

- Hefner, R. A.: Inheritance of crooked little fingers (streblomicrodactyly). *J. Hered.* 20: 395-398 (1929).
- Hefner, R. A.: Crooked little finger (minor streblomicrodactyly). *J. Hered.* (1941).
- Keonner, D. M.: Abnormalities of the hands and feet. *J. Hered.* 25: 329 (1934).
- Moore, W. G. and Messina, P.: Camptodactylism and its variable expression. *J. Hered.* 27: 27-30 (1936).
- Nowak, H.: Drei Stammbäume von Klinodaktylie. *Dtsch. med. Wschr.* 60: 2001 (1934).
- Pol, D.: Brachydaktylie, Klinodaktylie, Hyperphalangie und ihre Grundlagen. *Virchows Arch. Path. Anat.* 229: 388-530 (1921).
- Ritterskamp, P.: Eine Familie mit Kamptodaktylie. *Münch. med. Wschr.* 724-725 (1936).
- Schmidt, L., von: Die Streckung krummer Finger. *Dtsch. med. Wschr.* 83: (1921).
- Spear, G. S.: The inheritance of flexed fingers. *J. Hered.* 37: 189-192 (1946).
- Stiles, K. A. and Schalck, J.: A pedigree of curved forefingers. *J. Hered.* 36: 211-216 (1945).
- Stoddard, S. E.: Nomenclature of hereditary crooked fingers. *J. Hered.* 30: 510-512 (1939).
- Tomesku, I.: Kongenitale Deviationen der Phalangen. Angeborene Kontrakturen der Finger und Klinodaktylien. *Arch. orthop. Unfall-Chir.* 26: 126-137 (1928).
- Vidal, E.: Brachydactylie symétrique et autres anomalies osseuses, héréditaires de plusieurs générations. *Bull. Acad. nat. Med. (Paris)* 63: 632-648 (1910).
- Wegelin, Carl: Über eine erbliche Mißbildung des kleinen Fingers. *Berl. klin. Wschr.* 12: (1917, cited by Zurukzoglu, 1929).
- Zurukzoglu, St.: Über eine erbliche Mißbildung des kleinen Fingers (Klinodaktylie). *Arch. Klaus-Stift. Vererb.-Forsch.* 4: 217-218 (1929).

Author's address: P. C. Dutta, 1 B Gopal Bose Lane, Calcutta 9 (India)

Acta genet., Basel 15: 77-86 (1965)

From the Anthropological Survey of India, Indian Museum, Calcutta, India

Further Observations on Ear Lobe Attachment

By PRATAP DUTTA and PRANAB GANGULY

The type of attachment of ear lobe in man is an easily observable genetic trait, presumably having no adaptive value. The frequencies of completely attached type of ear lobe exhibit considerable inter-population variations. The genetics of this trait is somewhat complicated and yet to be fully understood (Dutta, 1963). This trait, therefore, cannot at present be satisfactorily utilised in exact linkage studies in man. The investigations of Quelprud (1934, 1941), Powell and Whitney (1937), Wiener (1937), Kloepper (1946/47), Gates (1954) and others have, however, demonstrated that the ear lobe attachment is a hereditary character, and that it can profitably be used in population studies.

Dutta (1963), in a recent communication, has emphasized the desirability of observing the type of ear lobe attachment as a marker in population studies. While presenting data obtained from the Gandhabanik caste of West Bengal (Eastern India), he has also suggested that this trait may be included in making routine observations with other genetic traits.

In the present study, additional observations made among the populations of the Nicobar Islands and Madhya Pradesh (Central India) will be briefly discussed, to see the extent of variability of this trait and its application in population studies.

Material and Method

Observations on ear lobe types were made on 1139 adult individuals, 729 from the Nicobar Islands and 410 from the State of Madhya Pradesh.

Both areas of the investigations are distinctly different in respect to physical environment and geographical set-up. The Nicobar Archi-

pelago, consisting of twenty islands, is situated in the mid-waters of the Bay of Bengal; while Madhya Pradesh, is a centrally located state in the mainland of the Indian sub-continent (Fig. 1).

