

The cranial affinities of man and the ape / by Rud. Virchow.

Contributors

Virchow, Rudolf Karl, 1821-1902.
Royal College of Surgeons of England

Publication/Creation

Berlin : C.G. Lüderitz'sche Verlagsbuchhandlung ; London : Williams & Norgate, 1871.

Persistent URL

<https://wellcomecollection.org/works/r93d8ff2>

Provider

Royal College of Surgeons

License and attribution

This material has been provided by This material has been provided by The Royal College of Surgeons of England. The original may be consulted at The Royal College of Surgeons of England. where the originals may be consulted. This work has been identified as being free of known restrictions under copyright law, including all related and neighbouring rights and is being made available under the Creative Commons, Public Domain Mark.

You can copy, modify, distribute and perform the work, even for commercial purposes, without asking permission.



Wellcome Collection
183 Euston Road
London NW1 2BE UK
T +44 (0)20 7611 8722
E library@wellcomecollection.org
<https://wellcomecollection.org>

THE
CRANIAL AFFINITIES
OF
MAN AND THE APE

BY



RUD. VIRCHOW.



WITH SIX WOODCUTS.

BERLIN 1871.

C. G. LÜDERITZ'sche Verlagsbuchhandlung.

CARL HABEL.

25 Schöneberger Strasse 25.

LONDON,

WILLIAMS & NORGATE

14 Henriette Street 14, Covent Garden.

NEW-YORK,

E. STEIGER.

22-24 Frankfort Street 22-24.

PARIS,

LIBRAIRIE A. FRANCK

(F. VIEWEG PROPRIÉTAIRE)

67 Rue de Richelieu 67.

Quarterly German Magazine

Tr. 314

THE question touching the descent of Man from the Ape, takes now such a prominent place in the thoughts of so large a number of living persons, that in a manner it has come to be regarded as a necessity for us to make ourselves more intimately acquainted with the reasons inducing so many to follow up the enquiry. In endeavouring to do this, it is naturally impossible to overlook either the striking resemblance of the Ape to the Human Being, or the fact, that it has not been reserved for us to furnish the first anatomical demonstrations of the existence of that likeness. In the second century after the birth of Christ, Galen, the most celebrated medical writer of antiquity, earnestly recommended all such as were desirous of preparing themselves for acquiring the knowledge of Man and his diseases, to apply themselves to the study of the anatomy of some Apes that "are nearest Man"¹; and this counsel was so conscientiously adhered to, till to the close of the Middle Ages that, it may be said almost all the anatomical knowledge of the physicians of those times, rested on the study of the structure of the Ape. It therefore excited no astonishment whatever, when in the seventeenth century, the first Ape possessing a human resemblance in the stricter sense, was brought to Europe², to hear that it was called by the natives of Borneo, Orang-Outang, that is, "man of the woods". Nor were any objections raised when a century later, the celebrated naturalist Linnæus, in his zoological

system which struck out an entirely new path, ranged Man under the scientific name of *homo sapiens*, with the monkeys and some other mammals, in one great division known as the Primates (Quadrumana).

Since that time, the distinctions between the Ape and the Human Being have formed the subject of diligent research; for the system demands a correct exposition of all the differing, but for that reason, characteristic signs, of each class and species. To this end, the separate bones and the whole skeletons of Apes, their muscles, their brain etc. were subjected to an increasingly careful examination. These investigations however, although at first apparently very productive of results, in process of time lost much of their significance. It came to be seen that the different classes of Apes differed in many respects more from each other, than they did from Man. This fact became more evident as the Apes bearing a close resemblance to Man, increased in number, bringing an influx of specimens to Europe; and especially since the year 1847, when the first certain intelligence reached us of the most remarkable of all, the Gorilla.

This ever nearer approach to a human resemblance excited considerable uneasiness. That class of persons whose wisdom never fails them, and who seem to have a prescience of all things under the heavens, have taken refuge in simply turning their back on the anatomical sequence of the whole question. They appealed to the subjoined adjective *sapiens* (wise), adducing it as a proof that Linnæus had acknowledged it was the mind that distinguished Man from all other animals. To what end, they asked, all those tedious researches, when to Man has been given such a decisive physiological badge as reason; nay, when every individual might himself be acutely sensible of the

difference in his own inner consciousness. Carl Vogt³ has made use of this style of demonstration, but reversing it, and he has thereby, probably done away with it once and for ever. He collected the reports and notices of a large number of human beings, whose minds, notwithstanding they were well advanced in years, had never attained to any real development of the reason; whose intellectual culture did not in all cases come up even to that of the man-resembling Apes. In this manner, he contrasted (if I may be permitted the mode of expression), man-like (anthropoid) apes with ape-like men; and while at the same time showing that the organisation of these apelike men not unfrequently partook of the monkey type, he arrived at the conclusion that, by pursuing the path struck out by him, it would be found "to mount higher and higher up to the common origin of that primary class, from which we, as well as monkeys are derived".

It would in fact be much easier to pick out certain of the lower animals which are distinguished from their neighbours by the astounding keenness of their instinct, than to remove Man from the group of vertebrates. How high a place for instance, do not ants take over the majority of all the other insects, by reason of their physiological qualities! But would this be any reason for setting them in a class apart? Man then, according to his whole organisation and development, must be classed with the vertebrates, not only however, for reasons drawn from the structure of his skeleton or only of his vertebral column, as the term might lead us to suppose, but for reasons founded on his nervous system, especially on his brain; for this at least every one must admit, that without a brain, nay more, without a good and perfectly developed brain, the human mind has no existence. *Man has a mind*

and a reasonable will only in as much, and in so far as he possesses a brain, and the latter, again, only in so far as he is a vertebrate animal.

From what has been said then, it is not hard to understand that the special research into the resemblance between Man and the Ape, has also been chiefly confined to the systems of bones and nerves; or to speak more clearly, to the skull and brain. They belong necessarily to each other; and the presence and development of the one, is a necessary condition for the presence and development of the other. It is therefore to a certain extent allowable, from the bones, to deduce consequences touching the nervous system, and especially from the skull, back again to the brain, a method of reasoning which preponderates as for instance, in paleontology, the science of the fossil remains of plants and animals now extinct. Let us now pass on first to the important doctrine of the spine or vertebral column.

In all vertebrate animals, it is the *spine* that forms what I might call the base, the firm framework of the trunk. In its early stages the spine is cartilaginous, but soon ossifies in the majority of all classes of vertebrates. It is only in the lower classes of fishes (cartilage-fishes), that this cartilaginous stage continues throughout the whole term of existence. All the other fishes, the amphibia, birds, reptiles, mammals, and Man, get an osseous vertebral column or spine, which is composed of a variously large, but in the individual classes and species, usually fixed number of separate *vertebrae*. These are strung in a row either one over the other, or behind each other, and are held together by intervertebral cartilages.

The separate *vertebrae* according to their position in the

column, are generally found to differ somewhat in their construction; their height, breadth, circumference, and special arrangements, varying according to the uses and appliances of that certain region of the body. Although this seems to suggest a great variety in the appearance and forms of the vertebræ, still their fundamental outline remains the same throughout, making it a matter of no difficulty to lay down an ideal plan or model of the type of a vertebra. Every single vertebra (Fig. I) forms a ring or annulus, moderately curved inwards, to the front of it a thicker and more elevated part may be distinguished, to which is given the name of *vertebral body* (*k*), at each side a lower protuberance, — the *arches* (*b*), and to the back, a part rather more raised and jutting more outwards, known as the *spinous process* (*d*). Those four parts are found repeated in every vertebra.

