II.—On the Structure and Development of the Crow's Skull.

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PLATES XXXIV., XXXV., AND XXXVI.

Introductory Remarks.

MY first materials for working out this type of skull were obtained for me by our esteemed member, W. H. Ince, Esq. Other specimens came to me from friends in different parts of the country, no few of these having been laid under contribution for hatched and unhatched chicks of various birds. The Crow is the great sub-rational chief of the whole kingdom of the Birds; he has the largest brain; the most wit and wisdom; albeit, at times the cruellest of the birds of wing. He, or at least some of the secondary chieftains of his tribe, can speak with man's voice, and, full of drollery and satire, make mockery of all and every of the many voices that are in the world.

Half the known breeds that are, owe allegiance to the kingly Crow: of a full and literal *myriad* of feathered species, a good half are ennobled by Mr. Huxley's title, namely, that high-sounding and yet hoarse name—"Coracomorphæ."* This term—the *Crow-form*—is not to be taken as interchangeable with the name of the Crow family—"Corvidæ"—but as the expression of a sweeping generalization which gathers together from the very ends of the earth all those birds that have the same morphological characters as the Crow. Even birds that are to all intents and purposes *Crows* have to be broken up into many "sub-families,"—there are the *Northern* and the *Southern Crows*; the *Starlings*, *Choughs*, *Nutcrackers*, *Birds of Paradise*, and a host of others; all *Crows*, not, strictly speaking, "*Corvidæ*," but "*Sturnidæ*," "*Paradisæidæ*," and the like.

Now the term "*Coracomorphæ*" may be used to express such a general physiognomy as would make an ordinary observer say of a bird, "That form reminds me of a Crow:" such a remark would not be made concerning a Grouse, a Plover, or a Cormorant.

But there underlies the visible form and fashion and colour of a living bird some modification of its plan of structure which is always the correlate of certain outward characters; and an anatomist familiar with the construction of the various types seldom makes a wrong guess as to what morphological group he will have to refer any new bird, when he has taken a good survey of its outward form. Professor Huxley, in the paper referred to, has seized hold of the great controlling portion of a bird's structure,

* See "On the Classification of Birds," 'Proc. Zool. Soc.,' 1867, pp. 415-472.

namely, its head, and especially its *face*: by the structure of the face, which must have all things else in harmony with it, he has sought to give the birds a true morphological grouping. Such a system of taxonomy has great and evident value; but in the present state of our knowledge the physiognomical groups do not admit of simple superposition on the morphological groups. In some cases they fit accurately; in others they come short in one place and overlap in another; and thus the zoologist has to "drive two-in-hand" through the various ornithological territories; and as the various regions in a geological map cannot be made to correspond with political or with ethnological divisions, so it is in our present attempts at making the two taxonomic modes of *bird-survey* agree.

If the palate of a Fowl be examined, it will be seen to be deeply cleft; if that of a Goose, the cleft will be found to be closed in front: the palate of a *Podargus* (Giant Goatsucker) has its two sides bound together by two bony plates—the hard palate. The cleft in the Fowl and Goose is divided into two, by the "vomer," or ploughshare-bone, which lies at the middle.

In the Fowl neither the upper maxillaries nor the palatines meet at the mid-line below; in the Goose the maxillaries do thus meet and combine; in *Podargus* both the maxillaries and palatines coalesce, as in Man and the other Mammalia.

For the perfectly cloven palate of the Fowl, Professor Huxley has coined the term "Schizognathous"; for the half-closed palate of the Goose, as well as for the well-floored palate of the *Podargus*, the same *Mint* has yielded the term "Desmognathous."

But the *Crow-form* stands in need of another name for its type of palate than either of these; and, as the Common Sparrow well displays this third kind of mouth-roof, our bold group-maker calls it the "Ægithognathous" palate. Now I could have wished that either this bird or the Crow had given both names, that is to say, to the general type and to the palate; then we should have had the Coracomorphous birds with Coracognathous faces, or the Ægithomorphous birds with Ægithognathous faces.

Nevertheless, the two groups are almost at one, in reality, and it does not weigh a feather with me how the thing is put, if so be the student will get his mind clear upon the subject.

The cleft in the Sparrow or Crow's face is stopped-up in front, not by coalescence of the maxillary bones, which are similar to those of a Fowl, but by having a double vomer, which unites at the mid-line in front, where it is broad, emarginate, and winged.

