forced from outside, to do what is already its inner tendency, to grow fat. A little piglet delights us with its rosy appearance; the blood shines through the skin. Its snout also shows how the blood penetrates to the surface. In older pigs the rosy colour is not so obvious.

Pigs are especially vulnerable to certain diseases, such as erysipelas (red murrain). This disease is only an exaggeration of what is always prevalent in a pig, the tendency of the blood to stream into the periphery. It seems that the force which causes coagulation of the blood is not very active in the pig. The albumen is very robust, but the pig is lacking in formative forces. The two fundamental types of quadrupeds, the ruminants and the predators, do not come to full expression in the organism of the pig. It is as though the pig organism is built independently of the specific qualities otherwise predominant in animals. We must place the pigs in a middle position between the horned and antlered types of ruminants and the predators.

The rodents can be sub-divided into different groups. Some have the character of predacious animals, others have qualities showing a tendency towards the ruminants in type. The squirrel, and a still smaller animal, the shrew, climb trees. They tend to show more similarity with the predatory types, only they are more nervous than the beasts of prey. Others, like the rabbits and their larger relatives resemble more the ruminant kind of mammal. Some hares, the more exotic species, are close to the earth, while others are more mobile. If we classify the rodents properly, we can always relate them either to the ruminants or to the predators. Their skeletons are very mobile. Goethe drew attention to this fact. It is the fore-limbs which show this quality of mobility especially. The squirrel can turn its hand round. The rodents have a tendency to free the fore-limbs, to sit upright, to

make gestures which bring the fore-arms up to the mouth, and to use them in conjunction with the teeth. Rodents develop the incisors, the "nervous" teeth especially. This gives them problems; they must use these teeth constantly, otherwise the incisors, continuing to grow, become too long and the animal runs the risk of either choking or starving. The jaws of rodents can become closed, clamped together, because the incisor teeth have grown too long. The rodent must gnaw and nibble, to prevent excess growth of its front teeth; it is the slave of its incisors. Its peculiar nibbling activity is explained by this necessity. Rodents do not only eat; they destroy, by gnawing and nibbling constantly. If we can imagine this tendency to be guided properly, then instead of being destructive, it gives rise to artistic skill. The beaver building its dam is an example of this, whereas the mouse only moves material about aimlessly, in a process of destruction.

