

ON THE PRIMITIVE FORM OF THE HUMAN SKULL.*

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UNLESS man forms an exception to the great law of nature, which produces not merely a manifold and continuous alteration of the forms of life, by adapting them to new vital conditions, but shows in the plan of creation a progressive development from lower to higher forms, from the invertebrate to the vertebrate animal, from the fish to the amphibian, and from the latter to the bird or mammal, then the human form must equally have been developed in the scale of life from a lower organisation, like that which we find in the present creation in the animals standing next to us. This view is supported by the fact that the marks of a higher development, which distinguish man from the anthropoid apes, constitute by no means an immutable and fixed type, but exist in different degrees in various human races, and thus render the gradual development of these characters distinctly visible. Here the question presents itself, whether the oldest human remains of prehistoric times, which approach nearer the origin of our species, present the characters of a lower organisation. If this be so, this circumstance, combined with other observations, would form strong arguments in favour of the assumption of a natural origin of man. If such marks be not found, we are still permitted to assume that the oldest remains hitherto found do not reach so far back in time as to show an important deviation from the present organisation of man; not even from such a low organisation as we find at present in the lowest living savages.

But considering that human bones are only exceptionally dug out from graves of the pre-historic period, it is, at all events striking in the highest degree, that even this scant number of human fossils present such marks of an inferior organisation, and that, too, in regions now inhabited by the most civilised peoples. And we must also lay stress upon the point, that the proofs are in our hands; that the corporeal shape of the primitive form is, in some of its component parts, inferior to that of our rudest savages. The form of the forehead of the Neander-skull, the dentition and the form of the jaw of La Naulette, the prognathism of some infantile jaws of the stone period of Western

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Europe, exceed, as regards their animal form, that observed in living savages.

We may attempt the collation of such characters as have been observed in other parts of the human frame, in order to obtain, as it were, a sight of the perfect image of the primitive man. These characters must not be considered as accidental exceptions from the normal form, which was the common theory on meeting with such finds ; for these peculiarities in the organisation of the pre-historic man do not occur as exceptions, but as a rule ; and what is decisive is the circumstance that they mostly present a foetal character, and thus exhibit an early stage of development. They also frequently stand in reciprocal dependence ; one character determines the other according to the law of harmony or co-existence which governs the form of all living bodies. With the flying forehead we find, as a rule, a projecting jaw, large teeth, a high temporal line, a strongly developed occipital ridge, simple cranial sutures, small cranial capacity.

I confine myself here to collate, from a large number of very old and rudely-shaped crania, the most striking deviations from the normal form, and to compare them with the formation of the lowest races, in order to obtain an idea of the primitive form of the human skull, the whole of which we have not yet found among the ruins of the past, but which we shall surely find some day. It might not be difficult, by a similar method, to determine the original form of the other parts of the skeleton. We obtain this knowledge less by fossil finds than by the examination of the corporeal frame of living savages, who present the low state of their organisation not merely by the peculiarities of their cranial structure, but by a different proportion of the length of the bones of the extremities, by the elongated form of the thorax from in front backwards, by a slighter rotation of the humerus, the articular surface of which is more directed backwards, the perforation of the elbow fossa, the narrower pelvis with unusually vertical ossa ilii, the backwardly projecting heel-bone, the larynx approaching the animal form, and by other characters.

Most of the skulls of the highest antiquity are distinguished by the thickness of the cranial bones ; this may partly be due to great muscular action, and partly to mode of life, which furnished an excess of phosphate of lime for the nourishment of the bones. The anthropoid apes have stronger cranial bones than are usually found in man ; and many savage peoples, like some Negro tribes, Esquimaux and Australians, have usually very thick and dense crania. This density of the osseous tissue seems to be wanting in the Mongol race. Herodotus already mentions the soft skulls of the Persians,* and the hardness of

* Lib. iii, cap. 12.

the Egyptian skulls, and ascribes it to the circumstance that the Egyptians walked about bareheaded and wore short hair. We, nevertheless, find not rarely Mongol skulls with thick bones, in which the diploë is largely developed, containing wide cells ; the bones are therefore thick, but neither dense nor heavy. Similar skulls, genuine brachycephali of the stone period, have been found near Uelde, in Westphalia ; they resemble, in their general forms, the crania of the reindeer period found in Belgium. Do they by this peculiarity betray their Asiatic origin ? It may be mentioned here that Blumenbach* calls a very dense, thick, and heavy Botocudo skull, the most orang-like skull of his whole collection, although some Ethiopian skulls had a more projecting upper jaw.

Smallness of the cranial cavity is a second character of the retarded development of the cranium. It may co-exist with an apparently favourable cranial diameter, because thick cranial bones, or projecting parietal protuberances, increase the width, and projection of the glabella, or of the occipital ridge, increase the length. The cast of the Engis- and still more of the Neander-skull, the casts of Negro and Australian skulls, show this peculiarity, as already pointed out by Gratiolet.

The long, narrow, nearly cylindrical form which is seen in most old skulls of Western and Northern Europe, and Northern Africa,—this decided dolichocephaly may, therefore, be held to be an imperfect and primitive form, because observations made during the growth of this skull have shown that its final increase in width is commensurate with the increase of the intelligence. The Mongol race, whose heads are broader than those of Europeans, present only an apparent exception to the law that the mental capacity is chiefly expressed in the breadth of the cranium ; for the greatest width of the brachycephalous Mongol skull lies between the parietal protuberances ; but the width in relation to mental capacity lies over the base of the cranium. The finds of several old skulls in Scandinavia and Western Europe may have led to the view that the oldest race of these countries was brachycephalic, like the present Lapps, who, like this tribe, lived associated with the reindeer, and spread over Southern Europe. But the Neander- and Engis-skulls, which must be considered as old, if not older, than the reindeer-men, are long skulls. In England also, from finds in the graves, it is considered that the dolichocephalic race is older than the brachycephalic. Although the succession of peoples of a different type and of different descent, in Europe, is still involved in doubt, yet certain it is, that as regards the anatomical characters, the dolichocephalic type of these old skulls stands lower than the brachy-

* Decas, vi. *Coll. suæ Cranior. div. gent. ill.* Goett., 1820, p. lviii.

cephalic, and must be held to be the original. But it is possible that it may have immigrated at a later period. As it often has happened in history, so may in these remote periods a ruder but physically stronger race have overcome a weaker nomadic people, and gradually occupied their dwelling-places.