These antero-lateral wings are supplied on each side with an additional bone. The two bones are grafted upon the cartilaginous nasal walls and their long scrolls—the "ali-nasal" or "*anterior* (not *inferior*) turbinals."

This metamorphic fusion of parts, essentially distinct in morphological origin, is very remarkable; and to add to the mystery, the vomerine moieties are each of them formed in a distinct plate of cartilage, which, as a rule, does not exist in other birds.

The "Coracomorphæ"—five thousand known species there are of these—are characterized by this structure, at least as far as I can find, for I have worked out this part in scores of types,* not only of the natives of the Old World, but to an equal or even greater extent in South American, Malaysian, and Australian forms—the feathered denizens of the "Notogæa," or Southern World.

The Swifts ("Cypselus") have this structure as completely as their Passerine relations the Swallows. Just above the Ostrich order, the *Hemipods* ("Turnicomorphæ") show this structure on a very large scale, but the bony substance is only strongly tied to the cartilage.

Leaving out the Tinamous, which are merely little Ostriches struggling to become of the winged order, there are certain *climbing* birds which refuse to conform to my friend's Greek rules, "and he whose heart is as the heart of a lion, did utterly melt" in presence of this difficulty; these birds, the Woodpeckers, retaining the strongest marks of any of a reptilian parentage, I beg to call the "Saurognathæ."

Differences of so remarkable a kind existing in the fore-face of the great groups of birds, and correlated with such exquisite specializations as we find in the Woodpeckers on one hand, and the Singing-birds on the other—to say nothing of other groups, each member of which is a marvel of adaptive modification—such peculiarities as these may well decoy the student into these enchanting zoological territories.

On the Development of the Skull and Face of the Genus Corvus.

My youngest Crow-embryo is the Hooded Crow (*C. cornix*) at about the sixth day of incubation. The natural size of its head is shown in Plate XXXIV., Fig. 1. A palatal view of the skull (Fig. 2) at this stage shows that the first "præ-oral arch" (*trabeculæ tr.*) has coalesced throughout nearly its entire length, the posterior part (apices of the rods) alone being distinct. These apices diverge round the pituitary body (*py.*), and then coalesce with the "investing mass" (*i. v.*) of the notochord (*n. c.*). The distal ends, besides coalescing by a continuation forwards of the median commissure, have sent forwards an azygous rostrum, the "pre-nasal cartilage"; this single cartilage answers to the double cartilages in which the mandible terminates.

* Through the kindness of my friends, Osbert Salvin, Esq., and Mr. W. J. Williams, Assist. Sec. Zool. Soc.

On each side, in the indifferent tissue that covers this rod *above*, the præ-maxillaries are found, as small oval patches of osteoblasts (Fig. 3, *p. n.*, *p. x.*). The cartilaginous cranium is already well formed, and the auditory sacs (*au.*) with their enclosed otoliths (*ot.*) are well seen in this delicate skull when examined as a transparent object. The pituitary space (*py.*) is still freely continuous with the space in which the notochord (*n. c.*) lies—"the posterior basi-cranial fontanelle"—but the halves of the "investing mass" (*i. v.*) have united on each side with the auditory mass, and also with each other behind; where they have formed the bilobate occipital condyle (*o. c.*). From the investing mass on each side, a little in front of the condyle, there is a crest of cartilage, the "ex-occipital" (*e. o.*), which is growing towards its fellow in the "super-occipital" region (*s. o.*), and is becoming coalesced to the hinder margin of the auditory sac.

A side view of the cranio-facial axis, from the "sella turceca" forwards, is shown in Fig. 4; it takes in the whole trabecular bar. Here we see how large the terminal cartilage is, notwithstanding its temporary character, and also that the trabeculæ have sent upwards a crest of cartilage which is continuous with the keel growing from the cranial *floor* and nasal *roof* from the optic foramen (2) to the commencement of the pre-nasal rostrum (*p. n.*). Not only has continuous metamorphosis of the mother-cells into cartilage made these various morphological parts one, but the roof of the nasal sacs and the floor of the hemispheres have undergone the same change. Between the eye and nose the nasal wall has become a large uniform plate of cartilage; this is the "pars plana" (*p. p.*) or "ecto-ethmoid." A transverse section through this region (Fig. 5) shows the relation of the "ecto-" to the "meso-ethmoid." In another section (Fig. 6) the septum nasi is cut through, and the ali-septal cartilages are seen each to give off an elegant scroll with two turns; this is the equivalent of the human "inferior turbinal," although its position is in *front* of and not *below* the true olfactory region. A section made between the eye-balls (Fig. 7) shows the cartilaginous continuity of the two trabeculæ; their ascending crests, the anterior sphenoidal keel (præ-sphenoid), and the "orbito-sphenoidal laminæ."

