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Phylum ; Chordata
Class : Aves
Order : Columbiformes
Family : Columbidae
Genus : Columba
Species : livia

THE PIGEON

In our study of the class,aves most any bird could have been selected,for they are all more or less similar in structure, however, one immediately sees the impracticability of attempting to disect a bird as small as a sparrow or one as large as a turkey. For reasons of size and economy, therefore, the pigeon was chosen as a very suitable bird.

Birds may be looked upon as sharing with mammals the first place in the animal kingdom. In fact the class of birds are even more specialized in structure and habits than are the mammals, their most striking specialization being their adaptation to an aerial life. Birds also have several characteristics in common with reptiles, for example the large eggs, the lack of a complete diaphragm, the quadrate bone connecting the lower jaw with the skull, and the single occipital condyle.

The domestic pigeon is known under many varieties, all of which are believed to have been bred by artificial selection from the rock dove which is found alongthe north-temperate shores of Europe. The different domesticated varieties have been widely scattered over the earth due to the influence of man.

In our study of the external structure of the pigeon we see that the legs are covered with hard scales similar to those found on the turtle. The beak and claws are also horny epidermal structures. The most prominent feature of a bird is that its skin is covered with

feathers. Without examining them they appear to be rather uniform, however, on turning them back there are seen to be many bare spots.

Feathers are homologous with scales, as "the feather may be regarded as a cornified outgrowth from the skin, which has arisen on a papilla of the derma."* The feathers not only enable the bird to fly but they also serve as a covering enabling the bird to maintain its high body temperature.

There are three kinds of feathers; the contour feathers, down feathers, and pinteathers or filoplumes. The filoplumes lie among the others and are of a hair-like nature. The down feathers are of a fluffy nature, therebeing no shaft or hooks. The barbs arise from the distal end of the quill. The down feathers anlong with the filoplumes form a worm inner covering. The contour feather is made up of two portions, the quill and the vane. The quill is hollow and is that portion of the feather which projects into the skin. The vane is composed of a central shaft, which is solid and has small projections extending from it, the barbs. The barbs are usually provided with hooklike outgrowths which enable them to overlap barbules of continuous barbs. The feathers are often of various colors. The coloration is not the same in like species and meither is it symmetrical within the individual.

In the pigeon we can distinguish a head, neck, trunk, and tail.

The head articulated with the vertebral column by a single condyle and has a very great range of movement. The mouth is inclosed by a toothless, horny beak. On its upper surface are the pair of nares. They appear just in front of a swollen area called the cere. The eyes are large but do not project from the head. They possess the same three lids as do the reptiles, the upper, lower, and nictitating membrane. The external openings of the ear are situated just behind and

*Hertwig

below the eye. They are surrounded by specially modified feathers.

Flying is one of the most dificult and highly developed methods of locomotion in the animal kingdom and in order to fly there must be a proper proportionment of weight. This adaptation is watched with interest in the pigeon. In the head we find no teeth or large masticatory muscles, the performance of chewing being done in the gizzard. Thus we see that the head is spared any unnecessary weight. Another effect which has been correlated with the loss of teeth is the fact that the bird has developed a high degree of intelligence, for this reason its brain is very large. Since the head can only have a definate proportion of weight something had to go and it proved to be the teeth.

The neck is rather long and is loosely covered with skin, so enabling it to bend easily. At the base of it is an enlargement of the oesophagus called the crop. The crop is used as a storage room for food. It also secreats a milky substance called pigeons milk with which the nestling are fed.

The trunk is composed of two regions, the thoracic and the abdominal. To the former belong the wings and to the latter belong the legs. The wings are manipulated by large pectoral muscles. These muscles are so large that they form about one-fourth of the bird. Both divisions of the trunk are built very rigidly so as to firmly support the bird when in locomotion by wing or leg.

Just inside the body wall of the trunk are several pairs of air sacs. These sacs communicate with the lungs and with the bones, which are hollow, and serve as additional oxygen supplyers when the bird is in flight.

Near the base of the tail is the anus with its thick circular lips. It is the external opening of the cloaca.

The tail is short and wide and is used primarily in directing the birds flight. It is made of twelve tail quills and bears the uropygial gland. This gland secrets an oil with which the bird oils its feathers.

There are two pairs of appendages, the wings and the legs. Each bare the usual three divisions; the proximal, middle and distal. In the wing the upper arm is short and partly within the trunk. The fore amm there are two sets of quills, the ten promaries and the thirteen secomdaries. Beside these there is a small tuft of feathers on the outer forward side of the wing which is capable of independent movement. These feathers are attached to the first digit and form what is called the ala spuria. On both the dorsal and ventral surfaces of the wing are short contour feathers called the wing coverts.

The three divisions of the leg are the thigh, the shank, and the ankle and foot respectively. The ankle and foot are composed of the vertical shalt and the four toes, three of which project forward while the other one projects backward.