There is a whole series of facts which proves that a very pronounced dolichocephaly is a primary and less developed form of the human skull. We see it decrease with the progress of civilisation, as Broca found in the population of France. The same observation has been made in Germany, where the old Germans, at the period of their wars with the Romans, were dolichocephalic, and differed so little in cranial structure from the Celtic or Gallic type, that we must assume the near affinity of these tribes. But at the present day most Germans, as shown by the observations of Welcker, are brachycephali or mesocephali, the latter standing intermediate between the long and short skulls. Ecker* arrived at the same result when comparing the old Alemanni with their descendants, the present Suabians, whose skulls have diminished in length but become broader. I, myself,† have shown that the human skull, during its growth, continues longest to extend in breadth, whence it follows that the breadth diameter of the cranium corresponds most with the intellectual development of the brain. This connection is also shown by the following observation. On comparing the brain of a rude Negro or Australian with that of the civilised European, or with that of a highly intellectual man, it strikes us at once that these brains differ much less in their length than in their breadth. The assertion seems, therefore, well founded, that the elongated, narrow, and, at times, almost cylindrical form of the human cranium, is the rude and primary one, which gradually disappears in proportion as the brain, by its development, increases in size, and, mostly, in breadth. These primitive dolichocephalic skulls have a narrow, low, and receding forehead, the region of the sagittal suture, and often the frontal suture, is somewhat projecting, which imparts to the vertex a boat-shaped form; the temporal squama is low, but elongated from behind forwards, so that it sometimes reaches the frontal bone by intruding between the parietal bone and the great wing of the sphenoid bone, as seen frequently in the Negro, and which also occurs in the Australian, the Mongol, and the old Peruvian. This connection of the temporal squama to the frontal bone is observed in the anthropoid apes, the chimpanzee and gorilla; more rarely in the ourang-outang, but is by no means absent,‡ as asserted by Cuvier and

* *Crania Germaniæ Merid.-Occid.* Freib., i b, 1865, p. 82.

† *Amtl. Bericht über die 40. Vers. deutscher Naturf. u. Aerzte zu Hannover im Sept. 1865*, p. 242.

‡ R. Owen. *On the Osteol. of the Chimp. and Orang.*, p. 357; and C. B. Brühl, *Zur Kenntniss des Orangkopfes und der Orangarten.* Wien, 1856, p. 11.

M. J. Weber. The condition of the temporal squama shows very plainly the share which the separate cranial bones have in the total form of the cranium, or rather how they determine it. If the cranium be high and spacious, the temporal squama reaches high up, and its upper margin is circular; if the cranium be flat, or long and narrow, then the squama is elongated from in front backwards, and its upper margin is almost straight. It is thus found in the anthropoid apes, the Negro and the Australian, in the Neander-skull, and in the strongly dolichocephalic skulls of the old Germanic graves. That the orang possesses more rarely than the other large apes a temporal squama reaching the frontal bone, arises no doubt from the more brachycephalic form of his skull. On comparing with the human skull that of a mammal—of a dog, for instance—it is observed that the bones of the cranium take an unequal share in the diminution of the cranial capacity. The frontal bone is comparatively little altered in length; its upper point intrudes in many mammals even between the parietal bones, but it is flat and narrow. Perceptibly shortened is the sagittal suture of the parietal bones, but the latter remain the most curved and largest bones of the cranium. The temporal squama is low, and its upper margin runs straight. The occipital squama, which is showed in the shape of a narrow osseous ridge between the parietal bones, is most shortened. The skull of the great apes shows almost the same deviations from that of the human form.

The characters observed in the skulls of the lower races, namely, a narrow and low frontal bone, a short sagittal suture, a low temporal squama, a short occipital squama, the upper margin of which forms a flat arch, are therefore to be considered as approximations to the animal form, and they stand to each other in organic connection. If the occipital squama projects like a ball, a peculiarity frequently seen in Celtic and old Germanic skulls, it is also a mark of arrested development, and, like the great projection of the parietal protuberances, is a stoppage at the infantile form. Welcker* has shown that during the growth of the skull, the bones flatten and thus increase the cranial capacity, and he ascribes justly the arching of the bones to the pressure of the growing brain. We not rarely find in skulls of a rude form that the sides of the cranium under the parietal protuberances down to the temporal region form almost an even plain; this also is an infantile form, to which Meckel already drew attention by observing that in the infantile skull from the projecting ossification points, the upper and the lower portions of the bones almost form a right angle. We rarely find in crania of a rude form the parietal protuberances

* *Untersuchungen ueber Wachsthum und Bau des Menschl.-Schädels.* Leipzig, 1862.