Most of the investing bones can now be seen. I have already spoken of the præ-maxillaries, and others will be better shown in an embryo more advanced, but four out of five of the mandibular splints can now be well observed. On the inner side of the "articulo-Meckelian rod" (Fig. 8, *cr.*) the "coronoid" is seen at the top; and the "angulare" (*ang.*) on the inner side, and part of the "surangulare" (*s. ag.*) below. On the outer side (Fig. 9) the whole of the large "surangulare" is shown, as also, much further forwards, the "dentary" (*d.*); the "splenial" (*sp.*) is shown in a more advanced stage.

W.K.P. del. ad nat. G. West on Stone.

W. West & Co. imp.

Development of Crow's Skull.

This more advanced stage has been obtained in an embryo of the Rook (*C. frugilegus*), two days older, or about the eighth or ninth day of incubation. The basal view of the skull (Plate XXXV., Fig. 1) shows several things not present, and others not figured in the earlier stage. The cartilaginous skull is well formed, and its *first* bony instalment is gained, namely, the "basi-occipital" (*b. o.*). This is formed as a delicate bony investment to the cranial part of the notochord, and then spreads laterally into the halves of the "investing mass" (*i. v.*). The whole occipital cartilage is now well seen with its condyloid foramen (9), and the passages for the "vagus" nerve (8). The condyle (*o. c.*) is more typically ornithic, being nearly hemispherical; the great tympanic alæ also grow widely from the ex-occipital region (*e. o.*), which is not ossified as yet. The super-occipital cartilage (*s. o.*) is a thin commissure uniting the huge ear sacs (*au.*). This is still better seen in Fig. 2, where the anterior, horizontal, and posterior semicircular canals have stretched the auditory cartilaginous coat almost to bursting. The "ali-sphenoidal" cartilages grow up *directly* from the pituitary part of the "investing mass" (Fig. 1, *py. iv.*), but the space itself, embraced in front by the *top ends* of the trabeculæ, is membranous below. So much of the "basilar plate," or investing mass, as is not ossified by the notochordal bony sheath still forms a broad floor with a free front edge. The "posterior sphenoid" here borrows—*afterwards*, from the symmetrical ossifications formed in the thick sub-mucous cushion which is stuffed between the fauces and basis-cranii.

These bones, my "basi-temporals," are beautifully shown in this stage (Fig. 1, *b. t.*), as also the grooved bony style which yields hardening material to the fore-part of the basi-sphenoid; this is the "parasphenoid" (*pa. s.*). Further forwards, the cartilaginous base is seen between the palatines (*pa.*), and this becomes cleft, vertically, to form the hinge between the face and skull. The rest of the cartilage is the base of the nasal septum (*s. n.*), and the "præ-nasal rostrum" (*p. n.*). Besides the parasphenoid, the trabecular arch has the præ-maxillaries; these are very much increased in development since the last stage (Figs. 3, 4, 5, *p. x.*). Seen from above (Fig. 4), they already meet, nearly cover the "præ-nasal," and send their nasal processes to the ethmoid, above.

The vomerine splints were not well made out in this preparation, although I obscurely saw the division into two halves; but in a Brown Linnet at this stage, I found them to be formed as "endostoses," in an oval patch of *cartilage*. Above the trabecular region (Fig. 3) the "ali-nasals," "ecto-ethmoid," and "meso-ethmoids," are shown as increasing in size and becoming perfect in form, and between the ethmo-presphenoidal plate (*eth. p. s.*) and the trabecular crest a thin longitudinal cleft has been formed, the

membranous interorbital space (*i. o. s.*). The "nasals" (Figs. 3 and 4, *n.*), the frontals (*f.*), the parietals and squamosals (Figs. 2 and 3, *p. sq.*), are now well demonstrable; but the great "fontanelle" (*fo.*) occupies most of the cranial roof. The second pair of *præ-oral* facial bars are undergoing rapid development; at first delicate crescentic bars of soft mother-cartilage, or indifferent tissue, they are now partly *true* cartilage, but principally bone. Behind (= *above*) the pterygoids fit by a cup to a ball on the fore-face of the pier of the next arch, the quadrate, and then, converging to the mid-line, they send a "meso-ptyergoid process" over the upper edge of each palatine. This *process* afterwards becomes a separate bone.