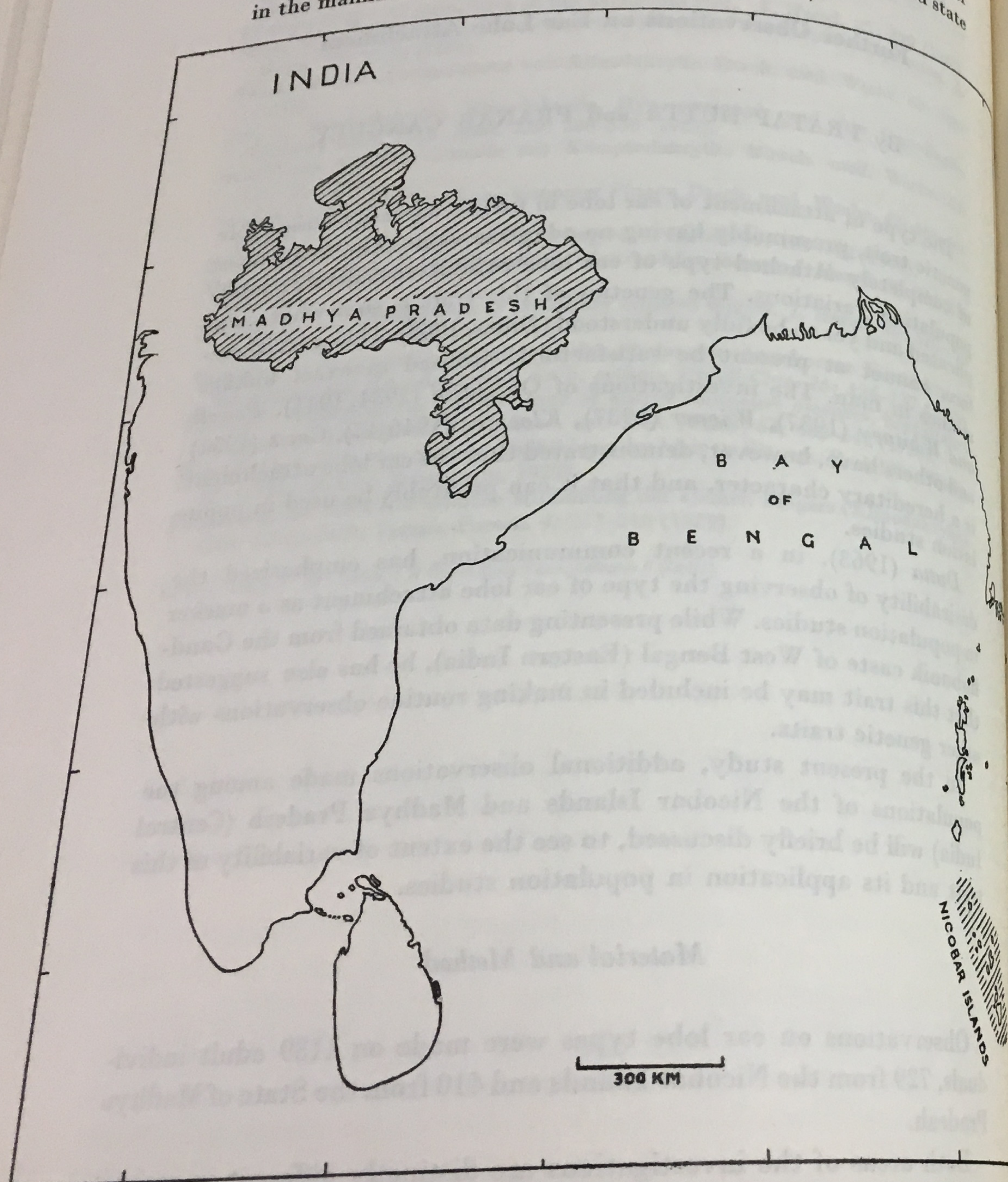


Fig. 1. Map showing the fields of investigation.

The inhabitants of Nicobar Islands, known as Nicobarese, are essentially a Mongoloid people. They are divided into five endogamous groups, of which four groups were studied. The sample of the Nicobarese includes 341 individuals (175 males and 166 females) from Car Nicobar Island, 111 males from Chowra Island, 158 individuals (77 males and 81 females) from Terressa and Bompoka Islands, and 119 Southern Nicobarese (65 males and 54 females) belonging to the islands of Pulo Milo, Little Nicobar, Kondul and Great Nicobar. The women of Chowra Island could not be studied because their ear lobes were found to be distended due to the weight of large wooden ear-plugs, worn as ornaments.

In Madhya Pradesh the investigations were restricted in three contiguous districts, namely, Seoni, Jabalpur and Satna. The collection of data was done caste- and community-wise from adult male individuals only. The sample from Madhya Pradesh comprises 97 Brahmmins, 103 intermediate castes (49 Rajputs, 26 Ahirs and 28 Telis), 54 Chamars – all belonging to the Hindu community; and 54 tribals (28 Gonds and 26 Kols) and 102 Muslims representing the non-Hindu communities.

