ployer-employe cooperation by visits to industrial plants, correspondence with governmental departments and labor organizations and by conferences.

Six thousand copies of "Self-Appraisal for Junior Engineers" were placed in the hands of engineering students last year by the Engineers' Council for Professional Development, composed of representatives of the national engineering societies and professional organizations. Nearly 5,000 copies of a booklet on "Engineering—A Career—A Culture" were distributed during the year.

The council, conducting an investigation on the accrediting of schools, sponsored visits to schools in New England and the Middle Atlantic States. The work is now being initiated in other states. The council is also directing studies on the evaluation of professional qualifications, guidance literature and aptitude tests. A selected reading list of books on general fields of knowledge for young engineers and a bibliography of technical literature have been prepared.

The council seeks uniformity in engineering degrees. Conferences are being arranged for boys interested in engineering, their parents and local engineering groups. A survey has been made of university extension facilities, and a manual on guidance for local sections of the national engineering societies is available.

SPECIAL ARTICLES

THE NEW DISCOVERY OF THREE SKULLS OF SINANTHROPUS PEKINENSIS

FOLLOWING the recovery of several fragments of a very small adult of *Sinanthropus* from Locus I (Locality 1) in the latter part of our spring field season at Choukoutien, we had the good fortune during the fall season of this year to unearth three additional more or less well-preserved skulls, two of which were recovered in one day. All three skulls belong to adult individuals. The skull recovered first, and designated as Skull I of Locus L, is the largest with a cranial capacity of approximately 1,200 cc and with its coronal and sagittal sutures partly fused. The second skull (Skull II of Locus L) is the smallest of the group, with a cranial capacity not higher than 1,050 cc and its coronal, sagittal and lambdoid sutures fused. This skull shows a clear indication of the persistence of a metopic suture. The third skull (Skull III of Locus L) is smaller than Skull I but larger than Skull II. The cranial capacity of Skull III is approximately 1,100 cc. Although all the sutures of this skull are still patent, yet other characteristic features make it evident that we are dealing with a young adult individual. Parts of the face are preserved in all three skulls, thus, in Skull III both nasal bones and the entire lateral border of the orbit in complete connection with the brain case; in Skull II the frontal process of the maxilla, the lower border of the orbit, the cheek-bone and fragments of the alveolar process of the upper jaw with palate and ten teeth *in situ* (premolars and molars) which, however, are not connected with the skull. Belonging to Skull I are several teeth only.

I had previously arrived at the conclusion that the large teeth may belong to male individuals and the small to female individuals. This assumption has been confirmed by the fact that the large type of teeth was found to pertain to the bigger skull (Skull I) and the small type of teeth to the small skull (Skull II). Thus it seems quite certain that the latter represents the skull of a female individual and the former that of a male individual.

All three skulls have the same appearance as Skull I of Locus E described by Davidson Black.[1] However, since this skull belongs to a child of about 8 to 9 years (*cf.* Weidenreich, 1935)[2] the characteristics of the *Sinanthropus* type are much more pronounced in the recently recovered skulls. Measurements reveal that *Sinanthropus* as a whole occupies the lowest place in the order of all hominids, including *Pithecanthropus,* in regard to those peculiarities which determine its position in the line of evolution. This is particularly true for Skull II of Locus L, while Skull I of Locus L in part falls within the lower limits of the range of variations of the Neanderthal group. However, Skull II apparently is even lower than *Pithecanthropus,* the difference being that the *Sinanthropus* skull shows a more pronounced frontal tuber than *Pithecanthropus,* the entire forehead of which is flattened. The smallness and lowness of *Sinanthropus* Skull II is all the more remarkable since the skull fragments recovered last summer and considered to pertain to an adult individual are still smaller in dimensions than the respective parts of Skull II of Locus L and *Pithecanthropus* (*cf.* Weidenreich, 1937).[3]

As to the face, the parts preserved in Skulls II and III yield a rather good idea of the general structure, at least as far as the upper parts are concerned. The nasal bridge is broad and flat. There is no groove between the root of the nose and the forehead. The orbit is very low; the lateral border recedes backwards below the frontal zygomatic suture. The lacrimal fossa is missing in all skulls. The orbit is deep and the superior orbital fissure very small. The cheek bone is remarkably high, as high as that of the Rhodesia Skull. A canine fossa does not exist and the anterior surface of the frontal process of the maxilla

[1] Davidson Black, *Palaeontologia Sinica,* Ser. D, 7: 2, 1931.

[2] Franz Weidenreich, *Bull. Geol. Soc. China,* 14: 427–468, 1935.

[3] *Idem., Bull. Geol. Soc. China,* Ting Memorial Volume (in press).

is slightly convex and not depressed, as in recent man. The upper jaw therefore must have projected considerably. The palate is broad and high.