Where the palatines (*pa.*) are bowed out behind, they send outwards a triangular plate, which, not becoming infected by the bony matter of the main bar, develops rapidly into hyaline cartilage, to have, afterwards, its own endosteal centre—the "trans-palatine."

Two splints are seen on each side, belonging to the pterygo-palatine arch. These are the very small *ichthyic* maxillaries (*mx.*), and the slender "jugals" (*j.*) which clamp the quadrate without the intervention of a "quadrato-jugal," as in many birds. The retral process of the maxillary (maxillo-palatine of Huxley) can already be seen passing towards the mid-line, *above* the palatines.

The hyoid arch, well developed as to cartilage, but with no bony deposits, was not wholly worked out in this stage. It will be described in the next.

But the mandible is now very instructive. Seen on the inner side (Fig. 5), the dentary (*d.*) is seen to have surrounded all but the inner face of Meckel's cartilage (*mk.*) in front; farther backwards the most splint-like of the splints—the splenial (*sp.*)—is now evident, and the coronoid (*cr.*), the "angular" (*ag.*), and the surangular (*s. ag.*), are growing rapidly; the two latter are shown in relation to the articular cartilage (*ar.*) in Fig. 6. Ossification had commenced in the proximal portion of the rod. The articular region (*ar.*), which, as seen from below (Fig. 6), sends backwards the "posterior angular process," and inwards the "internal angular process." This latter is the otherwise-used symmorph of the "Manubrium Mallei" of Man.

My next stage is supplied by the ripe chick of a Carrion Crow (*C. corone*, Plate XXXV., Fig. 7, and Plate XXXVI., Figs. 1-6). The process of development during the last five or six days of incubation is very rapid, and indeed very rapid is the whole process of growth in these high, noble, hot-blooded birds. The study of their growth and metamorphosis, as compared, not only with that of a Reptile or Fish, but even with that of the young of the slow-growing "*Præcoces*," suggests the possibility of a compromise between the doctrine of *Development* and that of *Creation*.

W.K.P. del ad nat. G. West on Stone.

W. West & Co imp.

Development of Crow's Skull.

From the stored-up wealth of the egg things new and old have been required, and an architectural process has freely applied the *lime* which was ready at hand. This hardening of the walls has given us new bony centres, and has obliterated the distinction between others that were separate. Turning to the basal view, we see that the minute bone-sheath of the notochord has become a recognizable "basi-occipital" (Plate XXXVI., Fig. 1, *b. o.*); the "basi-temporals" (*b. t.*) have become one broad unbent-bow-shaped piece, and the parasphenoid, or "sphenoidal rostrum" (*r. bs.*), has got its *ichthyic* "temporal wings," has grafted itself upon the skull-base, and is being fused with the basi-temporal. The lateral occipital region has now its proper ossifications, the ex-occipitals (*e. o.*); and the upper part of the arch has begun to ossify by another pair of centres, the supra-occipitals (Plate XXXVI., Figs. 4 and 5, *s. o.*). On the roof (Fig. 3, *p. f.*), the parietals and frontals meet at the mid-line, and the nasals (*n.*) and præ-maxillaries (*p. x.*) have begun to acquire their permanent form. In the side view (Fig. 2), the squamosal (*sq.*) is seen flanking the roof-bones; the ali-sphenoid (*al. s.*) has a bilobate osseous centre, evidently by the fusion of two smaller ones. Attached to the large "ecto-ethmoidal" flap, or "pars plana" (*p. p.*), is a small rod-shaped lachrymal (*l.*); in this side view also the fish-like character of the maxillary (*max.*) is well seen, as also the ectosteal patch on the quadrate (*q.*). Below, the pterygo-palatine arcade (Fig. 1, *pg. pa.*) has developed greatly, and the free cartilaginous "trans-palatine" flap has become typical in form. The mandible (Fig. 2, outer view; and Plate XXXV., Fig. 7, inner view) is now in a characteristic *reptilian* condition, with its one endosteal bone and its five parosteal investments. In the hyoid arch the shaft of the stapes (Fig. 2, *st.*), and the proximal pier of the "cornu major" (Fig. 6, *br. 1.*), have each acquired an ectosteal sheath. The small cerato-hyals (*c. h.*), the "basi-uro-hyal" (*b. h.*, *u. h.*), as well as the distal part of the long rod (third post-oral), are still mere cartilage.