The types of ear lobe attachment have been divided here into three well defined categories – free, intermediate and attached. “Free” means completely free lobe as illustrated in Fig. 906 in Martin and Saller (1961), and “attached” means completely adherent lobe shown in Fig. 907 in the same treatise. Between these two extremes of free and attached types, several gradations were encountered which have been combined into a single category “intermediate”, to avoid arbitrariness in scoring.

While examining the individuals, the lobes were slightly drawn apart to see the extent of attachment. This was done in order to avoid any observational error, particularly in case of small ear lobes.

Results and Discussion

In Table I the distribution of frequencies of the types of ear lobe attachment in the Nicobar Islands is shown. It can readily be inferred from the data that the Nicobarese are not a homogeneous people with respect to this trait. Inter-group variability is considerable in four male as well as in three female groups, the values of χ^2 (22.739 for the male and 43.066 for the female groups) are significantly high ($P <$

0.001) in both sexes. Both males and females of Terressa differ from all others in having the highest frequencies of free lobe and lowest frequencies of attached type are highest.

The percentage of attached type of ear lobe in females is somewhat higher in two groups, namely, the Car Nicobarese (female 47.59% and male 42.29%), and the Southern Nicobarese (female 75.93% and male 55.38%), while the reverse is found in case of the Terressan (female 23.46% and male 29.87%). Again, in respect of the overall percentage of attached type, we find, that the females exceed the males by a fraction of a unit only. This does not corroborate the males by a (1934) finding that adherent lobes are more frequently found in women. According to *Quelprud* the frequencies of adherent lobes found in females and males, when expressed as a ratio, comes to about 2:1.

The overall frequencies of Nicobarese men and women do not differ significantly ($\chi^2 = 0.530$, $P > 0.70$). When each group is considered separately, no remarkable sex difference is found among the Car

Table I

Frequencies of the Types of Ear Lobe Attachment in the Nicobar Islands

Group	No.	Types of ear lobe			Heterogeneity
		Free %	Inter- mediate %	At- tached %	
Male:					
Car Nicobarese	175	18.86	38.86	42.29	$\chi^2 = 22.739$ d.f. = 6 $P < 0.001$
Chowrite	111	14.41	30.63	54.95	
Terressan	77	36.37	33.77	29.87	
Southern Nicobarese	65	15.38	29.23	55.38	
Female:					
Car Nicobarese	166	16.87	35.54	47.59	$\chi^2 = 43.066$ d.f. = 4 $P < 0.001$
Terressan	81	37.04	39.51	23.46	
Southern Nicobarese	54	3.70	20.37	75.93	
Total males	428	20.33	34.35	45.33	$\chi^2 = 0.530$ d.f. = 2 $P > 0.70$
Total females	301	19.93	33.89	46.18	
Both sexes	729	20.16	34.16	45.68	

Nicobarese ($\chi^2 = 0.9747$, $P > 0.50$) as well as among the Terressan ($\chi^2 = 0.9707$, $P > 0.50$). However, the Southern Nicobarese exhibit sex difference; the value of χ^2 (6.8413) reaches the level of significance ($P < 0.05$).

In the State of Madhya Pradesh the frequency of individuals with attached lobe varies between 14 per cent and 26 per cent, yielding an overall frequency of 19.02 per cent. In Table II the distribution of the frequencies of types of ear lobe in Madhya Pradesh population is presented. Relatively low frequencies of attached type are found among the Hindu population (Brahmin, intermediate castes and Chamar) when compared with those of the non-Hindus (tribals and Muslim); the magnitude of variation is, however, not large enough to reach the level of significant difference ($\chi^2 = 12.089$, $P > 0.10$).

Striking variation with regard to the overall frequencies of individuals having different types of ear lobe attachments is apparent when the population of Madhya Pradesh is compared with those of the Nicobars. The variation is so great that no statistical test is needed for its demonstration.

