Proceedings of the Iowa Academy of Science

Volume 59 | Annual Issue Article 66

1952

A Four-Winged Domestic Fowl

Grover C. Hawk

A Four-Winged Domestic Fowl

By Grover C. Hawk

Variations in structure in any given species of animal, range from the most minute structures that can be examined by microscopic or other technical means, to the gross items that are easily discernable with the unaided eye. Such variations are of extreme interest to the biologist and serve to forcibly remind him of the vast range of variations possible in any given species. The report on the present specimen seeks, not to present it as a monstrocity of the strange and unusual type, but rather to relate it in some measure with the usual development in chicks and to some of the rather obvious problems involved.

This four-winged chick, which was of the Hi-line variety, was hatched during the latter part of March 1951, in the Des Moines area and was secured along with other chicks of like type, by a housewife in Indianola, Iowa. In a few days the primary wing feathers appeared on the extra wings, as well as on the normals, and, due to the position of the wings, these feathers interfered with the normal use of the left foot. The ends of the feathers were clipped and the other chicks of the flock, being quick to note such differences in structure, began to peck this chick in various places. The housewife presented the chick to me early in April and it was kept with other chicks until the end of the college year, at which time it was killed, embalmed and injected as to the arteries, being some 9-10 weeks of age. It was a vigorous and active male specimen and had made about an average growth. Its external appearance was normal, including a well-developed comb, with the exception of the extra pair of wings.

External Features

On removal of the feathers, the extra pair of wings proved to be attached to the left body wall just anterior to the thigh, being slightly dorsal to the middle portion of the femur. The axis of the extra pair of wings was at about a sixty degree angle with the main axis of the body. The right hand, or more dorsad wing, was the less normally developed of the pair as to size and external appearance.

The normal left wing had the following measurements: length of humerus—2⅝ inches, radius and ulnar—2½ inches, third portion of wing—2½ inches. The normal right wing had the same approximate measurements. The extra pair of wings measured as follows: left humerus—2⅛ inches, radius and ulnar—2 inches and the

third portion—1½ inches. Right humerus—2 inches, radio-ulnar—1¾ inches and the third portion—1¾ inches. The measurements in each portion of the extra wings being less than in the normal wings.

The primary wing feathers were well developed on all of the wings with the following numbers present: Left normal wing, 11 primaries and 14 secondaries, right normal wing, 11 primaries and 13 secondaries. In each case the right extra wing was less well developed than the left extra wing. In general, the extra wings were well covered with normal feathers, excepting the third portion of the right one, which was sparcely covered. The extra heavy group of feathers normally found ventral to the wings were present in each case.

Internal Structures

1. Skeletal Portions. A representation of the normal endoskeleton of the left wing is here presented for review purposes. The location of the fifth, sixth and seventh ribs are especially called to your attention, likewise the position of the femur, the bones of the pectoral girdle, as well as that of the wing. Particular mention should be made of the foramen formed by the bases of the coracoid, the clavicle and the scapula bones, thru which the tendon of the pectoralis minor muscle passes.

The pair of accessory wings is attached to the left body wall, between the sixth and the seventh ribs, somewhat dorsal to a mid-lateral line of the body. An abortive type of pectoral girdle is present, with the left hand portion more nearly normal than the right hand side. The left scapula is fairly well formed and extends dorsally and at an angle posteriorally of about thirty degrees. The right hand scapula is a small rounded mass of bone. The left clavicle is related rather normally to the scapula and the humerus, while the right clavicle is an isolated strip of bone and cartilage, not joined to the scapula, nor humerus on its own side. The coracoids are well developed in each case, with the right hand one being somewhat more slender and elongated. Each coracoid unites with the scapula on the one hand and with the bony plate of the accessory sternum on the other. This bony sternum is heavy and lies between the middle portions of the sixth and seventh ribs, which are widely separated, and with which the bony sternum is fused. The ventral end of the sixth rib is not attached to the normal sternum by a costal cartilage, as would be normal. The foramen for the passage of the tendon of the pectoralis minor muscle is quite apparent on the left side, at the junction of the scapula, the clavicle and the coracoid bones, tho no tendon, nor muscle were found. The endoskeleton of

the left wing was nearly normal in the number of parts and in having partially moveable joints, altho the musculature was very rudimentary and almost non-functional. In the right hand wing, the humerus was more slender, the radius and ulnar bones were fused as a single heavy bone and the digits were not well formed in the third portion of the wing. The elbow and distal joints were not functional, being fused. There was very little development of muscle related to the right wing, even that connected with the body wall. The central body of the accessory bony sternum was curved somewhat, both in what would have been the transverse and the longitudinal directions. There was a well marked sternal tip of cartilage on the posterior end.

