SCIENCE:

PUBLISHED BY N. D. C. HODGES, 874 BROADWAY, NEW YORK.

SUBSCRIPTIONS.—United States and Canada..... .....$3.50 a year.
Great Britain and Europe..... 4.50 a year.

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BRAIN AND SKULL CORRELATIONS.

BY S. V. CLEVENGER, M.D.

THE sizes and shapes of skulls afford only unsafe anthropological and psychological generalizations. While the broad, the long, and the round heads are characteristic of certain races, they are even less invariably so than that the Mediterraneans are black-haired and the Norse are "tow-headed."

Heretofore crania have usually been studied as though it were possible to detach them from everything else in the universe. Their relationship to the contained brains, the phylogenetic and embryological development of the brain and skull together, and the influences of the one upon the other, have had but the most superficial consideration. The vast store of facts afforded us by modern biology, undigested and disjointed though they be, will yield unmistakable results if properly considered in relation to cause and effect association.

Every comparative anatomist has called attention to the occipital position of the foramen magnum of the lower vertebrates, and the tendency of this foramen to occupy a position farther forward in the ascending scale of the mammalia, until, in the primates, it is near, or at, the centre of the base of the skull.

In the *Journal of Nervous and Mental Diseases*, April, 1880, in an article entitled "Sulcus Rolando and Intelligence," I called attention to the different positions occupied by this fissure in different brains, showing that the sulcus of Rolando was placed farther backward in the adult than in the younger animal, and that it formed the posterior boundary of the frontal lobe, which, developing as the intelligence was greater, pressed backward upon the parietal and occipital brain, causing the cerebellum to be covered by the cerebrum; the lesser size of the frontal lobes allowing the brain to fall forward in its case, leaving the cerebellum of quadrupeds uncovered, and this same pressure from before backward, projecting the temporal from the occipital lobe, and the temporal, finding more room below, curled under and forward in its growth and forms the fissure of Sylvius. I also noted that this crowding backward of the frontal brain as it grew larger affected the development of the skull, and as the tendency of the animal to assume more and more the erect posture balanced the head upon the more perpendicular spinal column, that the spinal cord necessarily assumed less obliquity of junction with the brain base, until, in some men, the angle of the cerebrum and medulla oblongata is 90 degrees. At the same time, the forehead, by pressure of the brain from behind, had a tendency to become more prominent.

At a meeting of the Chicago Academy of Medicine, March 13, 1891, when a number of convict skulls were being examined, I reminded the Fellows present of the publication mentioned, and stated that if this lessened obliquity of the medulla could be accepted as an index to the greater intelligence of animals, there might also be an osseous adaptation of the occipital bone to the angle formed by the medulla and brain. I therefore arranged the skulls in a series from greater to less angularity of the basi-occipital or basilar process, and was assured by Drs. Lydston, Williams, and Talbot, who were familiar with the histories of the individuals whose skulls were thus arranged, that this estimation of their intelligence was a very good one. With a pardonable desire to fully establish my priority to this announcement, I will mention that there were present Drs. Lydston, Talbot, Moyer, Kiernan, Stillman, Lagorio, Zeisler, Pynchon, and Williams at this March 13 1891, meeting.

The exterior surface of the basilar process, unless compensated by differences in diploe thicknesses or in some other way, should give a corresponding inclination to the pharynx at the junction of the basi-occipital with the body of the sphenoid, and as many thousand observations would be needed to establish relationships of this kind, I have concluded to ask laryngologists and others who have occasion to frequently examine throats, to keep records of pharyngeal appearances and other data, from which deductions may be made, as follows: —

1. Inclination of posterior pharynx.

First degree, approaching the obliquity found among quadrupeds.

Second degree, obliquity less than first and greater than

Third degree, upright basilar process, or nearly so.

For the present, at least, more divisions between perpendicularity and the horizontal can scarcely be made in the living person, owing to muscular, mucous, and other coverings varying in thickness, enabling rough estimates only. A separate set of observations should be made upon skulls, where sufficient was known of the history to form an estimate of intelligence, the base for measurements being the same as with Camper's angles.

2 Shape of skull — brachycephalic, dolichocephalic, mesocephalic.

3. Size of skull, large, medium, or small for the age, height, or sex.

4. Intelligence.

5. Education.

6. Camper's angle.

7. Other information not included above, as to disease or injury affecting skull or brain, criminality, insanity, etc.

The correlations should be accepted as inter-dependent and not disconnected. For example, instead of intelligence being indicated by a high, wide, bold forehead, there may be hydrocephalic idiocy, and, generally speaking, we may sum up some cranio-cerebral peculiarities thus: —

1. The more erect position tends to move the foramen magnum forward. Increased intelligence and erectness are generally, but not invariably, associated in animals, so the position of the foramen alone as an index has a restricted value.

2. The frontal brain-growth is always associated with increased intelligence, and this development crowds the sulcus of Rolando farther back and pushes the medulla oblongata and pons Varolii into a more and more upright position, provided the brain-growth is greater than that of the skull, for a roomy skull may afford expansion and allow the primitive obliquity of medulla and occipital bone to persist.

3. The adjustment of the skull to its contents is a complex matter, but may be better understood by relating cause and effect as acting upon both more or less simultaneously, particularly with regard to the differences in hardness and developmental changes in both. For example, the beaver's skull and brain seem to have kept pace together so as to render convolutions unnecessary, and the beaver is an intelligent animal. The brain of Professor Leidy was highly convoluted, and appears to have been rendered so by his cerebral being greater than his skeletal growth, and this would seem to have been a family peculiarity, for his brother's brain presented a similar appearance of crowded convolutions.

4. When a juvenile retreating forehead has gradually been replaced in an adult by a more perpendicular one, through education acquired later in life, then the frontal brain may have crowded