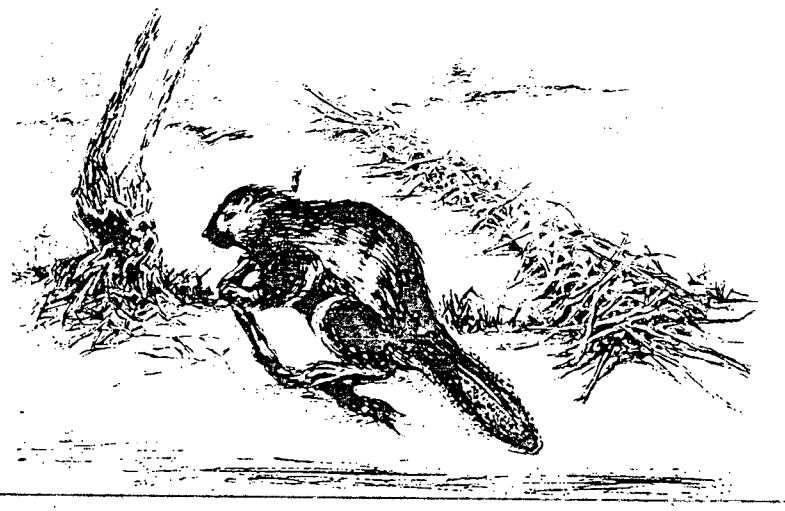

FIG. 23 *Beaver and dam*

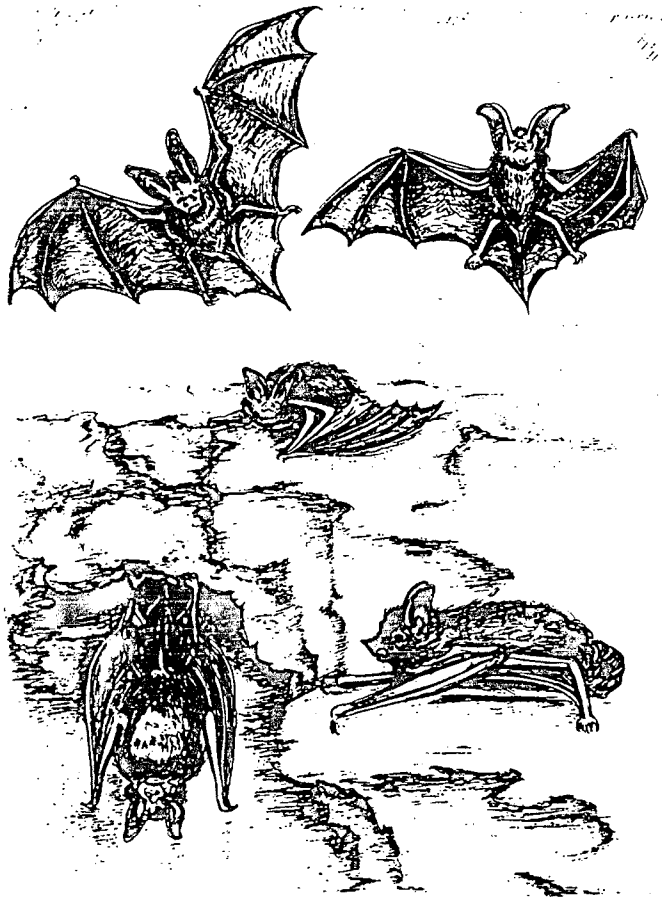

FIG. 24 *Bats*

Rodents are the smallest of the mammals. We can trace degrees of development among them, showing how they become more and more nervous as they strive slowly towards the acquiring of a head organisation. They do not reach it and so become restless. They strive towards something; they climb trees; they would like to fly in the air. Finally we find an animal like the bat, a mammal, which, in a peculiar way, begins to live in the air. The bat cannot really fly, but flutters; it is the flitter-mouse. The bats do not possess proper wings, but webs made of skin. These

are stretched over their fingers, which are elongated. This produces the enormous sensitivity of touch which bats possess; it is this sense which they use when moving about in their surroundings. Bats are uncanny creatures. They strive to become birds, but do not achieve their aim, and become degenerate. Thus there is something negative and eerie about them. They live in twilight and dwell in places which are falling into decay. We find them in ruins, where the atmosphere is weird. They sense this, and like to live in such surroundings. Their range of activity is small, but they would like to become birds. Their bodies shrink and look burnt out; there seems to be a sort of mummification process expressed in their organisms, and yet there is great sensibility, too. These animals are closely related to the rodents.

Rodents are partly predacious in character, partly like ruminants. In this group we feel that there is a striving after the bird type, a struggle to enter the element of air. The birds have developed the beak formation. The rodents develop the incisor teeth prominently, and also a well-developed nerves and senses system. If the rodents progressed towards a hornification process, they would arrive at beak formations. This mammal type does not quite achieve the bird organisation but strives towards it.

Bats cannot fly. They must first climb up and then they can glide down. It is not real flying, only a kind of fluttering glide. They do not achieve the bird-like characteristics. There are only the two types among the rodents, the predacious and the ruminant. Mice have acquired voices; they squeak and whistle. In their climbing and jumping movements they imitate the activity of the birds slightly, but they do not achieve their aim. They only become destructive parasites. Goethe says that, in trying to attain the qualities of birds and not reaching them, the various forms of the rodents appear.

There are other groups of mammals. The variety among them is due to the fact that the development of the mammals ceased in various steps. Thus there are fish-like mammals which remained behind in the water, like the seals, the sea-lion and the walrus. True mammals belong to the element of earth. The seal is the most intelligent and mobile of this group. The walrus is dull in