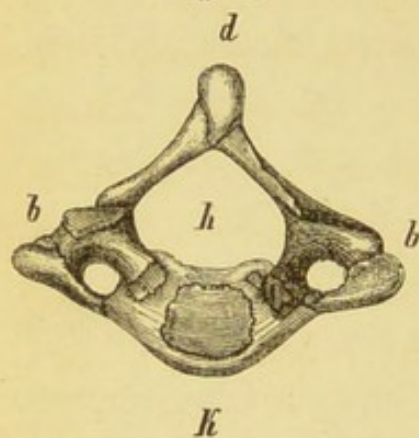
For our better understanding, it must further be kept in mind that, what in the human being is called the anterior or front, is in the most vertebrate animals the under or simply the abdominal side. What in the vertebrate animals is the upper side, comes the back or posterior side in Man. But as the human structure will be the most usual subject of our consideration, we shall, with a view to the human posture, as a rule make use of the terms anterior and posterior, before and behind.

In this upright posture, by passing your hand down the middle of the back, you can feel the protuberances of the spinous processes as they lap over each other. These lie so near the surface, that with every motion of the body, they are distinctly visible under their elastic covering. The whole row is termed the vertebral column, or *backbone*. The other parts of the vertebræ lie so deep, and partly so imbedded in

flesh (muscle), that it is very difficult to get at them in the living body. Our daily meal however, presents a regular opportunity for examining the arches and the bodies in our roasted or boiled dishes of mammals, birds, fish etc. The thicker and more protuberant vertebral bodies may be detected without any difficulty whatever. In younger animals, as for example in calves, still more remains of the original cartilage are to be found.

Let us choose for our demonstrations the vertebra of the

Fig. I.



neck of a young human being (see Fig. I). Here, we can discover in the cartilaginous base for each of the above named parts of a vertebra, peculiar osseous centres or germs, which may again be composed of several parts, the centre of ossification for the spinous pro-

cess, for instance consisting of two lateral halves. The older the animal, or the human being grows, those centres too, increase in size, the cartilaginous parts ossifying, and becoming part of the already existing osseous beginnings or centres. In adults, approaching and at length blending with one another, each vertebra comes to present a whole continuous osseous formation. However, the knowledge of the originally separate parts, is of the utmost consequence for the understanding of the structure of the skull, as we shall see presently.

The space enclosed by the osseous ring, the *great vertebral cavity* (*h*), contains the *spinal cord*, and as every contiguous vertebra is furnished with a similar cavity, a conti-

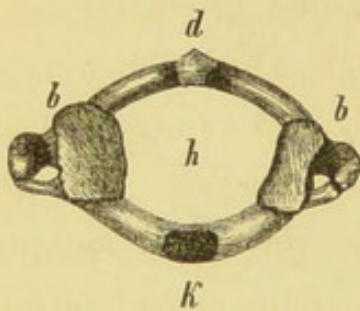
uous canal is formed by the lapping over of the vertebræ, called the *vertebral canal*, and which is carried on to the head. It is firmly closed to the front by the vertebral body and the intervertebral cartilage; to the side and the back, the interspaces between the arches and the spinous processes, by a ligamentous mass. In this manner, an effective protection is afforded the all-important spinal cord on the one hand, and on the other, the requisite flexibility is secured for the vertebral column.

At the point where the vertebral body and arch join, we observe on either side, a more complicated arrangement. The arch here throws out two small processes, one to the interior, the other to the exterior, by which such a junction with the body is effected, as to leave a small space between, called the *foramen*, which is designed to admit the passage of a blood-vessel, viz., the vertebral artery. The interior process has a slight groove on its upper and under surface. The vertebral arches approximating by twos, the corresponding grooves meet and form the *intervertebral opening*, through which the nerves of the spinal cord pass in and out. Lastly, the exterior processes of the arches throw out all sorts of processes and protuberances to the exterior, as well as to the upper and under sides, and acquire an ever-increasing complexity of form, especially in the pectoral and femoral vertebræ. Some of these processes, as the *articular*, serve to effect the flexible connection of the vertebræ with each other. Others again, are designed to be the processes for the insertion of muscles; finally, others establish the connection with adjoining bones, particularly with the *ribs*.

It is unimportant for our purpose to trace the numerous transition forms, now smaller, now larger, which the vertebræ

of the different divisions of the spine present. One only is of peculiar importance for our present examination, for which reason we shall bestow on it a special attention. It is situated on the topmost cervical vertebra, and is the bearer of the "globe of the skull", wherefore, even in the days of antiquity, it received the poetic appellation of the *atlas*. This vertebra is distinguished from all the others by the absence of the spinous process, and the body, even in its full-grown stage; and by the greater part of the osseous substance being pressed together into two lateral heaps, the so called lateral masses. For which reason it is usually described as an annulus composed of an exterior and interior curvature, and the two lateral protuberances. But the examination of an immature atlas shows, that all the essential parts of a vertebra are present even then. In the anterior half of the annulus is to be seen as we already know, the osseous centres (Fig. II, *k*) for the

Fig. II.



vertebral body; but be it remembered, it is diminutive from the beginning, and its growth soon ceases, leaving it only a gently swelling prominence or knob. Originally separated by a long cartilaginous portion, the

arches, (*b b*) join it, each having its separate independent osseous centre distinguishable as the transverse process, articular process, and foramen for the vertebral artery; they turn into the comparatively strong lateral protuberances, whose grooved articular surfaces secure a flexible junction with the head; for in order to effect the lateral motions of the head, the atlas is not, like all the other vertebræ, furnished either above, or below with that intervertebral cartilage. Lastly, on the posterior di-

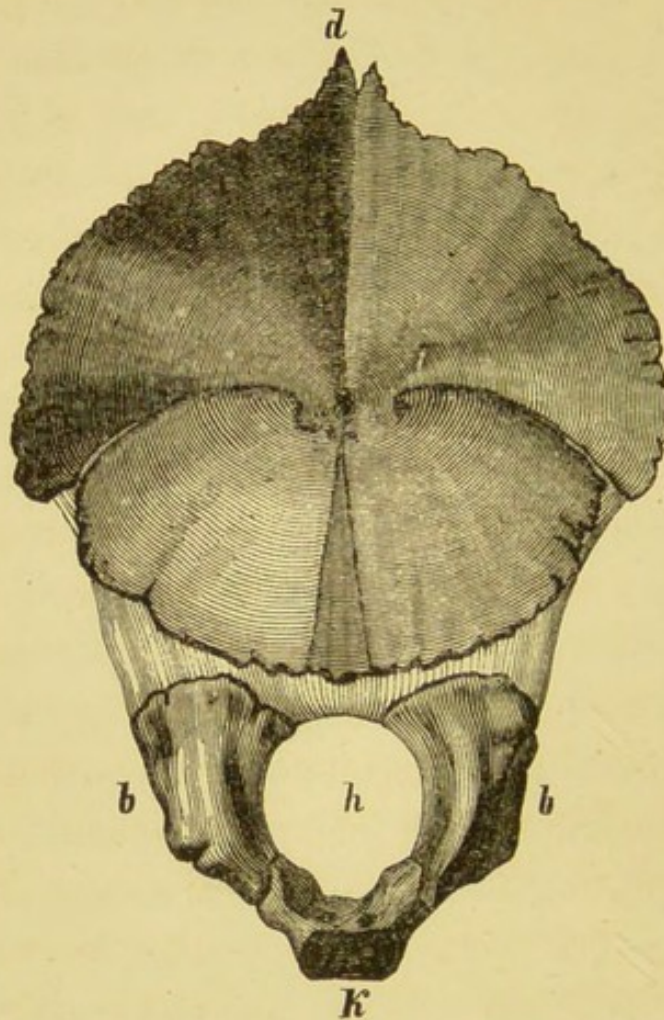
vision of the ring or annulus, we may observe a gentle rising, a suggestion of the spinous process (*d*), which springs from two parted osseous centres.