Earlier (1935) I was able to demonstrate that a close connection between *Sinanthropus* and certain groups of the present Mongol race could be assumed. The occurrence of the so-called "torus mandibularis" on the inner side of the mandible of some of the *Sinanthropus* jaws as well as on those of recent Mongols, especially Eskimos and Lapps, and furthermore the occurrence of shovel-shaped medial and lateral upper incisors in *Sinanthropus,* as also in modern Mongols, indicate some direct relationship between Peking Man and the Mongol group of recent mankind. Whether or not the broad and flat nose of *Sinanthropus* points to the same direction I do as yet not venture to state. However, in addition there is another conspicuous feature which, I believe, serves as further evidence for the assumption of such a special relationship. All three adult skulls show a large "inca-bone" (*os epactale*) which, it is true, is not confined to the ancient Peruvian natives, as the name suggests, but also occurs in other races of to-day. However, it is much more frequent in the American Indian and Mongol group (up to 7.8 per cent.) than in the latter (up to 2 per cent.).

As to the relation to *Pithecanthropus, Sinanthropus* Skull II of Locus L, together with the fragmentary *Sinanthropus* of Locus I mentioned above, prove incontestably that there is no appreciable difference between *Pithecanthropus* and *Sinanthropus* as far as the general shape and the lowness of the skull caps are concerned. Since it has been assumed that these two *Sinanthropus* skulls belong to female individuals, it is very probable that *Pithecanthropus* also belongs to the same sex, a probability which had already been pointed out by E. Dubois and Hrdlička. The *Sinanthropus* skulls differ from *Pithecanthropus* by only two characters, namely, in that the frontal bone proper is more vaulted in *Sinanthropus,* although its inclination to the glabella-inion line is distinctly more pronounced than in *Pithecanthropus.* Furthermore, the supraorbital ridges of *Sinanthropus* are separated from the forehead by a really broad furrow, while in *Pithecanthropus* they continue gradually to the brow. The latter phenomenon, however, seems to have some connection with the formation of the frontal air-sinuses. In *Pithecanthropus* these sinuses are conspicuously large and extend far lateralward over the roof of the orbit, whereas in all cases of *Sinanthropus* they are very small and closely confined to the interorbital region. I consider this appearance in the case of *Sinanthropus* as an indication of its being more primitive than *Pithecanthropus* and the latter, in spite of the absence of prominent frontal tubera, as a more advanced type of hominid.

Another important fact is disclosed by *Sinanthropus* Skull I of Locus L. This skull is not only the largest of all *Sinanthropus* skulls recovered hitherto (*ca.* 1,200 cc) but at the same time also the highest. Although its general structure and essential details show the same characters as the lowest Skull II of Locus L, yet its greater cranial capacity approaches closely the more primitive representatives of the Neanderthal group. I had earlier (1936)[4] assumed that there must be some relation between *Pithecanthropus* and *Javanthropus soloensis,* the latter resembling the former in several primitive characters. On the other hand, there is no doubt that *Javanthropus* has many peculiarities in common with *Sinanthropus,* as recently demonstrated by C. U. Ariens Kappers (1936)[5] in regard to the endocasts. I should not be surprised if *Pithecanthropus* at some future date should be found to represent nothing else but a special female type of *Javanthropus.* Since *Javanthropus* as a whole represents a very primitive form of Neanderthal Man, the line linking *Pithecanthropus* and *Sinanthropus,* respectively through *Javanthropus* or Neanderthal Man to recent man is continuous. The fact that there may be certain racial deviations does not matter greatly, since the determining factor does not depend on relatively minute differences but on the main course of human development itself.

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EXCHANGES BETWEEN BLOOD PLASMA AND TISSUE FLUID IN MAN

IN previous publications[1] we have shown, with normal men, that brief violent exercise produces a sudden transudation of up to 20 per cent. of the plasma water from the blood to the tissues. The return of the volume and the general concentration of the blood to the resting level follows, approximately, a logarithmic deceleration curve and requires about an hour. In these exchanges the water is accompanied by a small amount of proteins which are highly active osmotically (*i.e.,* their molecular size is small). This does not mean that the capillaries are extraordinarily permeable. The plasma calcium, including the so-called "diffusible" fraction, does not escape across the capillary wall more readily than does protein under these conditions.

The behavior of the sodium concentration in experiments of this type (exhaustion produced in 1 minute) throws further light on the permeability of the capil-

[4] *Idem, Peking Nat. Hist. Bull.,* 10: 4, 281–290, 1936.
[5] C. U. Ariens Kappers, *Jour. Anat.,* 71: 61–76, 1936.
[1] Keys, *Jour. Biol. Chem.,* 105, xlvi, 1934; Keys and Taylor, 1935, *ibid.,* 109, 55; Keys and Adelson, *Amer. Jour. Physiol.,* 115: 539, 1936.