2. Muscular development. There was little development of muscles that could be compared to the normal muscles of the pectoral region. Three definite strips of muscle were attached to the proximal portion of the left humerus on its posterior surface. The two dorsal portions originated on the main body of the sternum, near its mid portion and the third muscle originated on what would be the left hand portion of the bony sternum and extended caudad over most of the cartilage portion of the sternum. There was no evidence of a keel on the sternum. Contraction of these three muscles would move the humerous posteriorally. No opposing muscles were found.

3. Nervous connections. In birds, spinal nerves do not originate from the spinal cord in the definite manner that they do in MAMMALS, but as a diffuse network near the vertebral connections of the ribs. In the present specimen, three well formed nerves were found, which originated between the sixth and the seventh ribs from typical fusions of nerves and which connected with the accessory wing structures, where they joined the body wall. These three nerves united somewhat and a well formed nerve extended thru the axillary region of each wing, continuing distally along the median surface of the humerus bone toward the elbow joint.

4. Circulatory system. It was not possible to trace the vencus connections definitely in this specimen, since the veins were not injected. However, as judged from the arteries present and their size, there must have been a set of fairly large veins present. The normal lateral branching of the dorsal aorta, as related to the left hand portion of the body, is presented here for your reference. It will be noted that the urinogenital artery provides blood to the gonad and to the anterior portion of the kidney, that the femoral and the sciatic arteries lead to the middle and the posterior portions of the

kidney respectively and that they then pass on to the body wall and finally to the structures of the thigh and the entire leg. In this special chick, a very large artery originated from the aorta and passed laterally thru the anterior portion of the kidney, giving off two large branches to that organ. Just before reaching the body wall, a large branch extended ventrally and anterioraly and gave off a large branch to the spleen and another to the testis. Beyond the spleen, this large artery continued anteriorally to the region of the small intestine, where numerous branches were distributed to the mesentaries of the small intestinal region. An equally heavy branch continued anteriorally to an isolated, bi-lobed mass of liver, just posterior to the gizzard. A well defined accessory gall bladder, filled with bile, was present in this liver mass, with a bile duct connected with the small intestine some distance posterior to the gizzard. The main portion of the enlarged artery, which originated in the dorsal aorta, passed thru the body wall between the sixth and the seventh ribs, giving off a heavy branch to the body wall. It was not possible to trace out connections to the thigh region. Immediately after passing thru the body wall, the main artery divided into two branches, sending one to each of the accessory wings. These latter arteries compared very well with normal axillary and brachial arteries. In the left hand wing the artery branched into a radial and an ulnar vessel, as would be normal, tho on the right hand side there was no such branching, there being only a single radio-ulnar bone in that wing.

Summary and Discussion

Examples of structures of this sort serve to indicate that the protoplasmic setup in any given species of animal, to which we have chosen to attach the label "nature", may be a very highly variable material in organization and may deviate fundamentally and widely, from the so-called "normal". In vertebrates commonly, the limb buds develop from the surface layers of the somatopleure and mesodermic structures are formed beneath the epidermis. In due course, muscles, cartilages and bones are formed and the appropriate blood vessels and nerves are produced. In the normal chick, a limb bud on each side of the median line of the embryo, causes the appropriate structures to be formed to produce a normal wing and the structures such as the pectoral girdle, muscles, bloodvessels and nerves that connect it to the body wall.

In this abnormal chick, the two accessory limb buds were on the left side of the median line of the body and closely related to each other. In spite of other structures that were normally to appear in

this portion of the body, these accessory limb buds had sufficient dominance to, not only cause the production of a fairly normal limb structure, but to produce a considerable portion of the structures normally relating it to the body wall, in the way of a sternum and portions of the pectoral girdle. Also, there was sufficient dynamic power to modify the body wall as to the ribs and to modify the arterial setup very radically, even beyond their own immediate needs.

Specimens of this sort serve to forcibly confront us with the problem as to what is the fundamental dynamic that produces a limb bud in its usual position and what more would be needed, as in a case of this sort, to produce a pair of limb buds so close together and on the same side of the median line. The entire problem of checks and balances in normal development, as to whether one structure controls and limits the development of another structure, arises very naturally here. To date, we apparently have very little definite knowledge as to the fundamental nature of these determining factors, not only in the embryonic, but in the later stages of the life history as well. Any definite and final evidence in this connection will likely be made in some specialized field of biological chemistry. This again forcibly emphasizes the fact that our specialized fields of science are very closely knit together and that we are very sorely in need, as a scientific group, of persons, with sufficient knowledge and ability, to carefully synthetize our sciences. This synthesis should range from the minutest of technical fundamentals to the most highly specialized structural and functional characteristics of our past, present and possible future organisms.

HEDRICK, IOWA