A longitudinal section (Plate XXXV., Fig. 7) shows much that is instructive. The exact relation of the roof-bones to the cranio-facial axis; the large ear-capsule, with its prootic (*pro.*) and opisthotic ossifications (*op.*)—the only centres I have found in this type; and the notch and fenestra that re-differentiate the trabeculæ.

The "interorbital fenestra" (*i. o. s.*) is suboval, and somewhat tilted backwards. The cranio-facial cleft (*c. f. c.*) has severed the thick trabecular bar and its crest, and is creeping upwards so as to divide the ethmoid (*eth.*) from the nasal septum (*s. n.*). The vomerine moiety (*v.*) is seen beneath the hinder half of this notch; and beneath it the palatine (*pa.*). The "rostrum," or parasphenoid, nearly touches the basi-temporal (*b. t.*); and partly ossifying the "sella turceca," has behind it the "spheno-occipital synchondrosis."

This is followed by the growing basi-occipital (*b. o.*); this by the condyle (*o. c.*), and this is surmounted by the "ex-" and "super-occipitals" (*e. o.*, *s. o.*).

My next stage is a nestling of the Carrion Crow (*C. corone*), one week old.

The most noteworthy thing in these further illustrations is the great increase of size, every tissue having undergone rapid interstitial growth; but the relative proportion of the various bones and tracts of membrane and cartilage is much the same as at the time of hatching.

Certain morphological changes of great importance have nevertheless occurred, for the "super-occipitals" (Plate XXXVII., Figs. 1-5, *s. o.*) have coalesced at the middle, and the "meso-ethmoid" (Figs. 2 and 4, *p. e.*) has acquired a bony centre.

The lachrymal (*l.*) is larger, is creeping up the fore-edge of the ecto-ethmoid (Fig. 2): the "articulare" (Figs. 2 and 6, *ar.*) now embraces the internal angular process. The elements of the posterior sphenoid, and of the auditory capsule, all these are becoming more closely related to each other.

The hyoid cartilages (Fig. 7) are only larger, altogether, than in the ripe embryo; the elements of the mandible (Figs. 2 and 6) are now closely similar to what is seen in the adult Lizard or Crocodile.

The fifth stage is that of the young Rook (*C. frugilegus*), ready to fly. It is replete with interest.

The basal and lateral elements of the occiput, &c. (Plate XXXVIII., Figs. 1, 4, *e. o.*, *b. o.*) have coalesced; but the upper piece (*s. o.*) still forms an elegant, distinct keystone above (Plate XXXIX., Figs. 1 and 2). The basi-temporals have coalesced with the overlying "para-basisphenoidal" ossification, and at their outer angle the internal carotids (Fig. 1, *b. t.*, *i. c.*) are seen entering.

The fore-part of the "sphenoidal rostrum" (*r. b. s.*) is embraced by the forks of the vomer (*v.*), and its sides by the "meso-pterygoid process" of the pterygoid, and by the "post-palatine processes." The "trans-palatine" (*t. pa.*) is still solid cartilage, without bony deposit; it is a large and well-defined morphological element.

The grooved upper surface of the vomer receives the thick part of the base of the septum-nasi; this base is then two-winged, and these wings are a part of each trabeculæ, unaltered in shape although coalesced together. In front of this part is the shrinking "præ-nasal rostrum" (*p. n.*) which lies between the recurrent ali-nasal folds.

The ali-nasal floor (*al. n.*), over which lies a "turbinal," is seen on each side of the base of the nasal septum; behind, it is continuous with the vomer on each side, the moieties of which are grafted upon the cartilage.

WKE del. a.i. nat. G. West on Stone.

W. West & C^o imp.

Development of Crow's Skull.

The large coalesced præ-maxillaries (*px.*) are seen overlapping the maxillaries (Plate XXXVIII., Fig. 1, *mx.*), and the retral process of these latter bones has now acquired its elegant ear-shape. Seen from above (Plate XXXVIII., Fig. 2), the cranial roof is well filled in; a little of the ethmoid (*eth.*) is seen, and two remnants of the great fontanelle (*fo.*); and the top of the "ecto-ethmoid" (*e. eth.*) projects on each side; afterwards it gets its own osseous centre, distinct from that of the "meso-ethmoid" (Figs. 2 and 4, *pe.*), and from that of the "pars plana" (*p. p.*). This latter part is still unossified (see also Fig. 2). The lachrymal (*l.*) now occupies nearly all its anterior edge. The "meso-ethmoidal" bone (*p. e.*) nearly reaches the notch (Fig. 4, *c. f. c.*) in front, and the interorbital fenestra (*i. o. s.*) behind. The septum-nasi is still soft, as also all the anterior sphenoidal region, which has its orbito-sphenoidal lips very small. In more advanced young I find a distinct præ-sphenoid perched above and between the huge middle ethmoid and basi-sphenoid, but no orbito-sphenoids; the orbital plates of the frontals do duty for them in these high, perching types. The auditory capsule (Fig. 4) has coalesced with the ex-occipital (*e. o.*) and its own opisthotic (*op.*) and prootic (*pro.*) pieces are no longer distinct; the ali-sphenoid (*al. s.*) is now well ossified; the knob of cartilage projecting from it in the post-frontal region is part of the ear-sac—the "sphenotic."