obliterated, they are in most cases projecting as in the new born and in the female skull, the latter preserving also in other respects infantile characters. In such cases the greatest cranial breadth lies between the parietal protuberances; thus it is with the crania of Australians and other rude skulls of primitive times, *e.g.* the Engis skull, hence a large interparietal breadth is no proof of a good cerebral development, it is, on the contrary, a mark of arrested development. The Malay-skull with its rounded form has its greatest breadth between the parietal protuberances, but becomes narrower at the base, and is by this, as well as other characters, recognised as a rude form of the brachycephalic type. Already in the year 1828 Mayer† wrote that the Malay-skull resembles in form the type of the Orang skulls. At a later period, he describes‡ in the skull of a Malay woman a sinus pterygoideus and a sinus jugalis, as a species of animal form, and he also designates the peculiar depression of the nose and the stunted nasal bones, as seen in the low Malay skulls, as well as the projections of the jaws as similar characters. He once found in a Malay-skull of Nukahiva, the nasal bones completely absent; in a second skull the stunted nasal bones were so intergrown with the upper jaw, that they seemed to be absent. He also remarks that this stunting of the nasal bones as well as the high and broad occiput, are not usually seen in the negro. Stunted nasal bones occur also occasionally in the Negro. Leuckart‡ describes two such Negro skulls of Blumenbach's collection. Among the Hottentots we find equally that the nasal bones frequently coalesce in a little squama. Leuckart mentions, however, that the form of the nasal bones of a Japanese skull resembled that of the orang outang; this applies also to a Kaffir skull of Vrolik's collection in Amsterdam. Soemmering§ also found that a Marquesa skull of the island of Nukahiva resembled much that of an ape.

It may be easily conceived that if, in addition to the usual form of the Malay skull, there is a morbid arrest of cerebral activity, it must give rise to a human cranial form which strikingly betrays the animal type. This is the case with the skull of a Malay female idiot which was shown to me in 1867 by Halbertsma, of Leyden, and which he subsequently described.|| But in this case the cranial capacity was not greatly limited; it was not such an arrest of cerebral development as seen in microcephali. Halbertsma found in eight female

* V. Meckel. *Neues Archiv für Physiologie*, 1828, p. 437.

† *Organ für die gesammte Heilkunde*. Bonn, i, 1841, p. 114.

‡ D'Alton und Burmeister. *Zeitung für Zoologie u. s. w.*, i, 1848, p. 57.

§ *Catalog. Mus. Anat. qu. Coll. S. Th. Soemmering*. Francof., 1830; and *Neue Denkschrift der Societät zu Erlangen*, i, 2.

|| Halbertsma. *Beschrijving van een Oost-Indischen Idiotenschedel*, *Nederl. Tijdschr. v. Geneesk.* Jaarg, 1864.

Malay skulls the mean capacity to be 1306. c. cm., that of the idiot amounted to 1265, whilst that of the orang was only 340 c. cm. But the imperfect development showed itself in the narrowness and length of the cranium, in the strong prognathism, in the size of the facial portion, in the elliptic dental arch of the upper jaw, the short occipital squama, the high-reaching attachment surface of the temporal muscle, and the but slightly curved sutures. Halbertsma concludes his description with the remark, that this skull shows how much the human form may lapse into the animal type, and that this derivation is not expressed in a single part but in the whole structure of the skull. The peculiarities which this skull possesses in excess, occur commonly in a less degree in other Malay-skulls, proving that there is also a lower form of the brachycephalic skull. The general outline of both is different; they are apparently sprung from a different root, but both express an arrested development or a low organisation. On taking this view of the Malay-skull, it appears improper to look upon it as a mixed and not as a racial form. The Malay has more claim to the denomination of race than the American or Caucasian. Setting aside the changes the human skull undergoes by culture, there remain two rude types—the dolichocephalic and the brachycephalic skull. We possess no facts for their common origin; but that they are of different descent may be deduced from the circumstance that those regions of the globe in which the above types are strongly represented, namely, equatorial Africa and South Asia, are also the homes of two species of anthropoid apes, who differ similarly in cranial structure.

Even when from this fact no conclusion is drawn as to the origin of man, the analogy of the formation still holds good, and some may attempt to explain it by climatic causes. Duvernoy was the first who opposed the dolichocephalic Chimpanzee to the brachycephalic Orang. Agassiz has pointed out that in Asia and Africa the large apes and the human races have the same colour of the skin. I myself have drawn attention to the fact* that the gorilla is also dolichocephalic, and that the approximation of two human races to the apes of the same countries in colour and cranial form appears the most formidable objection to the unity of the human species in the present state of our knowledge. The casts of ape and race skulls, *i.e.*, the cerebral forms shew that typical conformity more distinctly than the skulls themselves, whose projecting crests and frontal ridges in the apes do not clearly delineate the outlines of the cranium. In conformity with these remarks, M. L. Bischoff† calls the orang-outang

* *Verhandlungen des Naturhist. Vereins.* Bonn, 1864.

† *Ueber die Verschiedenheit in der Schädelbildung des Gorilla, Chimpanse und Orang-Outang.* München, 1867, p. 71.

brachycephalic, the gorilla and chimpanzee dolichocephalic and adds that these differences shew themselves already in very young animals. Virey even pointed out a psychical resemblance of the Negro to the wild African ape, and of the Asiatic to the gentle and docile orang outang. But there is no doubt the chimpanzee is also docile and gentle. If by races we understand, as was the original meaning of the term, roots of human stocks, there remain, of the hitherto distinguished racial forms, of which Buffon adopted six, Blumenbach by the fusion of the Lapps and Tatars, five ; Rudolphi, by giving up the Malay race, four, and Cuvier, by the rejection of the American, three ; there remain only two well-founded races, an Asiatic and an African, and the future will decide whether really the oldest European stocks, differing in cranial structure, have immigrated from Asia or Africa. The Austral negro, whose existence seems to militate against such a view, betrays by the height of his skull and his projecting parietal protuberances, an affinity to the Malay. It may also here be mentioned, that the oldest human civilisation had two regions of issue, India and Egypt, and that historical research has left the privilege of their respective antiquity undecided. Even the sharp-sighted Blumenbach* already maintained that all cranial forms may be arranged between the two extremes, namely, the Ethiopian and the Mongolic form.