Thus, by this wonderful and efficient arrangement, the atlas forms the most suitable transition to the *cranial vertebrae*, the vertebral nature of which, being so very much harder to detect, has for this reason been discovered only a comparatively short time ago. The human skull, like that of the higher vertebrate animals, is, as far as the main thing is concerned, composed of three consecutive vertebrae, which go by the names of the *frontal vertebra*, the *middle* or *parietal vertebra*, and the *occipital* or *posterior vertebra*. Each of them is composed of one body, two arches, and a spinous process made up of two lateral halves. But all these parts exist under such peculiar transformations, that long preparatory studies were necessary before ascertaining their signification. One noteworthy circumstance alone, throws immense difficulties in the way of comparison with the spinal vertebrae, and that is, *the comparatively compact, nay almost immovable connection not only of the vertebral bodies with each other, but likewise of all the other vertebral parts of the cranium*, — a compactness perfectly adapted to protect that most important organ of our body, the brain, which is enclosed in this structure, against external influences and injuries. The occipital vertebra alone possesses an articular union with the atlas; towards the anterior it is firmly attached to the parietal vertebra, which in its turn, adheres as firmly, or even more so, to the frontal vertebra.

As the atlas forms the bridge from the cervical vertebrae to those of the cranium, so the occipital vertebra, by reason of its shape, is the cranial vertebra, that is easiest to explain.

We must however, again base our examination of it on the undeveloped, immature state, in which, (see Fig. III), all the

Fig. III.



parts essential to a vertebra, are most clearly discoverable. To the front, as you are aware, lies that peculiar bit of bone called the vertebral body (*k*), differing from the bodies of other vertebræ, only in having a more flattened form. Connected laterally with this on either side by cartilage, is the arch (*b*), which by means of its marked condyloid processes, approaches the lateral protuberances of the atlas, on which its articular centres rest. Towards the back, again parted by a cartilaginous suture, rather broader than the last, we come to the spinous process (*d*), such an enormous piece of bone, that it

far exceeds all the other parts of the vertebra in size, and for this very reason has been so difficult to explain. Look at this spinous process; it forms a broad, flat concave lamina rather thin for its size, which circumstance very soon procured for it the name of the *squama occipitalis*. It is that part which forms the back of the head, easy to be felt from its bulging outwards; and it is at the same time the only spinous process of the cranium, on which can be still quite distinctly felt a real osseous protuberance externally, a continuation as it were of the back-bone. These different parts of the back of the cranial vertebra surround,—and always in the form of a circle,—the *great occipital foramen* (*h*), being the continuation of the vertebral canal, and indeed through which the spinal cord passes without interruption up to the brain.

Obviously enough then, the change in the structure of this cranial vertebra, as contrasted with the spinal vertebræ, is chiefly denoted by the broad and flat expansion of the spinous process. The peculiarities of the other two cranial vertebrae partake of this same character. By a still farther enlargement of the spinous processes to *spinal laminae*, and at the same time as already mentioned, a disappearance of every external protuberance, of every node, every apophysis, the upper part of the cranium, the so-called Calvaria or *brain-pan*, acquires that smooth, rounded appearance, which is the peculiar adornment of the human skull. Corresponding in like manner to the spinous process, is the *frontal bone* of the anterior vertebra, that large osseous lamina reaching down to the sockets of the eyes, and which forms the support both for the bare part of the forehead, and for the front portion of it which is covered with hair. Although this likewise originally consisted of two lateral halves, yet in most human beings it

grows together at an early stage, to one uniform piece of bone like the squama occipitalis. It is only amongst the few it remains open through life, the above being the rule with the spinal laminae of the centre vertebra which occupies the region of the crown of the head and the sides, and therefore bears the name of *parietal* or *vertical bone*.

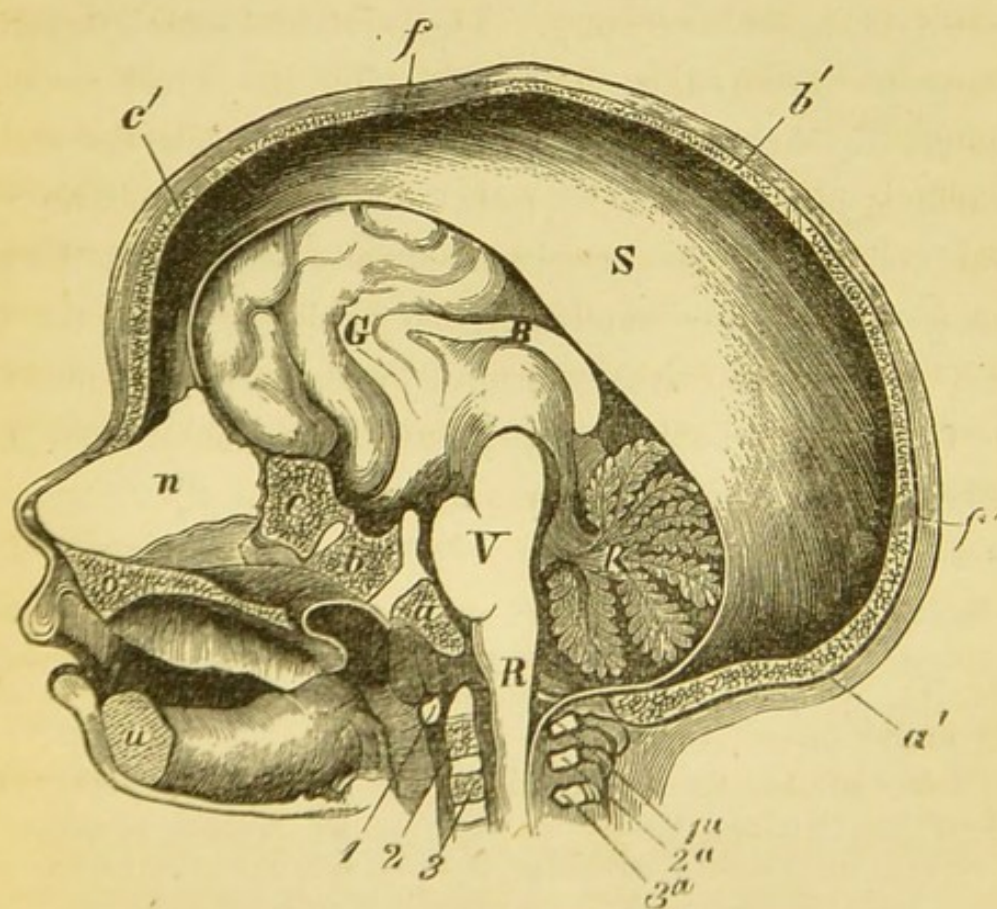
Hence as a rule, the calvaria of the adult (and the higher vertebrate animals), consists of four spinal laminae, of which, two belong respectively to the anterior and posterior vertebrae, and two to the centre vertebra. The whole meet closely, and are further held together by *sutures*, that is, firm fibrous matter. Amongst themselves however, we discover in many respects a confusing variety. While for instance, the squamous bone of the occiput at a very early stage, grows together inseparably with the arches of the occipital vertebra, by the ossification of their cartilaginous union, the frontal and parietal bones usually remain apart from their arches throughout life, disconnecting sutures forming on the contiguous borders. Easy as it therefore is, either from an artificial or accidental separation of the cranial bones, to actually see the connection of the several parts of the occipital vertebra with your own eyes, so in the same degree was it difficult to discover those bones, which must be regarded as the arches and bodies of the frontal vertebra.

In order to comprehend how this is, we must begin by excluding from our investigation all the *bones of the face*, for these are as little component parts of the cranium, as the ribs and pelvis are, of the backbone. The bones of the face, principally those of the upper and lower jaw, are simply attached to the cranial vertebrae, but for the rest in no connection whatever with them. They represent a system apart, of

the highest value for the scientific and artistic study of the head.

