

Article V.—THE ILIUM IN DINOSAURS AND BIRDS

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In both great groups of dinosaurs and in birds are found anterior prolongations of the ilium not present in primitive reptiles. The possession of a preacetabular part of the ilium is often used as a diagnostic character of the Dinosauria, but, when considered in connection with the related musculature, it is evident that these processes differ greatly, morphologically and functionally, in the two orders of dinosaurs and that they have probably had independent histories. Further, while the pars preacetabularis ilii of the bird may be considered as a development of that of the Ornithischia, it differs from it to a marked degree.

As shown in a previous paper¹ the anterior edge of the primitive ilium ascended vertically from the acetabulum, often with a slight projection at the top as an anterior superior spine. This marked the anterior termination of the ilio-tibial muscle or muscles, and the attachment of the ilio-pubic ligament and the adjacent axial muscles.

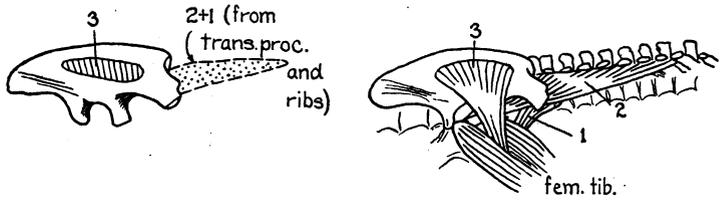
In the Saurischia, the pars preacetabularis is an anterior extension of the whole iliac surface, which now runs forward beyond the level of the acetabulum and in late forms arches outward considerably. The spine is not evident; the forward growth of the iliac blade has extended to or beyond the point at which it terminated and has incorporated it in the dorsal edge of the blade.

The pars preacetabularis in the Ornithischia is in marked contrast to this. It is a long, finger-like projection, a greatly exaggerated spine, which extends forward not the external surface of the ilium but merely its dorsal border which terminated at the spine. It extends more dorsally and medially than that of the Saurischia.

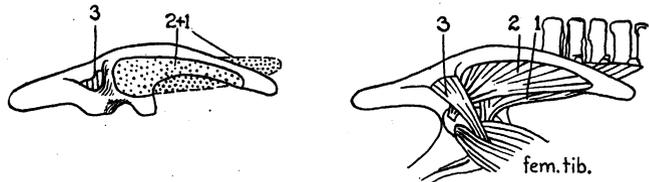
These two types are well differentiated even in the Trias. They are apparently independent developments, along different lines, from the anterior edge of the primitive ilium.

From other features of the pelvic structure we may infer that the pars preacetabularis of birds is homologous with that in the Ornithischia, but they differ considerably and we have no forms to bridge the gap; the *Archæopteryx* ilium is here shaped as in later birds. In order to attain this condition from that found in Ornithischia, we must assume that the ornithischian pars preacetabularis has swung medially, fused with verte-

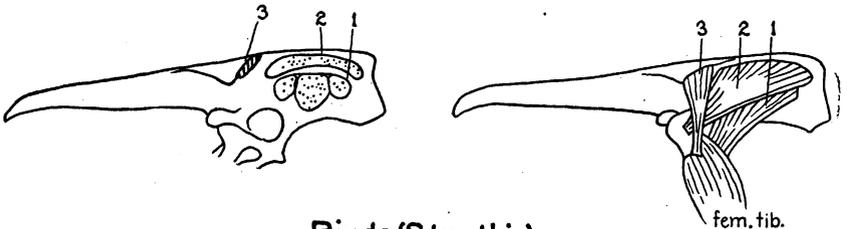
¹A. S. Romer, 1922 Bull. Amer. Mus. Nat. Hist., XLVI, Pl. XLIV.



Saurischians (Tyrannosaurus)



Ornithischians (Corythosaurus)



Birds (Struthio)

Fig. 1. The ilium (left) and its deeper musculature (right) in the two dinosaurian orders and birds, to show the contrast in the preacetabular parts.

In all cases the long extensors to the tibia extend along the upper border. The ilio-femoralis (3) probably originated from the outer surface, including the preacetabular extension in the Saurischia, but in Ornithischia, as in birds, became confined to the crest above the acetabulum. The pubo-ischio-femoralis internus, including the "quadratus lumborum" (1-2) undoubtedly ran beneath the saurischian process. In Ornithischia this process was primitively for the ilio-tibial muscles, a finger-like prolongation of the anterior spine contrasting markedly with that of the Saurischia. In later forms it began to pick up the origin of this muscle, a process which has been completely accomplished in birds, resulting in the large pars preacetabularis of that group, closely applied to the original lumbar region.

tebræ that were originally presacral to form a new anterior portion of the sacrum, and built up a broad surface below its original extent.

The musculature may now be considered.

ILIO-TIBIALIS. This muscle (sometimes in several parts) usually arises tendinously from the dorsal edge of the ilium. The possession of the ilio-tibialis origin at the dorsal edge is the one common feature of the pars preacetabularis in the groups discussed. In the Saurischia, its presence on the process was probably incidental; in the Ornithischia, the anterior prolongation of its area of origin appears to have been the main function of the process. It occupies this same position in birds, although a new function of the process has been added by the development of the surface ventral to its area of origin.