Stature and muscular force have some influence on dolichocephaly or brachycephaly, and it is worth examining how far it extends by the side of hereditary differences. The dolichocephalic skulls of the present Scandinavians, Germans, and Celts of the past we find combined with high stature.† The little, round, brachycephalic crania of remote northern antiquity, described by Nilsson and Eschricht, designate, like the human remains of the reindeer period found in Western and Southern Europe, a short race. Malays and Mongols are usually of shorter stature than North-Europeans and Negroes. Welcker found that short men incline more to brachycephaly, tall men to dolichocephaly. Thus we find also the gorilla superior in height and strength to the orang-outang. There is no doubt that the muscles, as shown by the researches of Fick, exercise a hitherto unnoticed influence on the form of the bones in general and upon some cranial bones. The strongest of these muscles, the temporal muscles, which compress the cranium on both sides the muscles of the neck, which act on the occipital as well as the frontal and corrugator muscles, which project the soft parts of the frontal region ; all these act upon the elongation of the cranium.

* *Decas v. Coll. suæ Cranior. div. gent. ill.* Goetting., 1808.

† Compare Schaaffhausen, *Ueber Germanische Grabstätten am Rhein, in den Jahr. de Vereins v. Altherthumsf.*, xlv, 1868, p. 109.

We find that when muscular force predominates in whole tribes, it is generally concomitant with a lesser degree of mental development; we thus find that the influence, which favours the increase of the skull in breadth is wanting. To assume that there is in the bones themselves a formative principle, we have no ground whatever. There exist startling examples of the influence of the muscles and the soft parts upon the shape of the bones. Blumenbach describes a skull, the facial bones were quite contracted by long continued spasms on one side. Another remarkable case is cited by Busch,* in which, in consequence of the contraction of the cicatrix after a severe burn, the bones of the left side of the face had become atrophied; the left half of the tongue also diminished in size. That the tongue corresponds to the space of the jaws is shown by the large tongue of the lower prognathous races. Virchow remarks that the position of the upper jaw is also determined by the tongue, he refers to the cretins and to a case of macroglossy.† Zillner‡ also shows that in cretinism the projection of the teeth is caused by the pressure of the tongue. The view of Retzius that dolichocephaly is produced by a great development of the occipital lobes, which is a privilege of human structure, and therefore represents a higher human form, is opposed to the occurrence of this cranial type, nor does it comport with the law of the development of the human brain. It is not the length of the occipital lobes, but their increasing breadth and height, which chiefly condition their stronger development in man. The old opinion that in man only, but not in the ape, the posterior lobes of the cerebrum cover the cerebellum has been proved to be erroneous.§

The following remark of Welcker: "As the ruder tribes of the Bashkirs and Calmucks are held to be the prototypes of brachycephaly, and as the narrow shape is considered to be the nobler form, so that every one speaks of the dolichocephaly of the Germans, it seems an affair of honour to save the dolichocephaly of the German skull," refers merely to a general prejudice, which the researches of Welcker himself have greatly removed. Aeby|| also arrived by his measurements at the conclusion that the most important character of the skull is not its length but its breadth; and he divides, therefore, the crania into stenocephali from 130-148, and eurycephali from 159-168 mm. in breadth.

* *Sitzungsberichte der Niederrh. Gesellsch. in d. Verhand. des Naturhist. Ver. Bonn*, 1865.

† Virchow, *Archiv*, vii, p. 133.

‡ *Ueber Idiotie*, Jena, 1860, p. 197.

§ *Bericht über die Zusammenkunft einiger Anthropologen in Goettingen*. Leipzig, 1861, p. 33.

|| *Die Schaedelformen des Menschen und der Aften*. Leipzig, 1867.

The sutures constitute an important character for the determination of the development of the skull. They are straighter, almost lineal, in the new-born, and but little dentated during early infancy. In many crania of savages we find them in the same condition as they exist in infants from two to six years old. Even the usually long dentations of the lambdoid suture are short. It is, therefore, not surprising that we find the same low form in the prehistoric man. The cranium of the Neandervally betrays also in this respect its high antiquity and primitive form.

The ramification of the dentations indicates a slower and longer growth of the cranium and the brain, and corresponds with a higher mental development. It may also arise from the arrest of osseous development; for instance, from the deficiency of bone-forming lime, as is frequently seen in rickety heads and the soft skulls of the Mongol race, in which the spongy substance predominates. In such cases intercalated bones are often met with in the sutures. Lucae* found the quantity of ashes of a skull with distinct dentated sutures to be less than that of a skull with obliterated sutures. In all crania the quantity of ash of the external table is larger than that of the spongy substance. Virchow† asserted that in rapid growth of the bones the sutures become dentated and Wormian bones arise; but this view is in contradiction with all other observations, and if in rickety subjects the sutures remain rectilinear, it is not the consequence of a slow but of an obstructed growth of the bones. Although Lucae does not agree with Virchow that the Wormian bones diminish the cranial capacity, he agrees with him in so far that the dentated sutures indicate a rapid growth of the margins of the sutures, whilst they should be considered only as the consequence of the progressive growth of the margins with a diminished ossification. The continuous pressure of the growing brain must, in many cases, be the cause of the sutures remaining open. Their early closure may be due either to an early cerebral development, or may be the result of an inflammatory process, in which case cerebral development is obstructed. We cannot, therefore, admit as a general rule the assertion of Serres that premature closure of the sutures obstructs mental development; for this early closure is frequently only the consequence of a deficient cerebral development. In rachitis, the softening of the bones, which produces curvatures, is usually followed by a thickening of the osseous tissues, and an inflammation of the periosteum seems to attend both processes. Stahl* found that straight finely-indented sutures are con-

* *Zur Architektur des Menschenschädels.* Frankf., 1857.

† *Gesammelte Abhandlungen.* Frank., 1856.

