CONCLUSIONS

On the basis of foregoing discussion regarding the inheritance of the various traits under consideration based on detailed twin, family and population analysis the following conclusions emerge with respect to each trait:

(i) Widow's peak: The trait is controlled by a single locus autosomal diallelic gene, where dominant allele is responsible for the presence of widow's peak and absence is due to the recessive allele. It is suggested that utmost care should be taken while recording the phenotypes, especially in the higher age groups where possibility of misclassification is relatively high.

(ii) Cleft chin: It is firmly established that the dominant allele of a one-locus autosomal diallelic gene is responsible for the manifestation of this trait. Its absence is due to the recessive allele.

(iii) Helix: The present data although does not confirm fully but strongly suggests that this trait may be due to a single locus diallelic dominant gene; dominant allele responsible for rolled helix. Further investigations are suggested.

(iv) Ear-lobe: Attached ear-lobes are firmly established to be inherited as recessive to the separate ear-lobes. A single locus autosomal diallelic dominant gene is responsible for the manifestation of separate ear-lobe type.
(v) **Hyper-extension of finger**: No definite conclusion could be arrived at regarding the heredity of this trait. It is likely that polygenes control the manifestation of this trait. On the other hand, it is also not unlikely that age and other environmental factors including misclassification influence the trait to a considerable extent. Hence it is quite probable that if such influences are corrected, the trait may show single locus diallelic autosomal dominant inheritance pattern. Further research is suggested.

(vi) **Dexterity of greater toe**: Analysis of twin data reveals that heredity and other influences have almost equal share in the manifestation of the trait. However, on the basis of the methods for analysis available at present, the mode of inheritance could not be established. Improvement of methods to account for the influences other than hereditary might help to arrive at some definite conclusion.

B. Behavioural Traits

1. **Hand grasping**, 2. **Arm folding**, 3. **Handedness**:

   All these three traits are definitely genetic in nature and each of them follow single locus diallelic autosomal inheritance pattern. The alleles responsible for R and L types do not maintain a strict dominant-recessive relationship. The heterozygotes get shifted either to R or L type, but the cause of such behaviour could not be ascertained. Hence it is suggested that investigations
should be undertaken to explain such behaviour of the heterozygotes. Moreover, further improvement in method of analysis of the family data is necessary to account for the extra-hereditary influences, which interfere in getting perfectly accurate results on the basis of the present method available.

(4) Footedness - The data for footedness could not be fitted to any model of inheritance perfectly. It appears that due to certain environmental causes the correct classification of individuals is not possible, and perhaps that is the major reason that the inheritance pattern of this trait could not be established. In future studies care should be taken to avoid misclassification.
SUMMARY

Aim:

The aim of the present study is an attempt to find out whether heredity has any contribution in the manifestation of the following characters and to establish the possible mode of inheritance, in case they are hereditary. The character studied are:

A. Morphological traits:


B. Behavioural traits:

(1) Hand clasping, (2) Arm folding, (3) Handedness, and (4) Footedness.

Method:

The principal methods adopted for this study are the twin, family and population.

Firstly, the estimates of heritability for different traits were obtained through the twins analysis. The family data were subjected to detailed statistical analysis, including testing of chance hypothesis, sib-pair analysis, segregation analysis and fitting of diallelic autosomal models. The population data were analysed with a view to see if it confirms the findings obtained through family data.
Material:

Our material consists of 107 pairs of twins (53 MZ and 54 DZ), 144 families consisting of father, mother and at least 2 children per family (total number of children are 429 and parents 288) and 424 (216 male and 208 female) unrelated persons from the general population. The families and individuals were selected at random from the Chitpavan Brahmin sub-caste of Maharashtra. There was no selection in obtaining the twins. Their zygosity was established by using standard methods prior to actual analysis of the data.

Results:

A. Morphological traits -

(1) Widow's peak: The hair line above the forehead in most of the individuals forms a continuous line, but in some individuals it drops at the middle of its course to form a V-shaped appearance in the mid-sagittal plane of the forehead. This shape is known as Widow's peak and on the basis of the analysis done it is established that presence of Widow's peak is dominant over absence. The trait is inherited due to a single locus autosomal diallelic dominant gene.