FIG. 25 *Walrus and Common Seal*

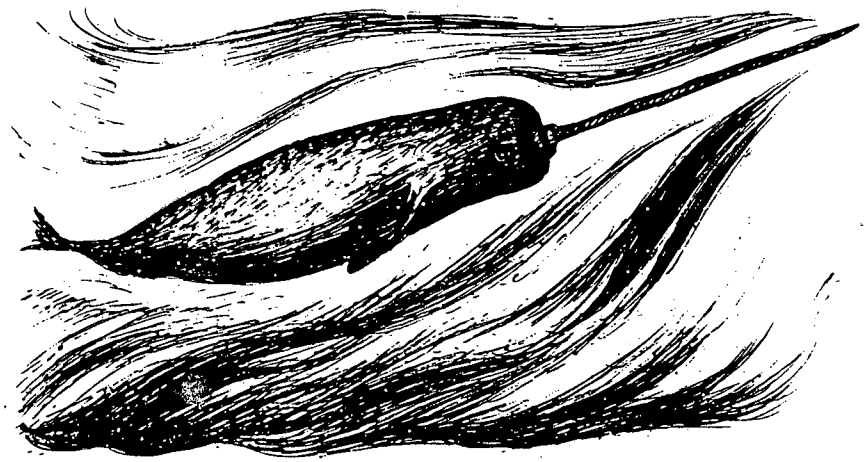

FIG. 26 *Narwhal*

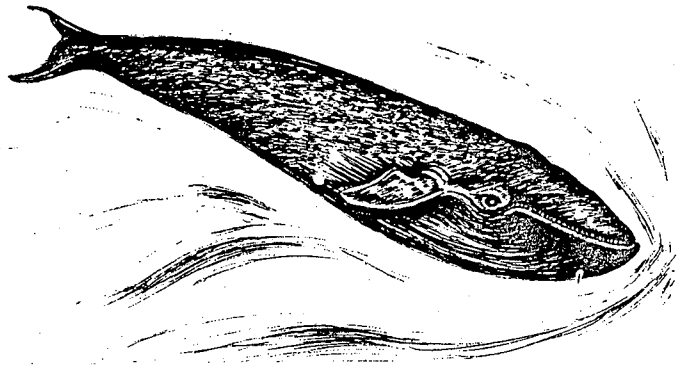

FIG. 27 *Blue Whale*

comparison with the seal; the sea-lion and the walrus develop the lower part of the organism more fully than the seal.

Then there are whales, porpoises and dolphins. The narwhal is close to the predacious mammals; the whale is nearer the cow type; it does nothing but open its enormous mouth and allow sea-water, with its contents, to flow through it. It deposits an enormous amount of fat to keep its blood warm; it has an armour of fat. It has no teeth, but barbs which form a kind of sieve to trap fish. The whale is entirely passive, an enormous mass of floating fat; it has a phlegmatic temperament. This is a type of mammal which has acquired the character of a fish. In our time, whales are dying out.

Other mammals are the remaining representatives of animals prevalent in previous epoches of evolution. The Pachyderms are creatures of very ancient times. The mammoth has already become extinct, and the elephants are the last remaining representatives of this ancient, wise, head-type. Others, such as the hippopotamus and the rhinoceros represent mammals of earlier times which developed the metabolic rather than the head-system. They are similar to the cow; they even show a kind of horn formation. These are huge, coarse, uncouth animals.

The tapirs are the primeval form of pigs; these very first mammals of the Tertiary Epoch unite in themselves all the various types. It is not easy to decide whether they are predators