‡ *Klinische Studien.* *All. Zeitschr. f. Psychiatrie*, 1854.

comitant with little cranial capacity, and that sutures with bevelled margins and dentated processes are conjoined with a larger cranial capacity. Compared with animals, man has the slowest ossification of the cranium and the greatest dentated sutures. The straight linear sutures are so much a mark of a senile synostosis, that some cranial sutures, like the frontal and sagittal, close first at those spots where they run straight. Welcker points out that the frontal suture closes first at the poorly dentated spot between the frontal eminence, which also applies to the suture between the occiput and the mastoid process. The depression of the posterior third of the sagittal suture, where it runs straightest, shows clearly an early closure at that spot. Lucae, therefore, justly supposes that senile obliteration commences first at the inner surface of the cranium, because the borders of the bones are joined there in a straight direction. From what has been stated, we arrive at the conclusion that early ossification and straight running sutures in healthy skulls are marks of inferior development. It did not escape the attention of Welcker that in animals and savages the sutures close early. Gratiolet* says also that the cranial sutures are more slowly closing in civilised peoples; but when he adds that their remaining longer open is the cause of their larger brain, we hold that the reverse is the case. He also points out that the closure of the sutures in the negro and the idiot commences in front, but in civilised peoples at the back. This observation is only half true. The early closure of the frontal suture indicates in most crania that the breadth growth of the forebrain by the elevation of the frontal bones, and the yielding of the coronal sutures, is sufficiently secured. The firm connection of the frontal bones to the root of the nose is probably the cause of the early closure of their suture.

The long continued breadth growth of the skull in its posterior and inferior parts, which may be observed in the heads of gifted men, necessarily conditions a later closure of the corresponding sutures. An early closure of the sutures at the occiput is only seen at the posterior part of the sagittal suture, and this may be connected with the slight increase of the subjacent cerebral convolutions. Welcker asserts that in an infant nine months old and in the adult the distance of the frontal eminences is the same, about 58 mm. in the average, which is doubted by Virchow and Lucae. Soemmering who had a Negro skull with a frontal suture, and latterly Humphry asserted that the frontal suture occurs both in broad and narrow foreheads. Welcker has, however, shown that it is found more frequently in brachycephalic peoples than in dolichocephalic, which might have been anticipated. In the burial place of Uelde of the stone period of

* *Comptes rendus*, 26 Août, 1856; and *Bullet. de la Soc. d'Anthrop.*, 1860.

Westphalia were found many crania with frontal sutures, which may be explained by the brachycephalic type and the predominance of the diploë. Engel* connects the open frontal suture with softness of the bone, hence in crania with a frontal suture all the sutures are frequently found open, as also pointed out by Welcker. That the short or long cranial form is connected with the early closure of the transverse or longitudinal sutures, and that the obliquity of the skull is in many, not in all, cases produced by the closure of a suture on one side only, are well known craniological facts. There are also numerous facts showing that in savage peoples the sutures are more simple. In the skull of a Negro, brought by Prince Max von Wied from Brazil, all the sutures are still open and strikingly simple; even the lambdoid suture is but little serpentine in its course.

The same condition presented a Peruvian skull, not artificially compressed, which Bibra brought from Algoa-Bay, also the cranium of Nieder-Ingelheim from a grave of the stone age, the Neander skull and partly also the Engis skull. Very simple, straight sutures are also seen in an Esquimaux, a Papua skull, and the old Batavia skull of Blumenbach's collection in Goettingen. The skulls of the New Caledonian, brought home by Bourgarel, now in the collection of the Garden of Plants of Paris; most of the African skulls† brought by Bilharz from Cairo, as well as the Negro skulls described by Barkow.‡ It were desirable that in future delineations of crania the sutures should be carefully attended to, which has hitherto been neglected and left to the fancy of the drawer. Broca has arranged that in the catalogue of the collection of the crania of the Paris Anthropological Society the development of the sutures should be mentioned. That the early closure of the sutures coincides with an inferior organisation is supported by many facts. Engel already pointed out that the idiot skull frequently showed premature synostosis of all the sutures. How much the formation of the bones differs in idiots is shown by the cretin skull cited by Hyrtl,§ in which there were 323 suture bones. According to Hyrtl, the suture bones arise when the ossification at the border does not proceed *pari passu* with the growth of the bone, and when the intermediate substance becomes ossified later, as is the case in hydrocephalus. Prichard remarked that in many Negro skulls all the sutures close early. Pruner-Bey|| also mentions this fact. J. Wallace found in four Negro skulls of a tribe of the west coast of Africa, who stand low in mental development, that the sagittal suture

* *Untersuchungen ueber Schaedelformen.* Prag., 1851.

† A. Ecker. *Schaedel Nordostafrikan. Völker.* Frankfort, 1866.

‡ *Comparative Morphologie*, 3 Bd. Breslau, 1865.

§ *Handbuch der Topogr. Anatomie.* Wien, 1853, p. 10.

|| *Mémoires de la Soc. d'Anthrop.* Paris, 1861.

left no trace. I saw in the possession of Van Beneden, of Louvain, in 1866, a small, oval, very thick, brown coloured skull from the peat of Blasfeld, near Antwerpen, in which the sutures were externally ossified, but internally quite obliterated; the straight but narrow forehead showed prominence in the direction of the frontal suture, of which a few dentations were still visible in the upper half; the whole sagittal suture was projecting, the vertex was roof-shaped, the plane of the temporal muscle was, in the whole, raised a few millimetres above the cranial surface. In this case there must have been a strong muscular pressure upon the skull. That this pressure is one of the causes of the early coalescence of the sutures may be proved by the fact that an artificial pressure upon the skull will produce the same effect. D'Orbigny says that the Aymará skulls presented closed sutures at all the spots which had been compressed; even the skulls of young persons showed this condition. Welcker found in a Huanca skull a portion of the coronal suture obliterated. Such is also the case with the macrocephalic skull brought by Prince E. Wittgenstein from the Crimea, which is now at Wiesbaden. On the other hand, in the compressed skulls from a grave near Niederolm, described by Ecker,* all the sutures are open, but little dentated. The heart-shaped Mexican skulls of the Paris Museum are in the same condition. The early-closing animal skull is more covered by muscles than the human skull. Finally, it is not surprising that the skulls of the fossil dog or wolf, as I have observed in the cave bones of Westphalia, have straighter sutures than the domestic dog.