The double nasal sac seen from above (Plate XXXIX., Fig. 3) shows the ali-nasal, ali-septal, and ali-ethmoidal regions (*al. n.*, *al. s.*, *al. e.*); in the latter is seen the broad top of the "meso-ethmoid" (*p. e.*). This part ends as a blunt spur, above the "orbito-presphenoid" (*o. s.*). The transverse sections are through the middle ethmoid, and behind the lateral ethmoids in Fig. 5; and through the unossified part of the middle ethmoid in Fig. 4. This latter section is through the upper and lower turbinals (*u. tb.*, *l. tb.*); the "middle turbinal" is a mere rudiment on the front of the "pars plana," or antorbital. This same section is through the nasals (*n.*), nasal processes of the præ-maxillaries (*p. x.*), the maxillaries and their maxillo-palatine processes (*mx.*), the forks of the vomer (*v.*), and the palatines (*pa.*). A longitudinal section outside the septum (Fig. 6) shows the ali-nasal turbinal (*a. n. t.*), the inferior turbinal (*l. tb.*), and the upper turbinal (*u. tb.*).

The mandible (Figs. 2 and 4) shows the "articulare" much more ossified, the investing elements much more developed; Meckel's cartilage (*mk.*) nearly hidden; and the coronoid (Fig. 4, *cr.*) ankylosed to the "articulare."

The "os hyoides" (Plate XXXIX., Fig. 7) shows an osseous tract in each "cerato-hyal" (*c. h.*), and both the pieces of the third post-oral (*br. 1*) have thin osseous shafts. The azygous piece (*bh.*, *uh.*) is still soft.

After another week or two the pointed fore-end of the pterygoid becomes detached as a distinct "meso-pterygoid," which after a few weeks coalesces with the palatine. The "trans-palatine" cartilage gets endostosis, completely ossifies, and then ankyloses with the palatine, so also do the vomerine forks; and at their fore-end, on each side, a new bone appears—the "septo-maxillary."

The septum-nasi ossifies in some degree, but most of the nasal labyrinth is permanently cartilaginous, yet the ecto- and meso-ethmoidal elements are well ossified and quite ankylosed. Almost every part of the skull and face undergoes this intensive and extensive ossification, but the quadrate bones and pterygoids keep distinct from their surroundings, and the palatines from each other behind. In their "ethmo-palatine" regions they are tied together by the vomer which coalesces by its forks; in front the palatines are fused with the rest of the face. The twisted, fusiform lachrymals are permanently distinct, and a trace or two of sutures can be seen over the "cranio-facial hinge." All the *twelve* pieces of the lower jaw become one V-shaped bone.

In the second post-oral the medio-stapedial is ossified, and all but the tips of the distal cerato-hyals; the upper ends of the third arch, and the greater part of the "uro-hyal" remain soft.

In conclusion, if anyone shall ask me why this multitude of bones should so soon melt into so few? I have only one answer, namely, that the reason lies, I suppose, first, in their genetic history in the "auld lang syne," and then in slow adaptive modifications during epoch after epoch.

DESCRIPTION OF PLATES.

PLATE XXXIV.—Development of skull in Hooded Crow (*Corvus cornix*), fifth or sixth day of incubation.

PLATE XXXV.—Figs. 1-6. Skull of Rook (*Corvus frugilegus*), eighth or ninth day of incubation. Fig. 7. Skull of Carrion Crow (*Corvus corone*), end of incubation.

PLATE XXXVI.—Skull of *Corvus corone*, end of incubation—continued.

[It is necessary to state that only three of Mr. Parker's Plates—Plates XXXIV., XXXV., and XXXVI.—appear in this number of the Journal. The remainder will be given in the succeeding number.—Ed. 'M. M. J.']