CHAPTER-II
HISTORICAL RESUME

This chapter deals with the resume of research literature pertaining to the relationships between heredity - Environment and intelligence.

The modern phase of the nature-nurture debate, especially in relation to intelligence, can be traced to the writings of Francis Galton. He was responsible for the first statistical study, based on Kinship correlation of the inheritance of the intelligence, and for the first adoption and twin study designed to desentangle hereditary and environmental influences of Intelligence. He also constructed the world’s first intelligence test. He founded and named the eugenics movement whose purpose was to improve the hereditary quality of the human race by selective breeding, and he was the first to propose that human races differ in innate intelligence.

In his book, "Hereditary Genius" published in 1869, Galton examined the family trees of 415 highly distinguished judges, statesman, military commandors, literary figures, scientists (modestly omitting himself), poets, artists and divines. He found that a much larger proportion of these eminent people than would be expected by chance had blood relatives who
were also eminent and that their close relatives were more often eminent than their distant relatives. Eminence seemed to run in families in much the same way as unusual physical attributes such as exceptional height which were already known to be largely hereditary. Galton concluded that genius is also largely hereditary.

Galton discounted the alternative possibility that members of the brilliant families were successful because of superior nurture, in the form of better education, opportunities and personal connections. But he was well aware of this alternative environmental explanation so to strengthen his argument he, therefore reported the results of an adoption study designed to disentangle hereditary and environmental effects. His adoption study focused on the effects of nepotism, the common practice among popes and other Roman Catholic dignitaries of adopting distantly related young boys and raising them in their own homes as 'nephews'. These boys, Galton argued, shared the environmental but not the genetic advantages of natural sons raised by eminent parents, if social help is really of the highest importance the nephews of the popes will attain eminence as frequently, or nearly so, as the sons of other eminent men, otherwise, they will not. Galton's evidence showed that they did
not. The natural sons of other eminent men went on to attain eminence far more often than the pope's adopted 'nephews', the social helps are the same, but hereditary gifts are wanting in the latter case.

Later, Galton published his pioneering twin study. He guessed (correctly) that identical twins are identical in heredity and that nonidentical twins differ in heredity to the same degree as ordinary siblings. The evidence collected showed identical twins to be much more alike in mental ability than nonidentical twins. This lent further weight to his theory that intelligence is largely hereditary.

After the initial studies by Galton (1876), comparisons of identical and fraternal twins as well as other kinds of familial studies as a case for a relationship between heredity and intelligence continued. Erlenmeyer Kimling and Jarvik (1963) reviewed fifty years of research and considered over fifty studies in which various degrees of genetic correspondence was related to intelligence. There was some variation in results from study to study, but there was also a clearly marked trend toward an increasing degree of genetic relationships, regardless of environmental commonality. The finding that the pattern of correlations averaged over independent studies was consistent
with the pattern predicted by a polygenic theory of inheritance has been widely cited as strong evidence for genetic determination of intelligence. For example, the average correlation in intelligence for MZ twins reared together was .87 and that for MZ twins reared apart was .75. The average correlation in intelligence for parent-child and sibling combinations was around .50, which closely approximated that would be expected from parents and children, as well as, sibling about 50% of their genes in common. Virtually no correlation in intelligence was found between unrelated persons, as would be expected from the absence of a genetic correspondence. However, unrelated person reared together sampled in five studies obtained a median correlation around .20. Similarly the correlation between the foster-parent-child was much smaller than natural parent and child. Despite the accumulation of a great many new data and discrediting of Burt's important study on MZ twins reared apart (Hearnshaw, 1979), Erlenmeyer-Kimling and Jarvik’s summary continue to be widely reproduced (Vernon, 1979).