The most palpable mark of an inferior organisation is the projection of the jaws and the teeth, which is the rule in many savage races, and is usually coincident with arrested cerebral development. It occurs in all races, but only exceptionably in the Caucasian. Camper's facial angle shows this condition. Blumenbach found it in the square head of a Sarmatian and in the narrow skull of a Congo negro. In the highest degree of prognathism the teeth are in the direction of the jaw. In the Malay, the anterior surface of the upper jaw under the nasal aperture is often distinctly concave, and the teeth of the upper jaw then project above those of the lower; in the Negro the above surface is convex.

Pruner-Bey calls double prognathism that rare occurrence, when the incisors of the lower jaw are also projected forwards, and thus form with those of the upper jaw an acute angle. Cranial fragments from the stone age show marks indicative of a prognathism which exceeds that of living savages. It is unquestionable that in the apes prognathism increases with the growth of the skull, and this is pro-

* *Archiv für Anthropologie*, i. Braunschweig, 1866.

bably the case with the lower races. Pruner-Bey found it slight in an infantile Negro-skull. I found the same in a Negro-skull of the first dentition in the Paris collection. It is, therefore, important to notice that in several infantile skulls of remote antiquity a very considerable prognathism has been observed. Pruner* first drew attention to this; that it was the skull of an idiot cannot be urged. I found the same conformation in some fragments of infantile skulls found at Uelde. It also struck me that we so frequently find in ancient female skulls so decided a prognathism that they almost resemble the Ethiopian skulls, and have been mistaken for it. The most prognathous skull in the cave of Frontal† is that of a female. This may be simply explained from the fact that the female skull retains in its growth more signs of imperfect development than the male, namely, the projection of the parietal protuberances, the lesser elevation of the frontal bone, the shorter and narrower cranial base, and with the latter is connected the more elliptical dental arch and the inclination to prognathism. When the characters of a race type were not viewed as a whole, and when the degree of the development of a skull was not yet distinguished from its type, then striking individual features were held as determining the racial form, and it was believed that these features occurred also in other races, although only exceptionally. Thus prognathism in a European skull was said to be an Ethiopian character. Blumenbach already said that the Negro is distinguished from the European as is the wild boar from the domestic swine. M. J. Weber‡ tried to show the occurrence of all race forms in the skulls of the inhabitants of the Rhenish provinces; but it is only because individual cranial bones may in all races present similar conditions of development, that such similarities of individual character which never represent a whole race type may occur. Among the negroid skulls which Weber found in the collection at Bonn, three are female skulls.

In the skull of a Jewish girl, delineated Tab. xvi of a work cited below, the forehead is wider, the sutures more dentated, the zygomatic bones less projecting than in the Negro, and the nose is, by a crista, separated from the surface of the upper jaw. In a female skull of the anatomical collection of Goettingen, the negroid type is limited to the projecting jaw; the round cranial form, the broad forehead with distinct frontal eminences, the broad wing of the sphenoid, the finely indented sutures, do not by any means correspond with the Ethiopian

* *Anthrop. Rev.*, London, No. 16, p. 126.

† Van Beneden and Dupont. *Bullet. de l'Acad. Roy. de Belge*, xix, No. 1.

‡ *Die Lehre von den Ur- und Racen-formen der Schaedel und Becken des Menschen*. Düsseld., 1830.

cranial form. Vrolik* also cites the skull of a girl nineteen years old which, by its prognathism, length of palate, and receding forehead, resembles that of a young negress; but whilst the form of the jaws reminds us of the orang, the nasal bones present a sharp ridge, and the sides of the cranium are arched. The lower jaw of La Naulette presents a decided animal prognathism, as the chin, so prominent a feature of human expression, is wanting. The jaw here takes part in the prognathism, and forms behind the incisors an obliquely directed surface. This striking simian form had, until then, not been observed. The fossil jaw of Arcy possesses it in a less degree; I also find it in the fragment of an old lower jaw of Fritzlar,† in the jaw of a young person found at Uelde, in which the canine tooth projects above the first molar nearly four mm., and in the lower jaw of Grevenbruck,‡ which also, in the elliptical form of the dental arch, betrays a low organisation. The jaw of La Naulette possesses another animal character, namely, the size of the molars; the last of which is the largest, with five roots, as in the anthropoid apes, with exception of the chimpanzee. Owen§ has pointed out that in the Caucasian race the two external roots of the last molar were usually grown together, and that sometimes the internal is united with them; which is never the case with the Melasian races. In Australians the wisdom tooth has always three distinct roots, as in the chimpanzee and the orang. In civilised races the posterior dental portion of the jaw is always shortened; that this is not the case in savage races, is shown by the fact that we find in them occasionally six instead of five molars. Soemmering found the latter five times in Ethiopian skulls; and we find also in the orang sometimes a supernumerary molar. It is frequently observed in the Negro, the Australian, and the Malay, that the true Molars are equal in size. The narrower base of the primitive skull, and the projection of its jaws, cause the dental arch to be more elliptical, whilst in the higher-formed human skull it is paraboloid. Among savages we find that the lower Negroes, the Australians, and especially the Malays, present this elongated form of the dental arch, so that the molars stand almost in straight lines and parallel to each other. In the collections of Utrecht and Leyden, so rich in Malay skulls, I noticed this form. The resemblance to the ape jaw becomes still greater when the dental arch is nearly rectangular, and when also the incisors form a straight line. I have thus seen it in Negroes

* *Musée Vrolik, Catalogue, etc.* Amsterdam, 1865, p. 64.

