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At the end of the present survey, the author would like to point out that (A) the data for *Macaca cyclopis* appear to be agreeable with those found by V. Bonin for another species of macaque and there are no significant differences between them. (B) It is appropriate to put several indices clearly arranged in phylogenetic order or the five different species of the primate. In other words, it is clearly understood that at least so far as the encephalometric data are concerned, it should be arranged in the following order—Homo> Chimpanzee >Orang-utan > Gorilla > Macaques; but on the contrary, some of the indices discussed here fail to follow this order and do show rather random arrangements. (C) As a whole, the characteristics of brain of *Macaca cyclopis* are as follows: I) The absolute brain weight and size of *Macaca cyclopis* are fairly small (83.15 grams in average). While the ratio of the body weight is 1: 56.51 and shows relatively large value (but is slightly smaller than that of man, 1: 22.31 for Japanese adult). The brain weight of *Macaca cyclopis* is not so heavy as *Macacus rhesus*' (1, 2, 7). According to the Shimada's classification for both indices of height/length and breadth/length, the character of the brain of *Macaca cyclopis* appears to belong to the lower type (67.99) in height, and the middle type-b (78.56) in breadth. II) Cephalic index of *Macaca cyclopis* is 79.98, and is of mesocephalic type, but its value is rather closely related to brachycephalic (3, 4). III) The frontal lobe and the occipital lobe are somewhat well developed than those of gorilla (3, 17, 25, 26). IV) The swelling of cerebral hemisphere is not so good, as man, chimpanzee and gorilla which seem to have the broader brain than *Macaca cyclopis* does (14, 15). V)

The upper parietal lobule of man and anthropoid-apes are more developed than *Macaca cyclopis* (18). VI) Temporal depth-index is fairly larger than anthropoid-apes. VII) The absolute area of corpus callosum is fairly small (20). The absolute height of corpus callosum is low, but is slightly higher than that of gorilla (21). The proportion of the length of corpus callosum to the length of cerebral hemisphere is larger than those of man and anthropoid-apes (22). VIII) The brain-stem angle is fairly large (27). IX) Rolandic and Sylvian angle are relatively large (28, 29). X) The central sulcus is not well developed and the tip of lower extremity of the sulcus shows to be clearly pointing dorsally (30). XI) The cerebellum and the mesencephalon of *Macaca cyclopis* are relatively well developed than those of man and anthropoid-apes (32, 33, 35). XII) The pons and the fossa rhomboidea of *Macaca cyclopis* are smaller than those of human brain (36, 37). XIII) The adhaesio interthalamica is remarkably large in *Macaca cyclopis* (31).

SUMMARY

The characteristic of the external morphology of twenty-two brains of *Macaca cyclopis* (Swinhoe) have been studied through a detailed scheme of encephalometry and the mean values and indices have been computed stastically with unbiased variance (u^2). The comparison has been also made with other five species of the primates. The results of measurements can be summarized as below:

- 1) The absolute brain weight of *Macaca cyclopis* is fairly small (83.15 grams in average), but its ratio to the body weight is relatively large (1:56.51).
- 2) The brain size is about 69.76mm long, 55.86mm broad, and its height is 50.23mm.

- 3) The brain module (Length + Breadth + Height/3) is 58.62 in right side and 58.61 in left side. The cerebral module (L+B+H/3) is quite smaller than those of the anthropoid apes (right side is 50.07, and left side is 50.19).
- 4) The cephalic index is mesocephalic type (79.98).
- 5) The temporal depth index shows the largest value (right side=20.88, left side=20.93) among the compared group.
- 6) According to Shimada's classification, the brain height belong to the lower type and the breadth of hemisphere is not fairly swollen and belongs to the middle type-b.
- 7) The average value of the projective upper and lower fronto-rolandic indices related to *Macaca cyclopis* (right side=45.90, left side=45.42) is somewhat larger than that of man, chimpanzee and orang-utan.
- 8) The brain of *Macaca cyclopis* shows a relatively large frontal and occipital length and seems to belong to both the frontal and occipital type.
- 9) The area of the corpus callosum is 64.77mm², and the callosum index (27.25) is clearly smaller than that of man and chimpanzee.
- 10) The Rolandic and Sylvian angles to the lateral horizontal line of *Macaca cyclopis* are also relatively large (Rolandic: right side=67.60°, left side=64.50°. Sylvian: right side=41.00°, left side=39.36°) and seems to show a close approximation to those of human brain.
- 11) The index of the central sulcus to the length of hemisphere is 46.19 and seems to show apparently smaller than that of gorilla (75.0) or man(65.6-70.6).
- 12) The area of adhaesio interthalamica is 51.46mm² and is generally between oval

and round in shape and is remarkably well developed than that of the human brain.

- 13) The relation of length between the corpus callosum and the cerebral hemisphere found in *Macaca cyclopis* is 2.54 and appears to show a very approximation with that of man and anthropoid apes. While the value of area/length of corpus callosum for *Macaca cyclopis* is fairly small (2.34).
- 14) The brain stem angle shows to have considerably larger value (128.54° by Ban's method and 130.23° by Shimada's method) than the human brain.

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REFERENCES

- Ariëns Kappers, C. U., 1927,
Indices for the anthropology of the brain applied to Chinese, Dolicho- and Brachycephalic Dutch, foetuses and neonati. Proc. K. Akad. Wet. Amsterdam, vol. 30, no. 1, 81-94 (cited from Martin and Saller '59).
- Ban, T., 1942,
Anthropological consideration on the Japanese brain (in Japanese) Acta Anat. Nippon, 19: No. 2, 124-135.
- Ban, T., 1941,