(2) Cleft chin: A depression, dimple or a fissure is observed to be present in the lower margin of the chin in some individuals. Such chins are known as cleft chins or
bilobed chins. This trait is established to be inherited as a single locus diallelic autosomal dominant. The recessive allele is responsible for the absence of the trait.

(3) Helix: Although in most of the people the outer margin of the helix is found to be rolled, in some it is flattened or unrolled. The rolled type is found to be dominant over the unrolled. Single locus diallelic autosomal dominant hypothesis is the most probable mode of inheritance of this trait.

(4) Ear-lobe: The attachment of the ear-lobe vary from person to person. The degree of attachment is so complete occasionally that no part of the ear-lobe is found to hang from the point of attachment. This condition is termed as attached ear-lobe and is found to be recessive to free ear-lobe. On the basis of detailed analysis single locus diallelic autosomal dominant hypothesis is established to be the mode of inheritance of free ear lobes.

(5) Hyper-extension of finger: In some individuals the fingers can be turned away from the palmer side towards the dorsal side of wrist, very rarely they can be even made to touch it. This phenomenon is termed as hyper-extension of finger. Although there may be many phenotypes depending on the extent of their movement, we have differentiated only two — rigid and flexible. Immovable fingers are
recorded as rigid and the rest are categorised under flexible. Although results of some analysis definitely show that there is a strong hereditary basis, we however, failed to establish any mode of inheritance. The failure may be due to interference of environmental factors. Also there is a possibility that the trait is controlled by polygenes. Further research is suggested.

(6) Dexterity of greater toe: The great toe of some individual is immovable or rigid, whereas in some it can be turned away from the other toes to a great extent. This mobility of the toe is termed as dexterity of greater toe. As in hyper-extension of finger, there may be many phenotypes depending upon the extent of flexibility of the great toe. However, we have recorded only two —— rigid and flexible. Influence of both heredity and other extra-hereditary factors seem to be strong in the manifestation of the trait, but we failed to establish the exact mode of its inheritance. Further research is necessary to arrive at a sound conclusion.

B. Behavioural Traits ——

(1) Hand claspíng: When individuals clasp their hands by interlocking the fingers, the fingers of right hand occupy the upper position in some individuals, whereas it is opposite in others. The first category of individuals are of R type and the latter are of L type. Single locus autosomal diallelic hypothesis is the most probable mode of inheritance of hand
claspimg types. However, the alleles do not maintain a
dominant-recessive relationship. The heterozygotes, due to
some unknown causes, get shifted to either R or L type.
Further research is needed to explain the behaviour of
heterozygotes.

(2) Arm folding - There are two ways of folding the arms across
the chest. Individuals are classified to be of R type when
the right arm takes the upper position and L type in the
other situation. Single locus autosomal diallelic hypothesis is the most probable mode of inheritance of this
trait. As in hand clasping, the heterozygotes do not show
ambi-type of arm folding, but get shifted to either ways.
Hence genotypically (RR) and (rr) individuals are pheno-
typically R and r respectively. Heterozygotes (Rr) may be
phenotypically either R or r, the cause of which should be
further investigated.

(3) Handedness - An individual is classified to be left
handed when he/she prefers the left hand to the right for
doing works which require some skill. The rest are right
handers. Like hand clasping and arm folding this trait
is found to be controlled by a single locus diallelic
autosomal gene without having any recessive-dominant
relationship between the alleles. Similarly, behaviour
of heterozygote depends upon some unknown factors, which shift it to either R or L ways. Further research is necessary to understand the heterozygotes.

(4) Footedness - An individual is classified to be either right or left footed on the basis of the foot which he/she prefers while walking or jumping on one foot. There is a great possibility that this behavioural trait is also controlled by a single locus diallelic autosomal gene. But unfortunately due to external influences, we could not definitely establish its mode of inheritance. Future investigators should be cautious while recording the trait.