The mouth and pharynx form a single space lying between the edges of the bill and oesophagus. The part with in the bill is the mouth while the remaining part is the pharynx. Within the mouth lies the long wedge-shaped tongue. Behind this, and in the area of the pharynx,is seen the circular cartilaginous ring with the glottis at its center. Behind the glottis is a paired transverse membrane with fringed edges. It is seen on the floor of the pharynx and behind it the oesophagus. The roof of the mouth is made by two elongated plates. At their hinder end are seen the openings of the mares and the Eustachian passages.

After the animal is carefully opened by making a midventral incision from the anus to the neck, the intermal organs are observed.

The body is seen to be divided into the usual two cavities; the pericardial and the abdominal. Within the first is seen the heart with a few of its most prominent vessels, while the main of the viscera is contained within the latter. Each is surrounded by a thin membrane; the pericardium and the peritoneum respectively.

The most prominent organ of the abdominal cavity is the liver. It is of a dark red color and occupies a large part of the cavity. At its left is seen the sphereical gizzard while behind it lie the intestines. The duodenum with its articulating pancreas lies just behind the liver in the median ventral line. Along the sides of the body are seen the thind transperant walled air sacs while at various localities the lungs will be seen lying under the above mentioned organs. At the neck will be seen the trachea with its supporting cartilaginous rings, also the tubular oesophagus. All the above organs are shown, as they lay undisturbed, in Ex. 5.

THE DIGESTIVE SYSTEM - This system is composed of the following organs; the mouth, pharynx, oesophagus, glandular stomach, gizzard, small intestine, large intestine, cloaca, the salviary glands, liver, and pancreas. From the mouth food goes into the oesophagus, which opens into the crop, the function and nature of which was previously mentioned. From the crop the food enters the glandular stomach. The proximal end of the stomach is called the cardiac division while the distal end or pyloric division is spoken of as the gizzard. In this division of the digestive system the food is ground fine by means of small stones and other hard substances. Lying along side of the gizzard in the folds of the mesenteries is seen the dark colored spleen. Attaching to the median side of the gizzard and passing from it is the duodenum. This is a large loop of the intestine and lying within this loop is the pink colored pancreas. The pancreas, by means of three ducts,

pours its secretion into the duodenum. The duodemum also receives bile secreation by means of two ducts from the gall bladder which is located in the liver. The ilium extends from the duodemum back to the large intestine of rectum. It is about seventy centimeters long while the rectum is very short, about three or four cemtimeters in length. The beginning of the rectum is marked by two pouches or ceca call the rectum diverticula. The rectum empties its contents into the cloaca, which is a large reservoir receiving excretions of various organs. The eggs also pass into this organ. Its exit is the anus. Diagrams of the above mentioned organs along with their relative sizes and shapes are shown in ex. 6,7,8, and 9.

THE UROGENITAL SYSTEM - The system studied was that of the female. It consisted of a single ovary in which the eggs or ova are developed. The ovary wall is ruptured and the eggs escape into the body cavity. From here they are communicated to the cloaca by means of a coiled oviduct. As the eggs pass down the oviduct they are fertilized and receive their white and shell. Just before the oviduct enters the cloaca there is an enlargement of its walls to form the uterus.

Lying on the dorsal body wall are the paired kidneys. They are of a three lobed nature and act a s purifiers of the blood. Their excretion is called urine and is communecated to the cloaca by means of a small tube called the ureter. The relative position and connection of the oviduct and ureter to the cloaca is shown in ex. 10.

THE CIRCULATORY SYSTEM - The heart,as previously stated, is large and is inclosed in the pericardium. It is composed of two auricles and two ventricles, the latter being completely separated by a thin septum. The circulation is double, and nowhere in the body, except in the capillaries, does the aerated blood come in contact with the unaerated blood. The blood is sent to the lungs from the ~~left~~ right ventricle

by means of the pulmonary artery. In the lungs the blood is aerated and returned to the left auricle by means of the pulmonary vein. From the left auricle the blood passes to the left ventricle and from here to the aorta, which distributes it to all parts of the body. The used blood from the body returns to the right auricle by means of the various veins. From the right auricle the blood passes into the right ventricle and thus complets the circuit. The various veins and arteries are very similar to those of the turtle. They were studied in detail and a complet diagram of the circulatory system may be seen in ex. 16.

THE RESPIRATORY SYSTEM - The organs of respiration are the larynx, which opens out to the pharynx by the slit-like glottis, the trachea, the bronchial tubes, which are located within the tissues of the lungs, and the lungs themselves. The trachea is kept open by cartilaginous rings which were previously noted. At the junction of the bronchial tubes with the trachea there is a slight enlargement called the syrinx. The syrinx is the organ of voice. Sounds are produced by the vibration of a fold of membrane at this place. As previously mentioned, the bones are hollow and there is a system of air sacs which greatly aid in the aeration of the blood. Breathing is accomplished by movements of the muscles of the thoracic region. The aeration of the blood is complet and a temperature of about (100F) is maintained in the pigeon.