Table II

Frequencies of the Types of Ear Lobe Attachment in Madhya Pradesh (Central India) Male Populations

Group	No.	Types of ear lobe			Heterogeneity
		Free %	Inter- mediate %	At- tached %	
Brahmin	97	63.92	21.65	14.43	$\chi^2 = 12.089$ d.f. = 8 $P > 0.10$
Intermediate castes	103	56.31	27.18	16.50	
Chamar	54	50.00	37.04	12.96	
Tribals	54	51.85	22.22	25.93	
Muslim	102	49.02	25.49	25.49	
Total	410	54.88	26.10	19.02	

In Madhya Pradesh the frequency of free type is more than double of that of the attached type, whereas in Nicobar Islands the proportions of free and attached types record a reverse pattern. The frequency of attached lobe among Gandhabaniks of West Bengal (24%,

cf. Dutta, 1963) is somewhat higher than that of the Madhya Pradesh population. The high incidence of attached lobe among the Nicobarese, however, cuts across Gates' (1954) assumption that the attached type is an African characteristic.

The heterogeneity among the Nicobarese populations may, as could be suggested, be due partly to the effect of random genetic drift, and partly to miscegenation. The populations are small and isolated; their numerical strength being as follows: Car Nicobar 8374, Chowra 1076, Terressa and Bompoka 596, and Southern Nicobars 405 (Gupta, 1955). In such small island communities, genetic isolation due to geographical and cultural barriers and inbreeding for countless centuries have, obviously, resulted in the accidental selection of certain genotypes. Furthermore, in fairly recent times, miscegenation with foreign traders and sailors, has effected a free inflow of foreign genes causing heterogeneity. Prolonged isolation followed by miscegenation have certainly augmented the local differentiation of the Nicobarese.

On the other hand, the castes and communities studied in the mainland of India in Madhya Pradesh are much larger in population size and, therefore, more genetically stable. The difference between the Hindu and non-Hindu groups of Madhya Pradesh with regard to the frequencies of adherent lobes cannot escape notice. The difference, however, is not statistically significant, perhaps due to the small size of the samples studied, or to the inadequacy of the test applied to evaluate genetic heterogeneity. Contextually, it may be mentioned that among the same population groups of Madhya Pradesh, significant variability in respect to another genetic trait, namely, middle phalangeal pilosity, was recorded (Dutta, 1964), whereas the Nicobarese were found to be more or less homogeneous (Ganguly and Pal, 1963).

The variability is very indicative of positive deductions relating to population variation, and warrants further investigation in this line with larger samples for its better exploitation in population studies.

Acute dearth of comparative material on the attachment of ear lobe is too apparent and, again, those which are available are mostly unsuitable for the purpose of comparison due to the lack of any uniform system of classification of the different types of attachment.

Thus, Powell and Whitney (1937) recognised only two types, free and attached; Wiener (1937) followed a four-fold classification – free,

attached and two intermediate types. Gabel (1958), Hooton and Dupertuis (1955) divided their material into three categories – soldered, attached and free; but it is not certain whether their soldered and attached types exactly correspond with our attached and intermediate types respectively. Martin (1928), Martin and Saller (1961) described the completely adherent type as "lobeless". This state of affair is not very satisfactory. It is highly desirable that different investigators adopt a standard system of classification in order to make their data comparable. Completely free and completely attached lobes are not difficult to identify. It may sometimes be felt necessary to sub-divide the intermediate forms, particularly in pedigree studies. In such cases, the criteria used to differentiate the sub-types should be explained. A picture often serves the purpose better than any amount of description.

Summary

The present paper deals with the types of ear lobe attachment which is an easily observable genetic trait, presumably not affected by adaptive changes. The mode of its inheritance is not yet well established and, therefore, the trait cannot at present be utilised for exact linkage studies. From the scanty investigations carried out so far, it appears to be a polygenic or multifactorial variable in man.

In this study the ear lobes have been classified into three types – free, intermediate and attached. This classification is recommended for future use to make the data, collected by different investigators, comparable to one another and to avoid arbitrariness in scoring. The intermediate type may be further sub-divided in pedigree studies. The necessity of following a uniform system of classification has been stressed.

The data obtained from 729 individuals from the Nicobar Islands and 410 individuals from Madhya Pradesh, a central state in India, have been presented. The island communities have been found to be remarkably heterogeneous, whereas the peoples of Madhya Pradesh are more or less homogeneous. Nearly half of the Nicobarese population have completely adherent lobes, but in Madhya Pradesh only one out of every five persons shows the adherent type. The significance of the observations has been discussed.

Very high frequency of attached lobe among the Nicobarese, a Mongoloid people, refutes *Gates'* hypothesis that it is an African characteristic. According to some investigators, such as, *Riddell* (cited by *Gates*, 1946) and *Quelprud* there is a significant excess of women with attached lobes, but in the present material there is no such significant sex difference.