We must farther take into consideration that, what is the fore-part in the spine, is the under part in the cranium, and vice-versa; what forms the posterior part in the spine, in the skull lies at the top, and partly to the front. The human head, having comparatively the strongest inclination over towards the upright vertebral column, there is hereby formed between the atlas and the body of the occipital vertebra, an angle open to the front, the upper arm of which runs off in the direction of the *base of the skull*, and reaching to the root of the nose. Here again, the occipital vertebra presents a most characteristic transformation, its body always extending more to the front in comparison to the spinal la-

Fig. IV.



mina. On the other hand, in the middle cranial vertebra, which forms the *crown* properly so called, the body lies downwards; and in the frontal vertebra, which presses quite forward, the body obtains a position removed even still farther to the back.

Those different positions can be best seen by examining the section of a head, (that of a new born child being preferable), divided from before backwards near the median line, through head and neck. (See Fig. IV.) Looking at it⁴, you perceive at once the immediate connection of the spinal cord (R), with the pons Varolii (V), and through it, with the cerebrum and the cerebellum (G and K). You may further trace how the brain in its perfection*, suddenly sends forth such a quantity of compound formations, and in such an abundance and variety, that makes a markedly increased expanse of space necessary. The vertebral canal therefore, extends away on the upper side of the great occipital opening, to the roomy *cavity of the skull*, while the arched *calvaria* is attached to the rather narrow and uniform vertebral column**. As has been already explained, the calvaria is divided into skull-cap, and skull-base, and the former as we can perceive is formed by the occipital squamous bone (*a'*), the parietal bone (*b'*), and the frontal bone (*c'*), connected with each other by sutures (*f* and *f'*).

*) The cerebrum consists as you are aware of two lateral halves called hemispheres. They are united in the middle by the corpus callosum cerebri (B), and parted by the falciform process (S), a fibrous membrane, which presses in between them.

**) In Plate IV, the numbers from 1 to 3 indicate the three uppermost cervical vertebræ, those from 1a to 3a the spinous processes belonging to them. Between the bodies is to be seen the intervertebral cartilage.

In order to discover the bodies belonging to the above, we must cast a glance at the base of the skull, and here we behold under an easily recognisable form, the body of the occipital vertebra (*a*). In front of it, -- in the child separated by a strong synchondrosis (cartilaginous union), -- is to be seen the body of the central cranial vertebra (*b*), which even in a newborn infant is but imperfectly separated by an intervertebral cartilage, from the bodies of the frontal vertebra (*c*). In front of this you observe a mass of cartilage (*n*), which reaches on the one side to the base of the skull, forming here the ethmoid bone; on the other it serves as the base for the septum of the nasal cavities. This partition wall reaches to the upper jaw (*o*), which faces the nearly isolated lower jaw bone (*u*), the inferior maxilla.

In this sketch, which has at the same time revealed to us the essential elements of the facial skeleton, it is the position of the bodies of the frontal, and parietal vertebræ that interests us. How has it been possible to overlook an apparently so obvious relation for so long? There are two reasons which may be given in explanation. Formerly it was not customary to bisect the skull in the manner here described, and it was consequently necessary first, not only to break down prejudice, but also to overcome the idea of preserving the connexion of the bones. Again, the true relation can be observed only in the skulls of quite young children, a relation which becomes less and less perceptible with every year, so that in adults it is hardly distinguishable. For in the adult, we no longer see distinct and separate vertebral bodies, but one solid bit of bone, the *os tribasilare*, which is formed by the cohesion of the bodies of all three cranial vertebræ. Till about the twentieth year of age, the body of the occi-

pital vertebra in the posterior portion of the basilar process, remains still separated by cartilage, hence its signification was less mysterious. On the other hand, the consolidation of the anterior vertebral bodies takes place so early, that from olden times they were regarded as a single inseparable piece of bone, and known under the common appellation of *wedge-bone*, (sphenoid). Later times have taught us, that the anterior sphenoid (*c*), is the body of the frontal bone (*c'*), and the posterior sphenoid (*b*), the body of the parietal bone (*b'*). The connection between these parts is effected by means of special "wings", which again correspond to the arches of the common vertebra. One can thus imagine the whole of the skull-cap as composed of three annular vertebræ placed one behind the other, and in the closest connection with one another.

The disclosure of this relation, so simple in itself, and still so mysterious, is altogether based on the increasing insight gained into the "*history of development*". This science is still in its infancy. The method of thought to which it has given birth, even the peculiar direction observation takes in it, and by which it has been created, was hidden from antiquity, and the Middle Ages. It is the glory of the Germans to have discovered it; and strange enough, we owe it to our great, our immortal poet. Starting from the study of physiognomy, which Lavater had encouraged him to undertake, Goethe applied himself to anatomy. Ever and again recurring to these studies during a course of years, he acquired great acuteness of insight into the fundamental laws of organic life.—As the poet said himself, he endeavoured to discover "the idea of the animal", and lo! what had hitherto been a sealed book to every one, disclosed itself before the prophetic

gaze of such an enquirer. A strange incident brought his thoughts hereon, to a conclusive result. On his second journey to Italy (1790), while visiting the Jewish burying-ground in Lido, his attendant picked up from the shore, a fractured ram's head, which from the state of decomposition in which it was, showed the several parts clearly. "Here", said Goethe, "I had the whole together in its most general outlines." ⁵

Later, it is true, the priority of the discovery was disputed. Some authors have tried to ascribe the honour of the first conception, to the old wizard bishop of Ratisbon, Albert the Great, and to Peter Frank, the celebrated clinical physician. I have already taken occasion to show in some other place, that this is not correct. The only man whose claims have any right whatever to consideration, is Oken the celebrated anatomist and zoologist of Jena, and a younger contemporary of Goethe's. But he himself has fixed as the date of his discovery, the August of the year 1806, when, while taking his holiday trip to the Hartz Forest, and slipping down the steep side of the Ilsenstein, he suddenly saw at his feet, "the most beautifully bleached skull of a hind. To pick it up, to turn it round, to examine it, was the work of a moment. The revelation came upon me like a flash of lightning — it is a vertebral column! And since that time, the cranium has been a vertebral column." Oken indisputably deserves the praise for having first brought the idea within strict scientific bounds, and gaining general recognition for it; but that it was *first* revealed to him, is not the case. It is undoubtedly a strange coincidence that on both occasions, an accidental circumstance while travelling, should have presented the decisive object to the prepared and practised vision of a thinker, and of an investigator; still the honour of having had the

vertebral theory discovered through it, must be accorded to the ram's skull.

To the farther perfection and universal establishment of this theory, another science as new, and likewise born of the German mind, has powerfully contributed; I allude to *comparative anatomy*, discovered by Kielmeyer, a quiet scholar of Tübingen, and the teacher of the renowned French zoologist Cuvier.⁶ Based on this groundwork, the relation of man to the higher animals, since that time classed under the term vertebrate animals, has appeared in quite a new light. The conviction has been gained, that a *common idea* must be discovered in the structure not only of those animals that have come to their full growth and perfection, and which hitherto have formed almost exclusively the subject of the scientific discussions of the systematists, but above all, of those which are in a state of development. From the simplest form of an egg, often microscopic in its dimensions, is built up a typical series of forms developing uninterruptedly the one out of the other, and rising at length to the perfection of organism. The higher the progressive step is, which we have before us in the history of individual organism, and the nearer it is of reaching its highest perfection, the more varied do the different organisms appear. Family is distinguished from family, genus from genus, species from species, individual from individual. Reverse the process, and the farther you trace back the simple organisms to their beginnings, the fewer stages of their development they have to run through, and the greater the resemblance between the individuals, the species and the genera, nay even between the grand divisions or families of the class of vertebrate animals. *All development is a process of dissimilarisation, and every higher animal*

organism in a lower stage of its evolution, resembles an inferior organism.