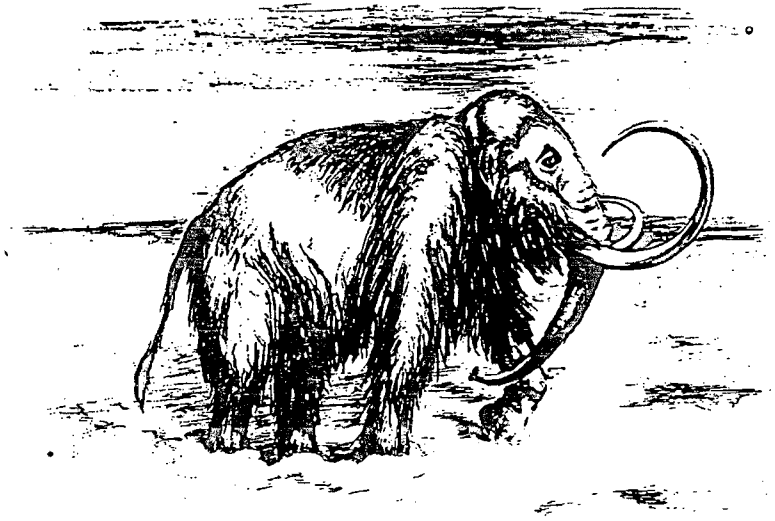

FIG. 28 *Mammoth*

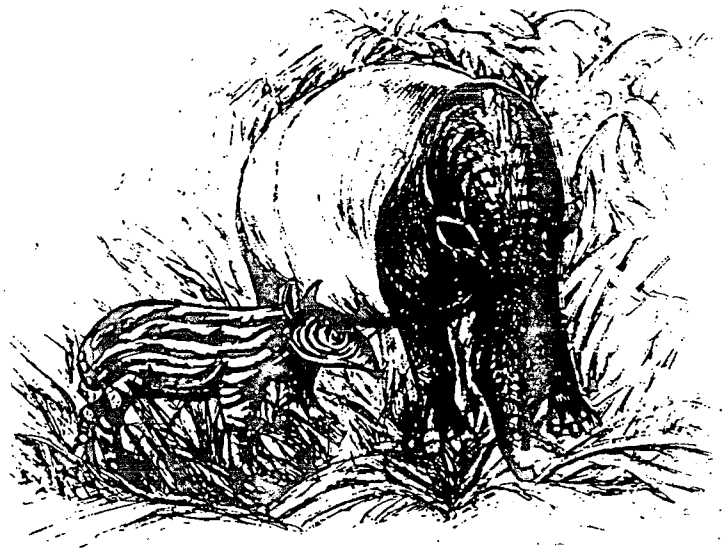

FIG. 29 *Tapir and young*

or any of the other types. The Pachyderms, the remains of previous epochs, do not really fit into any group.

We have already considered the Australian fauna of pouch-bearing animals, the Marsupials, and the Duck-billed Platypus. They represent a quite special animal world. Australia split off from the other continents early in evolution, and so the mammals could not develop there.

So, in reality, we return to the two fundamental types: the predators and the ruminants. There is only one group left over: the monkeys. They can only be understood if we look at them from a different standpoint. They have the tendency to combine all the various types in a way similar to Man. Just as the rodents do not reach the birds, so the apes do not reach Man. In striving to attain to Man, and not achieving the goal, the grotesque form of the ape is created. It is true that the tail-less apes have a semi-circular, evenly arranged tooth formation, containing all the various types of teeth, canines, incisors and molars.

A peculiar line of development begins in the apes. The arms have the tendency to become shorter, and the legs to become longer. Neither can be achieved fully, and so it happens that the disproportion becomes more apparent. The heaviness of the limbs is very obvious. We find all kinds of apes, some more like the predatory animals, some more resembling rodents, some tail-less apes which are more similar to Man. Apes have a tendency to become upright, but they do not attain this completely either. The apes are organised differently from all the other animals because they want to unite all the various types of mammals, including Man, but they cannot accomplish this. The apes attempt to achieve a kind of harmony, but it remains in the sub-human stage. So we must place the apes in a special group.

Just as the parrots are between the types of birds, so the apes are between the different kinds of mammals. They try to unite the two fundamental groups of mammals, the predators and the ruminants, and they would also like to include the qualities of the birds.

In Man the bird character is present, but in a spiritualised form; it is transformed into the thinking capacity. The bird organisation is not obvious in Man physically. It is contained in the activity of the head and the arms in the human being; in capacities and activities, rather than in the physical. Whereas in

FIG. 30 *Apes*

A. Long-tailed green Monkey
B. Baboon
C. Gorilla
D. Orang-utan

Man the predatory and the ruminant mammals are reflected physically in the thorax and the abdominal organs. the head is independent and does not betray that something of a bird nature is hidden within its forces. The ape tries to unite these three types but does not succeed in producing a likeness to Man. So the apes stand as a particular type in the animal kingdom.

The mammals can be traced back to the two fundamental types: predacious animals and ruminants. It would be good to abstain from observing only those types which are usually put together. Instead we should watch more intimately how the two fundamental groups mentioned here struggle and strive in the formation of the mammals. Only the apes trespass beyond this duality; the rodents do not.

So we have tried once more, as we have studied single animals, to understand the connection of Man with the mammals, at the same time trying to see and understand the contrast.

Now, to a certain extent, we have concluded the study of the mammals and birds. In the next lecture we will proceed to study the lower animals. We will start from the bottom, studying the history of the evolution of the lower animal world. It was not possible to study the higher animal kingdom in this way. There we must look at Man, and group the animals around the human being. Now we will start from below and proceed towards the higher animals.

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