ILIO-FEMORALIS. This primitively occupies a muscular area of origin above and rather to the back of the acetabulum. In the Saurischia the anterior expansion of the external iliac surface apparently has allowed the muscle to expand anteriorly. In the Ornithischia, the iliac surface tends to grow smaller rather than larger, and probably the muscle was reduced in its area of origin and very likely in bulk. In accordance with this, the probable bird homologue of this muscle, the ilio-femoralis externus is rather small and has a tendinous origin from the crest of the ilium above the acetabulum.

PUBO-ISCHIO-FEMORALIS INTERNUS. This muscle primitively arises from the inner surface of the pubo-ischium and inserts, as in lizards (Fig. 2), in two areas on the femur, one on the anterior (medial) aspect of the shaft, the other dorsally, close to the head. In the Alligator, part III of pubo-ischio-femoralis internus of Gadow¹ occupies the first primitive area of insertion; the second is occupied with a muscle which that writer calls "quadratus lumborum," but which is obviously a part of pubo-ischio-femoralis internus.

Both these parts arise dorsally, as contrasted with the original ventral internal position of the muscle's origin. This, in connection with the fact that there is no muscle in birds which corresponds in its origin with that of the primitive pubo-ischio-femoralis internus, suggests that this dorsal migration is a common archosaurian character.

The position, and sometimes the arched shape, of the saurischian preacetabular process indicates that this muscle arose in this group from the lumbar region, as in the Crocodilia, and passed outward beneath the process, with which it was unconnected.

The ornithischian process also evidently had nothing to do, primitively, with this muscle, which here also passed beneath the anterior prolongation of the ilium in its passage from the lumbar vertebræ to the

¹Gadow's parts I and II are probably not part of the true pubo-ischio-femoralis internus; their homologies are not essential to the point in question and will be discussed at another time.

femur. In late members of the order such an association probably took place to a certain extent.

But it will be noted that in birds this process has swung inwards to the region of origin of the pubo-ischio-femoralis internus from the lumbar vertebræ and, having fused with the vertebræ to form a new portion of the sacrum, has built a broad surface of bone over the former area of origin of the muscle. We would expect that the muscles arising from this surface then, to be the avian homologues of the pubo-ischio-femoralis internus. Their areas of insertion and general relations bear this out (Fig. 1).

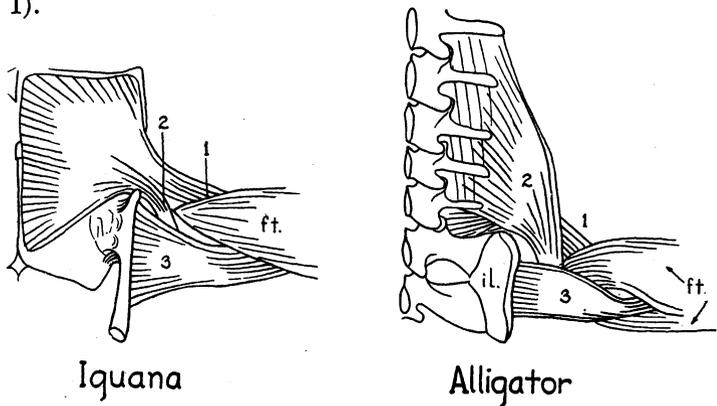


Fig. 2. Dorsal views of pelvic muscles in *Iguana* and Alligator (the sacrum removed in *Iguana*).

A part of the pubo-ischio-femoralis internus of *Iguana* (1) inserts anteriorly, as does part of the muscle similarly named by Gadow in the alligator. Another part (2) inserts similarly to the muscle named 'quadratus lumborum' in the alligator. The position of ilio-femoralis (3) should be noted and the muscles compared with the lateral views in Fig. 1.

Superficially, the preacetabular portions of the ilium in birds and saurischian dinosaurs appear somewhat alike; but it has been seen that they lie on opposite sides of the pubo-ischio-femoralis internus. The bird pars preacetabularis can, however, as we have seen, be derived from that found in the Ornithischia. And further, this process probably evolved independently of that found in the Saurischia.

I wish to express my thanks to Dr. W. K. Gregory, with whom this matter was discussed, for many valuable criticisms.

SUMMARY

1. The saurischian pars preacetabularis ilii is an extension of the external iliac surface.
2. The ornithischian pars preacetabularis is an exaggeration of the anterior iliac spine.

3. The bird pars preacetabularis may have been derived from that of the Ornithischia by a movement medially and the building up of a surface ventral to the original process.

4. The saurischian pars preacetabularis passed dorsal to the pubo-ischio-femoralis internus. That of the Ornithischia did so primitively but later picked up a portion of its origin. In the birds the entire origin of the muscle is from the pars preacetabularis, which is now medial to the muscle, in strong contrast to the saurischian process, which is lateral to it.