Further investigations with larger population samples from different parts of the world are needed for a better understanding of the geographical and ethnic variations of this trait and its utilization in population studies.

Zusammenfassung

Die obige Arbeit behandelt die verschiedenen Arten von Ohrläppchenansätzen, ein leicht zu beobachtendes genetisches Merkmal, das wahrscheinlich nicht durch Änderung in der Anpassung beeinflusst wird. Der Erbgang steht noch nicht ganz fest. Aus diesem Grund kann das Merkmal zurzeit nicht für exakte Koppelungsuntersuchungen verwandt werden. Nach den bisherigen unzulänglichen Untersuchungen dürfte eine polygene oder multifaktorielle Vererbung vorliegen. Bei der vorliegenden Untersuchung wurden die Ohrläppchen in drei Gruppen, und zwar freie, halbangewachsene und angewachsene, unterteilt. Diese Einteilung wird für den zukünftigen Gebrauch empfohlen, damit die Daten, die von verschiedenen Untersuchern gesammelt wurden, miteinander verglichen werden können, und um willkürliche Einteilungen zu vermeiden. Der Typ des halbangewachsenen Ohrläppchens kann seinerseits bei Stammbaumuntersuchungen unterteilt werden. Auf die Notwendigkeit eines einheitlichen Klassifizierungssystems wurde hingewiesen.

Von 729 Personen von den Nicobar-Inseln und von 410 Personen aus Madhya Pradesh, einem Staat in Zentralindien, wurden Daten vorgelegt. Die Inselbevölkerung erwies sich als bemerkenswert heterogen, während die Bevölkerung von Madhya Pradesh mehr oder weniger homogen ist. Beinahe die Hälfte der Bevölkerung von Nicobar hat vollständig angewachsene Ohrläppchen. In Madhya Pradesh zeigte nur einer von fünf den angewachsenen Typ. Die Bedeutung der Beobachtung wurde diskutiert.

Die grosse Häufigkeit der angewachsenen Ohrläppchen bei den Nicobariern, einem mongoliden Volksstamm, widerlegt die Hypothese

von *Gates*, daß dies ein afrikanisches Charakteristikum sei. Nach einigen Untersuchern, wie *Riddell* (zit. bei *Gates* 1946) und *Quelprud* überwiegen die angewachsenen Ohrläppchen bei Frauen erheblich. In dem vorliegenden Material fand sich dieser Geschlechtsunterschied nicht.

Weitere Untersuchungen mit größeren Bevölkerungsproben aus verschiedenen Teilen der Welt sind für ein besseres Verständnis der geographischen und ethnischen Variationen dieses Merkmales und seiner Verwendung bei Populationsuntersuchungen erforderlich.

Résumé

Les auteurs s'occupent des différents types de l'attachement du lobe de l'oreille, qui présente un caractère héréditaire facilement observable et qui est peu influencé par des facteurs péristatiques. Le mode d'hérédité n'est pas encore bien établi. De ce fait, ce caractère ne peut pas être encore utilisé pour des études de linkage. Il ressort des rares investigations qu'il s'agit probablement d'un facteur polygénique ou multifacteur, variable chez l'homme.

Les lobes de l'oreille ont été classés en 3 types: libre, intermédiaire et attaché. Cette classification est recommandée pour l'avenir, car elle facilite la comparaison des résultats des différents examinateurs et évite des classements erronés. Le type intermédiaire put être subdivisé lors d'études généalogiques. Les auteurs soulignent la nécessité d'un système uniforme de classification.

729 individus de l'Ile de Nicobar et 410 de l'Etat Madhya Pradesh, un état central des Indes, ont été examinés. Les habitants de l'île ont été trouvés remarquablement hétérogènes, alors que les peuples de Madhya Pradesh sont plus ou moins homogènes. A peu près la moitié de la population de Nicobar a des lobes complètement adhérents, alors qu'à Madhya Pradesh seulement une personne sur 5 présente ce type. Les auteurs discutent la signification de ces observations.

La haute fréquence des lobes attachés chez les habitants de Nicobar, qui est un peuple mongol, parle contre l'hypothèse de *Gates* qu'il s'agit d'un facteur caractéristique pour les Africains. Selon *Riddell* (cité par *Gates*, 1946), il y a un excès significatif de femmes avec lobes attachés, mais dans le matériel examiné cette différence entre les deux sexes n'est pas significative.

Des investigations concernant des populations plus grandes de différentes parties du monde sont nécessaires pour arriver à une meilleure compréhension des variations géographiques et ethniques de ce caractère et sur son utilisation pour la génétique des populations.