† R. Müller. *Ueber einige Menschliche Ueberreste aus der Steinperiode.* Marburg, 1864.

‡ *Sitzungsber d. Niederrhein. Gesell in den Verh d. Naturhis. ver.* Bonn, 1864, p. 30.

§ *Odontography.* London, 1840-50.

and Australians ; also in the lower jaw of a skull from Madura, in the Goettingen collection. In the child, as Welcker has shown, the distance of the last molars on both sides is less than at a later period, although the length of the dental arch does not increase after the second dentation. The fossil lower jaw of Grevenbrück possesses this character, and other signs of primitive form, in which it resembles that of a child, namely, the scant height of the horizontal portion, and the short articular process, forming an obtuse angle. Owen declares it a peculiarity of man that the pre-molars of the upper jaw have never three different fangs, as is the case with apes. Such a form had hitherto never been observed in lower races. I am the first who found this character pertaining to the remote antiquity of our species, in a skull of the bronze period* found at Olmütz ; the second pre-molar of the upper jaw has here three very distinct roots. I found the same in two skulls of the common shape in the anatomical collection of Goettingen ; in No. 1297, the first upper left premolar, and in No. 1354, the same tooth on the right, have three roots. Premolars with two separated fangs are not rarely met with in the lower races. The interval also (*diastema*) between the canine and the incisor, so well marked in the apes, is also met with even in man. A Kaffir skull in the collection of Erlangen, delineated by R. Wagner,† shows this plainly.

The nasal bones of the primitive skull we must assume to be small, as we find them so in the lowest races. In the latter, the floor of the nasal cavity passes, with a smooth plane, into the anterior wall of the upper jaw. The same form presents an old Germanic skull from Nieder-Ingelheim, and a skull from the so-called giant grave, which Dr. Wentzel, of Bergen, kindly presented me with.

That the rude skulls of antiquity show the effect of strong muscular action is easily conceived, when we consider that the first inhabitants of Europe had to sustain a great struggle with the animal world. Deep zygomatic fossæ, strongly projecting superciliary ridges, a high and projecting temporal line, a greatly developed occipital spine, are more or less combined. In a skull found near Lippstadt,‡ of the stone period, the semicircular line of the occiput runs in the shape of a sharp osseous ridge from one mastoid process to the other. Eschricht§ delineated a skull from a Danish barrow in the island Fyör, which has on the occiput a projecting osseous spine ; the temporal squama reaches the frontal bone. I, myself, possess a Germanic

* *Sitzungsber. d. Niederrh. Gesellsch. Verh. d. Naturhist. ver.* Bonn, 1865.

† *Icones, Zootom.* Leipz., 1841, Tab. II, fig. xv.

‡ *Sitzungsber. d. Niederrhein. Gesell. in Verh. d. Naturhist. ver.* Bonn, 1859, p. 103.

§ *Amtl. Bericht der 22 Vers. deutsch. Naturf. u. Aertze in Bremen*, 1844, p. 92.

skull of the rudest shape, found in Cologne, which is very long, narrow, thick, and prognathous; the temporal squama reaches the frontal bone, the sutures are simple, the temporal line strongly developed, a superior premolar has two divergent fangs, the occipital lines coalesce in the centre in a strongly projecting squama. A strong occipital crest is frequently accompanied with a weakly developed mastoid process, which is nearly wanting in the ape. If the skull is well fixed to the neck, it is less moveable on the vertebral column; the powerful mastoid processes of the human skull are, therefore, the result of the erect posture, with which many peculiarities of the human form are connected. The occipital foramen lying further back, the simple convex curve of the vertebral column, the walk with a projecting body of the Negro and other savage races, prove that the more noble human form is quite erect, by which a more free rotation of the head upon the vertebral column is acquired. Ecker has justly enumerated among the characters of the male skull, the large and strong mastoid processes, which correspond with the greater muscular force of the male. When B. Davis* cites, against this view, the small and little prominent mastoid processes of an Akassa Negro of the west coast of Africa, it may be explained by a strong posterior attachment of the skull to the vertebral column. I have several times seen small mastoid processes in rudely-shaped ancient skulls.

In this way we may, by the combination of individual fragments, found in Western Europe, obtain an idea of the primitive human skull. That the primitive man had a similar form in other regions, may be inferred from the fact that the lower races in different countries possess corresponding marks of a low organisation. But such a great resemblance of the oldest fossil skulls, affording a proof of a common origin, has hitherto not been found in our part of the world. There remains, as for the living races, two forms which cannot be united, namely, a brachycephalic, which is now mostly predominant among the peoples of Northern and Southern Asia, and a dolichocephalic type, prevalent in Europe and Africa.

It is not surprising that in the region intermediate between Europe and Asia, namely Russia, both types should prevail. According to the researches of Dr. Copernicki, of Bucharest, the great Russian in the north-east of the empire is dolichocephalic, inclining to a roof-shaped vertex, he is of high stature, fair or red haired. The little Russian, or Ruthene, is short and brachycephalic, his hair is chestnut, and he speaks a different dialect. Despite this difference in the fundamental form, the law of the development of the human skull is universally valid. The skull of savages possesses characters which are the same

* *Archiv für Anthropologie*, II. Braunschweig, 1867.