This fact was acknowledged in the full weight of its importance, even by Goethe's nearest contemporaries, and they clothed it in even a stricter formula than we are accustomed to do. John Frederick Meckel, the acute anatomist of Halle, in the year 1812, wrote as follows. "The same scale of gradation which is presented by the whole animal kingdom, the members of which include the different races and classes, as well as the extremes of the lowest and highest animals, can likewise be followed in the development of every higher animal; for from the moment of its existence, on to the period of its perfection, in respect both of its internal and external organisation, it essentially passes through all the forms which constitute the permanent condition of all those animals belonging to an inferior grade. The series of those forms are more numerous according as the animal is larger and more perfect, for they necessarily increase with the number of every inferior class they have left behind."⁷ He however adds, "It is not probable, at least it has not been observed, that a lower animal can overstep its class and assume a higher form." But he has sought in numerous examples to show, that through obstacles in the entire development, or in that of separate organs only, any higher animal may stop at a lower stage, and in consequence grow to resemble the animal corresponding to that stage. It is scarcely requisite for me to add, that in this respect he does not except the human being.

Indeed, there are cases of human beings showing a certain resemblance to animals (theromorphy). The fabulous histories of all peoples is filled with such tales. The story of

the beautiful Melusina, and also numerous portions of Egyptian and Grecian mythology may serve as examples. Thus we encounter on the one hand, many human beings bearing a resemblance to animals, and on the other, many animals bearing a resemblance to human beings, the monkey naturally claiming here a prominent place. Now, the above observations having been proved beyond a doubt, what thought seemed more pertinent, than that Man was derived from the Monkey? This idea, already long known, though but timidly uttered, and then mostly in relation to the negroes, by the slave-holders in the South States of North America, gradually gathered greater certainty, and growing bolder, counted many adherents in Europe, when through Darwin's celebrated book on the Origin of Species (1859), the notion of a progressive development of organic nature, from the meanest beginnings to the highest forms, has attained a greater and more extended popularity. Darwin has himself not pushed his system so far, as to carry back the pedigree of Man to the Monkey⁸. But Carl Vogt, Huxley, Hæckel⁹, and others have done so.

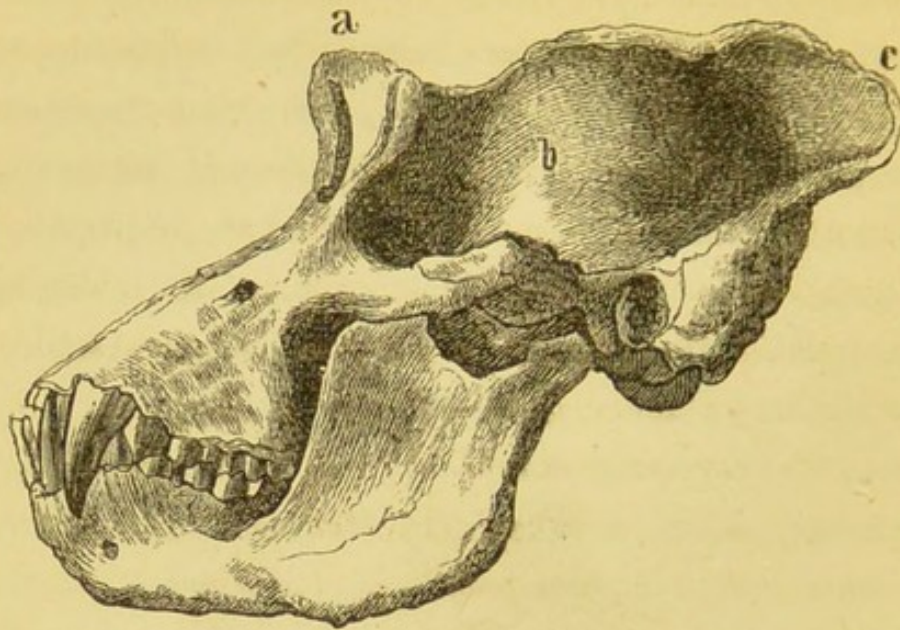
Here however, I must once for all refute a wide-spread, but false assertion. No naturalist down to the present time, has even affirmed, that any of the known, and now-existing families of Monkeys, is the ancestor of Man. In America there are no anthropoid Apes, none in the true sense of the word, —bearing a human resemblance. Such are to be found only in Africa and Asia; the chimpanzee and the gorilla in the regions of the former continent, and the orang-outang, and gibbon in those of the latter. Now American writers,¹⁰ even before Darwin, have laid considerable stress on the fact, that the home of the anthropoid Apes was also that of the lower organised human races, and that both in many respects, as for

example in complexion and conformation of the facial lines, offer striking parallels. Herefrom they have deduced a variety of origins for Men and Apes; and indeed the conclusion which Vogt drew was pretty self-evident, viz., that the negroes have one and the same origin with the apes of Africa, as the negritos of the Sunda Islands have with those of Asia. But Vogt has not said either, that the gorilla, or the chimpanzee is the ancestor of the negro; or that any certain Asiatic ape is the forefather of the negritos and the Malayans.

Indeed, thi very remarkable fact has been pointed out in the morphology of the monkey, viz., *that the resemblance of the baby monkey with the human baby, is much greater than that of old monkeys with perfect full-grown men.* And nowhere does the analogy come out more strongly than in the construction of the cranium. The lesser bulk and prominence of the facial bones, the less marked shape of the eye and the parts around it, the smooth arch of the calvaria, the general form of the skull-cap, the relation to one another of the cranial vertebræ, brings the head of the baby ape so near that of the human infant, that the resemblance may indeed be called "terrible". *But with every month and year of life, the skull of even the most anthropoidal ape grows more dissimilar to the human cranium.*

Let us look at the head of one of those gorillas so celebrated in recent years, and whose home is in the tropical south-west of Africa. The full-grown animal has an enormous head (Figure V); but that part of it which we find in a state of high development is not the skull-cap proper (*b*), the receptacle of, and at the same time the standard for the bulk of the brain; it is not the cranial vertebræ, but rather the external osseous appendages. The enormous jaw bone protrudes

Fig. V.

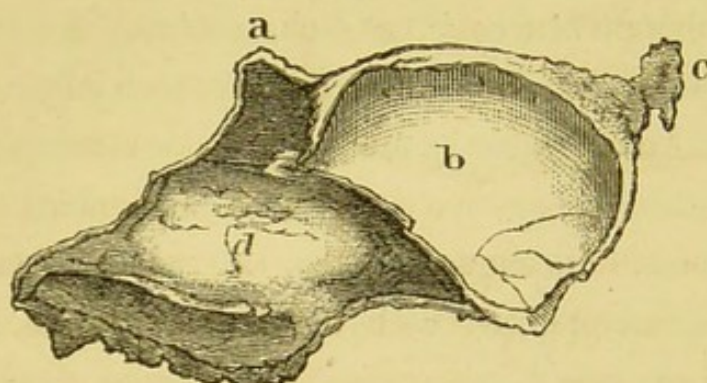


in its repulsive ugliness, with its great fangs superior in bulk to all the rest of the skull. The lower jaw, in its breadth and power, attests to the strength and size of the masticating muscles which are inserted in them. Corresponding to this, is the extent and arch of the cheekbone, under which these muscles must pass to be inserted in the skull. But while in Man they only occupy the region of the temples, and the side part of the parietal bone, they here cover the whole surface; and coming from both sides almost reach the median line, along which runs an elevated ridge of bone, in the gorilla terminating behind, in a regular bony comb or crest (*c*). This crest is the visible continuation of the backbone, which in the human cranium shows no traces of continuation; it is the repetition externally of the prominent spinous processes of the vertebral column. But, not only in the median line, but also in the direction of the back and side, we find a curved bony ridge marking the point of insertion of the temporal muscles. Added to this comes lastly, the great rugged curve of the

ridges of the orbit (*a*), completing the impression of savageness and bestiality.