ACKNOWLEDGEMENTS

The authors are indebted to the Director, Anthropological Survey of India, for giving them necessary facilities for the preparation of this paper, and to Shri B. N. Bagchi for the illustration reproduced here.

REFERENCES

- Dutta, P. C.: A note on the ear lobe. *Acta genet.*, Basel 13: 290-294 (1963).
 Dutta, P. C.: Middle phalangeal hair among some populations of Madhya Pradesh, India. *Z. Morph. Anthrop.* 55: 303-310 (1964).
 Gabel, N. E.: A racial study of the Fijians. *Anthrop. Rec.* 20: 22 (1958).
 Ganguly, P. and Pal, A.: Distribution of middle phalangeal hair among Chowra and Teressa Islands. *Eastern Anthrop.* 16: 122-132 (1963).
 Gates, R. R.: Human genetics. Vol. I. p. 245-246 (Macmillan, New York 1946).
 Gates, R. R.: Etudes sur le croisement de races (III. Nouvelles observations concernant les oreilles, en particulier les lobes). *J. genet. Hum.* 3: 95-112 (1954).
 Gupta, S. K.: The Andaman and Nicobar Islands. In: *Census of India, 1951*. (Ed. A. K. Ghosh) Manager of Publications, Delhi. Part I, Appendix A, p. L iii (1955).
 Hooton, E. A. and Dupertuis, C. W.: *The Physical Anthropology of Ireland*, No. 1. Peabody Museum, Cambridge, Mass. p. 71 (1955).
 Klopfer, H. W.: An investigation of 171 possible linkage relationship in man. *Ann. Eugen.*, Lond. 13: 35-37 (1946/47).
 Martin, R.: *Lehrbuch der Anthropologie*, p. 574 (Gustav Fischer Verlag, Jena 1928).
 Martin, R. und Saller, K.: *Lehrbuch der Anthropologie*. 7 Leif, p. 2075 (Gustav Fischer Verlag, Stuttgart 1961).
 Powell, E. F. and Whitney, D. D.: Ear lobe inheritance. *J. Hered.* 28: 185-186 (1937).
 Quelprud, T.: Familienforschungen über Merkmale des äußeren Ohres. *Z. Abst. Vererb.* 67: 296-299 (1934). Zit. in Gates (1946).
 Quelprud, T.: Variability and genetics of the human external ear. *Proc. Internat. Congr. Genetics Edinburgh*. p. 243 (1941). Zit. in Gates (1946).
 Wiener, A. S.: Complications in ear genetics. *J. Hered.* 28: 425-426 (1937).
- Authors' addresses: P. C. Dutta, 1 B Gopal Bose Lane, Calcutta - 9 (India). P. Ganguly, Anthropological Survey of India, Indian Museum, Calcutta - 13 (India)

Acta genet., Basel 15: 87-94 (1963)

From the Department of Genetics, University of Chile School of Medicine, Santiago, Chile

Blood Pressure Correlation Between Relatives in an Endogamic Population

By RICARDO CRUZ-COKE and EDMUNDO COVARRUBIAS

The classical study of Holt (1961), on finger print ridge counts, gives the best human example of polygenic inheritance in which theoretical correlation values are closely realized. One great advantage of this character is that the number of ridges is finally determined by the fourth month of foetal life, the influence of post-natal environment being completely excluded. In this example, multiple genetic factors are almost wholly responsible for the differences in total ridge counts. The correlation study of blood pressure inheritance is more difficult because this trait is under a strong influence of non-genetic factors (Pickering, 1961). A fundamental condition, for theoretical correlation values, to be realized is that inheritance alone is involved (Fraser Roberts, 1961). In the example of blood pressure, it is difficult to separate the influence of environment from the hereditary factors. Many authors have found low degrees of resemblance between close relatives, i.e. regression coefficients of the order of +0.20 against +0.50 for ridge counts or stature (Pickering, 1955; Miall, 1958, 1962; Cruz-Coke, 1959, 1961). This suggests that environmental factors may be relatively more important in determining blood pressure than stature or dermal ridge counts. Thus, the blood pressure phenotype seems to be the end result of the interaction of strong environmental factors and a weak genetic component.

Fisher (1946) has suggested that it is possible to study the "strength of heredity" by the correlation method, assuming that heredity, only, is concerned in causing resemblance between relatives, when the environmental effects are distributed haphazardly. It is possible that a given population would show higher correlation values if reared under relative uniform environment, and if environment difference