everywhere. There exists an unquestionable similarity of form between the skull of the old Briton and that of the present Australian. A scant breadth of the base of the skull is, in the Negro and the Malay as in the pre-historic man of Europe, the mark of an imperfect cerebral development ; the features, which resemble each other in all low races, are such as correspond with a scant development of the mental powers, the improvement of which has in all countries the same influence upon the improvement of the cranial form. There are two influences forming the characters of human races—climate and civilisation ; upon climate depend stature, general physical conformation, colour of skin and hair ; but it is civilisation which develops the brain, gives height and breadth to the skull, and diminishes the frame of the jaws. Indirectly civilisation acts upon all race characters, because it can limit and change the influences of the climate. On the other hand, climate often facilitates or impedes civilisation. It may further be asserted that whilst a manifoldness of type is caused by the difference of climatic conditions, mental culture may be a means for the approximation and equalisation of forms. It is not surprising that we find the extreme forms among savage peoples, and that the past presents to us forms more widely differing than the present. It is unquestionable that the anthropoid apes of Africa and Asia, which live under similar climatic influences, do not differ from each other in cranial form as much as human races of different parts of the globe. Their wider geographical distribution exposes them to greater changes of natural influences, and the different degrees of their civilisation produce other divergencies. But there exists a decided dolichocephalic and brachycephalic type in the cerebral form of these apes. I find the cast of the cranium of a chimpanzee one hundred and nineteen mm. long, and ninety-two in width, that of the orang one hundred and nine mm. long and ninety in width, that of a young orang one hundred and five mm. long and ninety-four wide. The differences are greater in adult animals, and are greater in length than in breadth. The type of the Negro and that of the Mongol are already recognisable in early infancy, as already observed by Blumenbach.* We cannot agree with Pruner-Bey and Aeby that race differences are not observed in the infantile skull, they only become more prominent at a later period. When we adhere to the designation of race skulls, as proposed by Retzius, namely, of the brachycephalic and dolichocephalic form, it must at least be allowed that the indication of the greatest length and the greatest breadth of a skull does not decisively characterise it. Two skulls may agree in these measures and yet differ in shape, descent, and the degree of their development. On the other hand,

* *Decas III, Coll., etc., No. 29 and 30.*

the length and breadth of a skull is a palpable mark of distinction, and herein consists its value. To this may be added that the widely differing cranial types, that of the Mongol and Negro, also differ in this respect, although the skull of the Negro can only be called long in proportion to its scant breadth. R. Owen* has pointed out that the dolichocephalic type of the African skull does not consist so much in its greater length as in its scant width and height, and that the length of the hemispheres is much more constant than their breadth and depth. Aeby, therefore does not distinguish skulls into long and short, but into narrow and broad. This denomination labours under the disadvantage that the greatest breadth of a skull occurs in different spots, and has therefore a different signification.

Every classification which relates to individual cranial measurements is defective, and the greatest confusion may arise if there be no agreement in the method of mensuration, as is unfortunately the case in measuring the breadth of crania. Sometimes the width is measured between the parietal eminences, sometimes over the auditory apertures or some other spot. The same skull may thus, when differently measured, be either dolichocephalic or brachycephalic, as is the case with a Malay skull of Macassar now in my possession. This skull is 169 mm. long, and measured over the auditory aperture 114 mm., but between the parietal eminences it is 131 mm. wide. As, according to Blumenbach, all different race types are connected by intermediate forms, it became necessary to adopt a medium measure between the long and the short skulls. Von Bär recommended a width amounting to 80 p.c., Welcker, 75 p.c. of the length. But when we speak of a dolichocephalic or brachycephalic type, we ought to attend not merely to the proportion of breadth to length, but to other characters usually combined with it. Halbertsma found in normal Malay female skulls, length 164 mm., breadth 135, cranial index 83. In the idiot cited above, the length is 173, breadth 130, cranial index 75, and that of an orang 74. Still the idiot has, despite her cranium being called long and narrow, not lost the Malay type. The high vertex, the high situated parietal eminences, the erect occipital squama are all preserved, and as the section of the cranium shows the cranial cavity is brachycephalic, the greater length is produced by a thickening of the cranial bones in the direction of the length diameter. The most minute measurements hitherto applied give no correct image of the skull, when we neglect the form and quality of every separate bone. Owing to the zeal of fixing the differences of cranial forms by systematic measurements, we have omitted to attend to the other characters, which may give us some clue to the degree of the develop-

* Du Chaillu. *A Journey to Ashango-land*. London, 1867, p. 439.

ment of the skull. Aebys says point blank, that the cranial form affords no certain means for a proper classification of races—but if the most important part of the body does not furnish us with a starting point for classification, then we ought to give up the attempt. But the want of success may perhaps be owing to a false method of investigation. Another error which underlies many views on cranial formation is this, that we search in nature for fixed types which do not exist in it. Even that form which we call dolichocephalic or brachycephalic, though probably of different origin, is not immutable. The form of a cranium is first determined by hereditary disposition, which may be altered by the influences of aliment, climate, muscular action, mental development, and intermixture with another type. Muscular pressure may have rendered the originally brachycephalic crania of the Esquimaux and Polynesians long and narrow, and the long and narrow skulls of pre-historic times may, by mental culture, have become broader in France, Germany, and elsewhere.

From what precedes, we may consider the axiom as established, that a skull which does not present the characters of a low organisation cannot be considered as belonging to the primitive man, although the skull may be found associated with the remains of extinct animals. It follows further, that we must place the primitive man lower in the scale than the rudest living savage. The Neander-skull and the La Naulette jaw present characters of a low organisation, such as we do not find in any living race. No doubt it is a great loss to science that we possess only a few fragments of the human organisation of the remotest periods. Our imagination must try, supported by the laws of organic formation, to collect the scattered parts of the primitive man, and to construct his frame ; until the time arrives when a happy find may confirm our speculations and deductions relating to a question, which hitherto inaccessible to science, has become the most important of anthropological inquiries.

ON THE ORIGIN OF THE ANTHROPOLOGICAL REVIEW AND ITS CONNECTION WITH THE ANTHRO- POLOGICAL SOCIETY.

IN closing our sixth volume, we purpose to give a short history of the origin of the *Review*, and to address a few words to our readers on the subject of the connection which has existed between it and the Anthropological Society of London. We have hitherto been too much en-