Still more striking is the extraordinary disproportion between the cavity of the skull proper, and the external appendages, which may be seen in a longitudinal section of the skull (Figure VI). The cavity of the skull proper (*b*) does not exhibit a much greater superficies than the cavity of the nose (*d*). At the crown (*c*) like a serrated promontory, the

Fig. VI.



crest towers over the arch of the calvaria, while to the front, the cranial cavity retreats to make way for the great frontal sinus (*a*). Comparatively little space is left for the brain; it is almost only the more animal parts, especially the apparatus for masticating and breathing, that develop. *Of all the parts of an Ape's head, it is the brain that grows least.*

If we now take into consideration that the brain of the anthropoid Ape contains all the chief parts of the human brain; that the brain of the infant approaches that of the baby ape in comparative size, it is obvious, that the Ape at some stage of development, strikes out a path opposed to that usually selected by the human being; that therefore the Ape, its head not excepted, would through farther growth, only become more and more dissimilar to Man. Even the largest Ape keeps its baby brain, although the jaw may be that of an

ox. The natural deduction therefore, seems to be, that *by progressive development an Ape can never become a Man*, nay rather, that this very development has created the deep gulf between them. In the little Uistiti for instance, in the east of Brazil, the very lowest in the scale, the bony frame-work of the head retains a stronger resemblance to Man than in the anthropoid species.

If then, it is the same great law of morphology that determines the structure of the Ape, as that of Man in its base, still the difference in the character of the two species is displayed in no direction so strikingly, as in their corporal development. First, there is the *duration* or term of life, and all connected with it; next the *rapidity* of development in the whole individual, as in the several parts; all which is very different in the Ape as compared with the Human Being. Apes generally speaking, have a short life, and a rapid growth; they are born in a state of bodily and intellectual maturity, which is frequently enough the case among animals, though never among men; they attain their perfection in a few years; and an early death puts a term to their existence. Although we have no exact data to guide us in fixing the absolute duration of the life of the anthropoid Apes, it is still open to doubt if any of them ever attains that age, at which the human body arrives at its full growth. This at least is certain, that even the tallest Apes are perfectly developed when Man is still in his earliest youth; and they are pubescent, when Man has scarcely outgrown childhood. Still more characteristic however, is the *distribution of the period of development to the several parts of the body*. In the Ape, the brain as a rule has reached perfection before the period of its shedding its teeth; while in Man it then takes its first real step to perfection. As soon as the

milk teeth have been replaced by the second, it is then that, that rapid growth of the jaw and facial bones commences, that enormous enlargement of the external parts of the bones of the skull, which are the most decisive marks of its animal character. This difference carries all the more weight with it, seeing the Ape casts its teeth at a far earlier period than Man. It is not our intention to go over the other parts of the body in like manner, let it suffice for me to state, that the differences are still more marked in other sections of the skeleton. The extension of the posterior section of the vertebral column to a tail, the disproportionate length of the arm, the diverging form of the pelvis, all those peculiarities vary in the different species, but none ever accept the human shape. That is intelligible; for not only the "man of the woods", but more or less all apes, are climbing animals. The tree is their natural home: no species can, in the proper sense of the word, walk. .

Hence the hopes of those naturalists who have desired to find in the Ape, the progenitor of Man, are deferred to the future. The circumstance of the gorilla having been comparatively but recently known, reanimated this hope, which has received fresh encouragement; further, from the discovery of some extinct species in the older strata of the earth's crust, likewise made only some thirty years ago. Not only in the East Indies, and the Brazils, but also in Europe, chiefly in England, France, and Greece, fossil remains of monkeys have been dug up, which fit in to the now existing families. None of those classes however, fill up the gap between Man and the Ape; and for the present, it is out of our power to say, whether research may ever succeed in fitting into each other through actual demonstration, all the intervening links of the species Man, and the species Ape.

As I have already stated, Vogt has struck out another path of investigation in order to fill up the gaps. Since some time past, cases have come to light where now and again in otherwise healthy families, members of the same have not progressed to a perfect development of skull and brain. From their at the same time having stopped on the lowest grade of intellectual cultivation, it was customary to denominate the condition, as that of congenital idiocy; and the objects themselves as *microcephali*, (small heads). Undoubtedly their brain as well as their skull, presented a very much greater resemblance to the brain and skull of the monkey, than is to be found among perfectly organized men. The comparatively vigorous growth indeed, of the jaw and facial bones, imparts something in a very high degree monkey-like to the appearance, justifying the employment of the expression "ape-like man".

But no greater value is to be attached to this expression, than to that of anthropomorphous, to the higher species of apes. Just as little as these apes are men, notwithstanding their human resemblance, so little are idiots, apes, notwithstanding their resemblance to monkeys. They are merely examples of impeded development, in the sense of Meckel, and all the more, as the stoppage in the development, by no means changes the whole structure of the body in a like degree, but is essentially confined to the brain and skull. It is then only one region of the body, that assumes this resemblance to the brute. All the other parts of the body retain their human resemblance so entirely, that an examination confined only to that region, would justify us in coming to the conclusion conveyed in the term.

The history of human malformations shows us similar *local*

arrestment, along with resemblance to the brute, under an often still far more surprising form. With reference to this, Meckel¹¹ with great justice had already attached some importance to the heart, and vascular system. "In fact," says he, "on a closer investigation into most of the abnormal conditions of the form of the heart, and the source of the vessels, we meet both the higher and the lower animal forms, and later, as well as earlier stages of development." Nay, he adds, and the remark is of peculiar importance, "the stage which constitutes its abnormal formations, is in so far still more interesting, than that which represents the embryonic, and the animal series, *because from the union of higher and lower shapes arising from one part out-growing the others*, a variety of forms is produced; a remark which is in so far deserving of attention, as it furnishes the explanation for the not always perfect resemblance between the abnormal shape of the heart, and its embryonic and animal conditions." He then describes human hearts which have the character not merely of those of the mammals, but likewise such as have the character of the higher and lower reptiles, of fishes, and even of insects, and crabs.

It may perhaps not be unimportant, to place before you, out of the numerous list of human deformities, one of the most striking; and it is that, in which the upper and lower members are so stunted as to give such a child the external appearance of a seal. Geoffroy Saint-Hilaire¹² has applied to this the term *Phocomele*; and with just as much right, we might call such individuals *seal-folk*, as those resembling monkeys, ape-folk.

Further, there are human monstrosities devoid of both head and heart. Are we to regard them as reminiscences of the

lowest order of fishes, the amphioxus, standing at the bottom-most step of the scale of vertebrate animals, also being endowed with neither head nor heart?

We see then, that in this way too much can be proved. The history of deformities might be turned to account to show, that every man in his earlier stages of development, has not only been like all animals, but really corresponds to all species, that in fact, at some time, he really has been, or may become a fish, a seal, a monkey.

Another result of experience must here be taken into consideration; as follows. The observation has not rarely been made, that in the artificial breeding of domestic animals, certain varieties *revert* again to the original species. Darwin, in his dissertation on the Origin of Species, has traced this reversion, or as it is called *atavism*, with the greatest assiduity, and therefrom drawn most important deductions, and in many respects incontrovertible. He goes even so far as to assume, that not only does variety revert to species, but likewise that species reverts to species. Vogt has extended this theory to the microcephals, but indeed, in its very widest application, that of the reversion of genus to genus.