THE NERVOUS SYSTEM - The nervous system consists of a central system, a peripheral system, andspecial sense organs. The central system is composed of the brain and spinal cord, the peripheral system includes the paired cranial and spinal nerves along with the sympathetic, and the special senses studied were those of sight and hearing.

The brain is very large, which is consistant with the birds intelligence. It is composed of the usual five divisions; thecerebrum, the

diencephalon, the optic lobes, the cerebellum, and the medulla oblongata. The cerebrum is very large composing about half the brain. The diencephalon is small and can only be seen from the ventral aspect by pressing the cerebral hemispheres appart. The cerebellum is large and disk like in shape. Its unusual size is due to the fact that itsiprincipal function is that of giving balance to the body. The optic lobes,pressed to one side by the large cerebrum, are also well marked, in correlation with the unusually large eyes and the dependence of the pigeon on the sense of sight. The olfactory lobes are relatively small, and the sense of smell is not at all keen. The medulla is bint downwards, as in the reptiles, and is continuous with the spinal cord. There are twelve pairs of cranial nerves as in the reptiles. Ex. 17 is a diagramatic sketch of the left brachial plexus, which is part of th peripheral system and controls the district of the pectoral muscles and wing.

The bird possess what is called telescopic vision. Its eye is very large and very sensitive and it is said that a bird can sight a worm in plowed ground while flying at an altitude of 300 feet. The eye is composed of two compartments; In the anterior one is the aqueous humor while in the posterior one is the viterous humor. Around the anterior compartment is a cartilaginous ring. Immediately below this interiorly is the iris which controls the amount of light which enters the lens which is directly behind it. The outer covering of the anterior compartment is called the cornea. The lens is held in place by ciliary processes. The posterior part of the eye is enclosed by three layers of tissue. Naming from the inside out theye are; retina,the choroid layer, and the sclerotic layer. It is on the retina that the image is cast. At the junction of the optic nerve there is a relatively large body which projects into the viterous humor, called the pecton. Its nature and function are not known.

The ear consists of the inner ear, of membranous labyrinth, the middle ear or tympanic cavity , and the extermal auditory meatus. The ear has two functions, that of hearing and that of balance or equilibrium. The former is carried about thru the recording of the vibrations of the air which strike the tympanic membrane due to the sound. The latter is accomplished by three semicircular canals which are in the three varions planes. These canals are filled with a liqu d and function in a similar manner as does a spirit level. A diagram of the ear will be seen in Ex. 19.

THE SKELETAL SYSTEM - This is made up of an exoskeleton and an endoskeleton. The exoskeleton has previously been discused and will therefore not be mentioned here.

The endoskeleton is composed of two division; the axial skeleton, and the appendicular skeleton. The axial skeleton is composed of the skull and vertebral column, with the ribs and the sternum. An extensive study of thes division was not.

The appendicular skeleton is composed of the framework of the extremities. It was previously mentioned that both the wing and the leg were composed of three division. The bones of these divisions are as follows; in the wing they are the humerus, the radius and ulna, and the ulnar and radial and carpo-metacarpus and digits. In the leg they are the femur, the fibula and tibio-tarsus, and the shaft along with the tarso-metatarsus and digits of phalanges. The position and relative size of there three divisions of the leg and wing will be seen in Ex. 24 and 25.

DEVELOPMENT - Unlike most domestic animals the pigeon chooses a mate for life. After fertilization the eggs pass down the oviduct and are covered with secretions from different glands, first with the white, them with a thin membrane, and lastly with a limy shell.

The eggs of the pigeon are laid ina roughly made nest and are incubated by both parents in turn for a period of about two weeks. Due to the action of gravity on the heavier yolk, the living disc is always directed upward enabling it to get ~~to~~ the best advantage of the body wormth of the parent. Cleavage of the embryo of a fowl is very similar to that of the reptiles.

The young bird breaks thru the shell by means of a hard structure on the tip of its beak, and mades its appearance covered with a fine down. For a few days after hatching the young bird is feed with the pigeon milk from the crop. Also for therfirst two or three days after hatching the young bird can neither see or hear. The young birds rapidly acquire the power to make coordinated muscular movements, and in a few days the voice develops. The independent life of the pigeon, in some cases, begins in about thirty-four days after hatching.

ECONOMIC VALUE - The main and most important value of the pigeon is its use as a food byrman. Before the carrier pigeon became extinct they were used as message carriers, and were of value in this respect.

An interesting story is told of a carrier used in the World War. All posible means of communication had been cut off and so this pigeon was started out with an important message. The pigeon delivered the message a distance of almost twinty-five miles in just twinty-five minutes, although one leg had been shot off and the breast injured by a machine gum. This only one example to show how highly developed the "homing faculty" had become in this type of pigeon

The class Aves in general is of great economic importance, both positively and negatively. They do much dammage in destroying grain and fruit crops yet they are of great aid to man because of the many harmful insects they destroy.

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