If what he states were correct, regarding the correspondence between the skulls of idiots and apes, it would in every case be a highly significant fact. He maintains that,¹³ "the skull of an idiot found in a fossil state, and even somewhat injured, the lower jaw, and the teeth of the upper one for instance, being wanting, would unquestionably be taken for the skull of an ape; and that not even the slightest indication would be discoverable in such a skull to justify a contradictory conclusion." I must first remark to this, that Vogt arrived at such conclusions by comparing an idiot's skull with that of a

chimpanzee, according to which, if we are to be consistent, we should regard the chimpanzee as our progenitor. This however contradicts the fact that the gorilla resembles Man in a still more striking degree than does the chimpanzee. The admission, that the jaw of the Idiot and the Ape cannot be confounded, must not be under-rated. When we consider that Lartet, from a fossilized fragment of an under jaw, found in an old marl stratum in the south of France, not only proved the existence of an antediluvian monkey, but even demonstrated the fact of a new family resembling man very closely, called the *dryopithecus*, it seems we ought to be able to judge of the value of the above concession. But with all that, I still doubt Vogt's main assertion. Even a microcephalic skull wanting all the face, excepting the bones of the nose, would suffice at the first glance to show the difference from the skull of a monkey; while a closer comparison would most assuredly furnish proofs of more undeniable distinctions. It suffices to call the position of the great occipital foramen, and the relation of the basilar process, which relation however, must be shown on young idiots, and monkeys of a higher age, not on full-grown idiots, and baby monkeys.¹⁴

But my chief ground of objection to Vogt is, that without any ceremony, he classes *diseased* and *monstrous* conditions along with normal and typic conditions. This, even from the point of view of a declared advocate for the theory of descent, cannot be ceded; for the origin of new species and varieties, has only then a meaning, when the single individuals of the species or variety, are so constructed, as to be able to lead an independent existence, or if necessary, to carry on the struggle for existence. Consequently, a species or variety cannot exist, if its individual members are so helpless, that they are unable

to do anything for their own preservation, when they have not even the power to attach themselves as parasites, to some higher being. And this is the case with the microcephals. Their idiocy is an obstacle to their undertaking any sort of independent labour which might promote self-preservation. It falls to the family, or to society to maintain them. Quite apart from their incapability of propagating, or in other words, of actually originating a species or variety, their intellectual condition, i. e. their brain, is so defective, that even did such a species or variety exist, it would at once perish without any struggle whatever, for existence. Along with this defect of understanding which many a monkey all but possesses, the microcephali are also deficient in instinct, which in the newborn monkey even, seems in an astonishing manner to fit it for performances as wonderful, as they are suitable and to the purpose.¹⁵ All such power is wanting in the microcephalic idiot; he labours under the misfortune of an imperfect brain; he suffers from a defect without any corresponding compensation. *He is a human being partially changed by disease, but he is not a Monkey.*

A partial, merely local change is certainly one of the most common sights either in the structure of the variety, or the race, for which reason, while on the one hand the natural or physiological changes are extremely apt to be confounded with the diseased or pathological ones; it is on the other, imperatively necessary to consider both in relation to each other. This view especially holds good in an examination into the nature of *inheritance*, (here understood in the sense of transmission of hereditary qualities), about which a few remarks of mine to this effect, were published some time since¹⁶ and when I in particular pointed out, that *inheritance* did not always bear

reference to the same sum of qualities, or of the signs within the range of the race or the species, but rather that those symbols might be increased or diminished in the separate generations. It is therefore possible, that a defect in development caused by disease, may be hereditary, and give rise to a variety or race. Think for a moment of the pug nose, which is not confined to dogs alone, but is to be found in swine, horses and so forth. But for the establishment of a variety or race, transmission is imperative, and transmission is not possible without propagation. Where this is not, no species can maintain itself. In the list of human monstrosities one of the most remarkable is the so-called "*Cherub*", in which both trunk and limbs are wanting, the head being the only part that developes; this produces the total impression of those pictures of heads so often painted by the artists of the Middle Ages, in, or on the clouds. Could such a "*Cherub*" live and propagate, a genus of *the trunkless* (*acormi*), would arise, representing animals endowed with spirit. Unfortunately, they are of as little use as the microcephals, for the theory of atavism, for they always maintain themselves at the expense of a twin-brother; and any hope of their spreading, or their attaining sovereignty in this world is nugatory. They suffice however, to illustrate the revers of the doctrine of reversion.

It may therefore be distinctly affirmed, that an actual proof of the derivation of Man from the Monkey, has hitherto not been produced; and in my opinion, the evidence required must consist, in the being able to point out *a certain species of monkey*. A general likeness to the species, showing us how man resembles one monkey in one thing, and another in another, is not sufficient. But all naturalists agree in saying, that none of the known Apes is this definite primary species.

And therewith is the verdict pronounced, that all investigations down to the present day, have not led to evidence, but merely to conjectures.

Is the question therewith decided? For the natural philosopher most assuredly not. Great districts of the earth are still quite unknown as respects their fossil creatures, and amongst those districts are just the homes of the anthropoidal or Man-Apes. Tropical Africa, Borneo, and the neighbouring islands are, as regards the above object, still virgin soil. One single fresh discovery, can give a new turn to the whole question. The reserve which most naturalists herein impose on themselves, is supported by the small number of actual proofs for Darwin's theory. Considered logically, and speculatively, the so-called theory of descent is excellent. Even before the publication of Darwin's book, I once publicly expressed myself to the following effect, "that it seemed to me like a *necessity of science* to recur to the capability of transition from species to species."¹⁷ And I added, "There exist at present great gaps in our knowledge. Dare we fill them up with conjectures? Of course we dare, for only by conjecture can the untrodden paths of investigation be opened up." Darwin has done this in the best sense of my words.

In that same aforesaid publication of mine, I continued as follows. "There is to be sure another method of filling up the gaps. We may simply accept the religious traditions of the story of the Creation, and thus exclude investigation altogether. But, and I utter it openly, although we do accept the theory of Personal Creation, we have still no right to consider investigation into the mechanical process, as inadmissible." Moreover, in all the fables of Creation in ancient religions, it is represented as carried out in a more or less mechanical man-

ner. According to the Jewish story of Creation, the first man is formed of the dust of the earth, his mate of one of his ribs; and from this pair are said to have descended all men, therefore all races. Wherefore all men are brethren, the whole genus one species. But is this much prized unity of the human race indeed so easy to be deduced, and understood from the suppositions of the Jewish fable? Has any one already observed the transition of one race into the other? The whole doctrine of the human races, rests on our observations of the transmission of corporeal and intellectual qualities. The traditions of the church point to Noah, as the progenitor of all races. How are we to imagine Noah to ourselves, and Adam, his progenitor in a direct line? — Prichard, the celebrated English ethnologist, and Bledsoe, the orthodox North American, have not scrupled to set down the first human beings as negroes.¹⁸ But this does not help us one step farther on, than as if they had declared them to be whites; for although it does occur that a negro may be white, and vice versa, still this is only another added to the list of human monstrosities. Notwithstanding his fair skin, a white negro possesses all the other properties of a negro, and no power can make him anything but a white negro. To truly become a white man, all the other parts of his body must likewise be changed; such a change is beyond the limits of any experience hitherto made. Nor has it ever been observed that a negro race has ever really passed into a white one.

On the contrary, the most ancient monuments of art, especially those of Assyria and Egypt, exhibit even at that early period, the typic representations of the single races, human as well as those of other animals, as they then existed. Here we are left entirely in the dark as far as experience

goes, and it is certainly very characteristic, that the advocates for the orthodox view, who take up arms with such warmth against Darwinism, should with naïve unconsciousness, act in regard to the human races, on the very same principle as he lays down for the animal species, without their either, being at all able to produce demonstrable proofs. *While facts seem to teach the invariability of the human races, and the animal species, both pious tradition, and speculative natural philosophy require their variability.*

Hence one should suppose, that theology and the natural sciences ought in justice, to be meted at least with the same measure. But our feeling rebels against this. It seems unesthetic to grant the variability of the animal species, along with that of the human races, because it inevitably brings us to the question of the derivation of Man from the Ape. Human pride cannot accord such an approach. Man calls for an insurmountable barrier between himself and the brute; the Lord of the Creation must construct a peculiar realm for himself within the bounds of created things.

In former times, this same sentiment led to similar partitions and divisions, within the limits of mankind themselves. Heroes, it was said, were descended from the gods in order not to mix them up with the common herd. Till far into the Middle Ages, many of the noble European families, in spite of Jewish and Christian Biblical belief, carried their genealogical tree up to the Grecian gods; as for instance, it was customary among generations of rulers to give out they were derived from Eneas, and through him from the goddess of beauty herself, even from Aphrodite. As late as the year 1466, Albert Achilles proclaimed by pen, his convictions regarding the descent of his house, viz., that his forefathers

had gone from Troy to Rome, and from thence to Swabia to the ancestral castle of the Hohenzollers.¹⁹

Such feelings however, are not decisive; they have no universal validity. Other countries produce other manners, other views and other feelings. Among the Indian anthropoids, there is one species, the Hulman which not only enjoys divine adoration, but is likewise thought worthy of the honour of being regarded as the true progenitor of man. A reigning family whose members bear the traditional name of, "Rana of the Tail", maintain their having been derived from the sacred Ape.²⁰ The Canadian Indians go still farther. They regard the whole living Creation as one great society, within the bounds of which man moves the first among his like; between him and the brutes they say, down even to the toad, exist the closest bonds of kinship. Just as he looks on the Wolf as his progenitor, so does he call the Bear his brother, the Fox his cousin.²¹

When we cease to be able to push fact any farther, there still remains scope for sentimental science. From the moral point of view however, we have no right to overturn the theory of descent, nor is there any reason for our doing so. If Man is the last of those transformations, through which the individual member of the animal kingdom has passed, he is likewise the highest and the noblest. In every case, it was an immeasurable progress which living nature had made, when the first Man was developed out of a lower animal, whether an Ape, or any other animal, which was at the same time the progenitor of the Ape. Nor was the progress less great, that man himself made, when in the course of thousands of years, he raised himself from the condition of a rude ape-like savage, to that of a citizen in a highly civilized state.

If this last idea is admissible, if it does not contradict feeling; if it is indeed the foundation of almost all the reflections on culture and civilisation, of the spiritualistic writers, then we must suppose, that the idea which teaches us to go back to look for our rude and savage progenitors among those cannibals of before, and after the deluge, should cause us no emotion, even if they were derived from the brutes. For morally speaking, it assuredly affords a higher satisfaction to think, that man has raised himself by his own labour, out of that state of rudeness, ignorance and bondage, to one of morality, knowledge and freedom; than to imagine that by his own fault he has fallen from a condition of god-like elevation and perfection, into one of meanness, pollution and sin, to redeem him out of which his own strength is insufficient.

Nothing so fortifies and increases the courage of the individual human being in his struggle for the highest good, as the consciousness, that there is such a thing in the world as *real* progress; that intellectual thought is not labour lost; and that all the acquisitions of the past, all the hopes of the future, rest on the possibility of passing on to coming generations an ever-increasing sum of advantages, not only in the way of corporeal inheritance, but much more in the way of intellectual transmission. Wherefore, this theory of descent although unproved, and in its separate deductions frequently erroneous, is a logical, but much more a moral postulate. Not as a new dogma, but as a light shining on the dark path of groping enquiry, will it bring abundant blessings to mankind.

NOTES.

¹) Claudius Galenus, *De anatomicis administrationibus*. Lib. I. c. 2. *simiæ hominis figuræ quam proximæ, simiæ vel maxime homini similes*. In the sixth chapter he draws up a list of the animals, which in their nature do not differ essentially from man (*quæ non multum ab hominum natura recedunt*): apes and their different species, bears, mice, ruminating animals, solipeds.

²) Nic. Tulpius Amstelodamensis, *Observationes medicæ*. Amstel. 1652 p. 283. Table XIII gives a description of them and Illustrations.

³) Carl Vogt, *Ueber die Mikrocephalen oder Affenmenschen*. — *Archiv für Anthropologie*. 1867. Bd. II. p. 267, 278.

⁴) The Plate is taken out of Virchow's „*Untersuchungen über die Entwicklung des Schädelgrundes im gesunden und kranken Zustande und über den Einfluss derselben auf Schädelform, Gesichtsbildung und Gehirnbau*. Berlin, 1857.“ Plate I, fig. 1, also to be found in Virchow's pamphlet: *Gœthe als Naturforscher*, Berlin, 1861. P. 105. The reader's attention is likewise called to Virchow's treatise „*How man grows*“ Berth. Auerbach's *Volkskalender* 1861. p. 95.

⁵) Compare pages 61 and 102 in above mentioned little work „*Gœthe als Naturforscher*“.

⁶) *idem* p. 123.

⁷) Joh. Friedr. Meckel, *Handbuch der pathologischen Anatomie*. Leipzig, 1812. Bd. I, S. 48.

⁸) This was written, before Darwin's new book on the descent of man was published.

⁹) Carl Vogt, *Vorlesungen über den Menschen*. Giessen 1863. Bd. II. S. 260, 276. — Thom. H. Huxley, *Zeugnisse für die Stellung des Menschen in der Natur*. Aus dem Engl. von V. Carus. Braunschweig, 1863. S. 120. — E. Hæckel, *Ueber die Entstehung und den Stammbaum des Menschengeschlechts*. 1868.

¹⁰) J. C. Nott and Geo. R. Gliddon, *Indigenous Races of the Earth*. Philadelphia, 1857. p. XIV. p. 548, 646, 650.

¹¹) Meckel a. a. O. S. 412, 419.

¹²) Isid. Geoffroy Saint-Hilaire, *Histoire des anomalies de l'organisation chez l'homme et les animaux*. Paris, 1836. T. II p. 208.

¹³) Carl Vogt, *Vorlesungen über den Menschen*. Bd. I. S. 252.

¹⁴) C. Aeby, „*Die Schädelformen des Menschen und der Affen*,“ Leipzig, 1867. In page 82 a stress has been justly laid on the fact, that in all investigation the mistake has been too frequently made of only comparing the baby-ape with the full-grown man.

¹⁵⁾ Alfred Russel Wallace, *Der Malayische Archipel, die Heimath des Orang-Utan und des Paradiesvogels* (The Malayan Archipelago, the home of the Orang-Outang & the Bird of Paradise). Translated from the English by A. B. Meyer. Brunswick 1869. Vol. I. Page 59.

¹⁶⁾ Virchow, *Ueber Erbllichkeit*. (Deutsche Jahrbücher für Politik und Literatur. Berlin, 1863. Bd. VI, S. 357.)

¹⁷⁾ Virchow, *Vier Reden über Leben und Kranksein*. Berlin 1862. p. 31. (held in the German Association of naturalists and physicians, Carlsruhe, Sept. 22, 1858.)

¹⁸⁾ Vide Quotation from Nott and Gliddon, l. c. p. 510.

¹⁹⁾ A. F. Riedel, *Geschichte des Preussischen Königshauses*. Berlin, 1861. Bd. I. S. 14.

²⁰⁾ A. E. Brehm, *Illustriertes Thierleben*. Hildburghausen, 1863. S. 42.

²¹⁾ Kohl, *Ueber die kanadischen Indianer*. (Ausland, 1859, Nr. 3. S. 54.)