Many studies have compared IQ similarity across pairs of levels of genetic or environmental relatedness, while holding the other constant, (Bouchard, 1984) compared identical twins
raised together to those raised apart) to draw conclusion about environmental effects while controlling the genetic effects. Scarr and Weinberg (1978) compared adopted siblings with natural sibling to draw conclusions about genetic effects while holding the environment (relatively) constant. Bouchard and McGue (1981) reviewed 111 studies comparing pairs of categories related either genetically or environmentally. They have also summarized a large number of correlations for intelligence between various paired relatives, including MZ and DZ twins. They reported a weighted average monozygotic correlation based on 4672 pairs from 34 studies of .86 and for 5546 DZ pairs from 41 studies of .60. If there were nothing but genetic factors expected values would be of 1.00 and .50. It is clear that this hypothesis is untenable as the MZ correlation is too low, suggesting that environmental influences made the MZ twins less perfectly similar. On the other hand, the DZ correlation is too high, suggesting that DZ twins share a more similar environment than do two children born at different time (Sibling, For which Bouchard and McGue report a correlation of .47 based on 26,473 Paris 68 reports) This last value comes close to the expected genetic value of .50, but still could be environmental in origin. They reported weighted mean correlation of .72 for 410 mid-parent mid-child pairing in three studies and .50 for 992
mid-parent-single offspring in eight studies. They also reported four studies with 476 pairs of cousin, with a weighted average of .15. In the last Bouchard and McGue concluded that the pattern of average correlation is remarkably consistent with polygenic theory. This is not to discount - the importance of environmental factors; MZ twins reared apart are far from perfectly correlated, DZ twins are more similar than other biological siblings and 'adoptive parent's intelligence, demonstrates a consistent relation with the intelligence of their adoption. Although the data clearly suggest the operation of environmental effects, no evidence was found for sex-role effects and maternal effects. That the data support the influence of partial genetic determination for intelligence is indisputable, that they are informative but the precise strength of this effect is dubious.

C.E. Gill et al. (1985) conducted a study on a genetic analysis of Tertiary Admission Examination (TAE) and Australian Scholastic Aptitude Test (ASAT) results for 264 pairs of MZ and DZ twins. Purely environmental models are rejected as inadequate explanations of variation in examination performance and genetic factors must be invoked to obtain a satisfactory fit to the data. Within the portion of the age cohort who are candidates for these examinations, genetic factors appear to account for about
70 per cent of variation while environmental experiences shared by siblings appear to have little or no influence. However, when corrections are made on the assumption that examination candidates represent the top 34 percent from a normal distribution of ability in the population, much greater variation between families is inferred for the population. If we also take account of the high correlation in educational achievement between husbands and wives the putative population twin correlation are consistent with heritabilities between 0.6 and 0.7 and modest contributions of shared environment around 20 percent of the total variance. The data suggest that a distinction between I.Q. tests and tests of scholastic achievement on the basis of their causes for variation is not justified. It has been suggested that there is a common genetic factor responsible for much of the covariation of ASAT.

Lynn et al. (1989) conducted a study on twins and summarized the data concerning the heritability of Intelligence using the twin method. Data from T. Takuma (1968) for 543 monozygotic and 134 dizygotic twin tested for intelligence at age 12 years yielded correlation coefficient at age 12 years yielded correlation coefficient of .782 and .491 respectively,
indicating a heritability of .582. Heavier twins at birth had significantly higher I.Q. at age 12 years suggested that parental nutrition on exerts a significant effect on Intelligence.

Teasdale and Owen (1987) has compared the intelligence test scores of 25 biological father with sons who were adopted away, 17 stepfathers with step sons and 29 fathers with sons in intact families. Father-son correlations for intelligence suggests a modest heritability with little familial environmental effect. The results indicated genetic dominance effects for intelligence. Normative data show that the mean intelligence test scores has risen between the parental and filial generations.

Cattell et al. (1981) gathered data on 470 brothers reared together, 84 identical twins reared together, 124 fraternal twins reared together and 3,000 unrelated males, between the ages of 12 to 18 years. They analysed the data employing equations of 6 concrete variances; they suggested that past work by the twin method has been seriously in error in equating intersib/or fraternal twins to inter-identical twins environmental differences. They further concludes that Burt's heritability of .80 is an upper limit, applying to the twin method estimates of environment difference only.
A large study that has been published since the summary by McGue was based on 2029 pairs of parents tested when in their teens, with one or more children also tested at that age. The regression of offspring on mid-parental value was \( .613 \pm 0.022 \) (Reed and Rich, 1982). The authors noted a slightly higher correlation between mother and offspring and a sibling correlation of \( .387 \). Actually the influence of assortative mating, when separately estimated turns out to be almost negligible.

Garfinkle (1982) administered Raven's Coloured Progressive Matrices (RCPM) on 137 MZ and 72 DZ same-sex twin pairs aged 4 to 8 years from Caucasian middle and upper middle class homes. The intra-class correlation was found to be \( .49 (\pm .07) \) and \( .39 (\pm .10) \) for MZ and DZ respectively. The estimate of broad heritability was reported as \( .20 (\pm .24) \).

Scores obtained by parents and children on intelligence tests have been correlated. In the most extensive of these studies, Conrad and Jones (1940) administered intelligence tests to 269 family groups, including 977 persons between the ages of 3 and 60. All subjects were native-born, spoke only English at home, and lived in rural districts of New England. Socioeconomic differences within this sampling were small. The younger
subjects were tested with the Stanford Binet, the older with the Army Alpha. For the entire sampling, the total parent-child correlation obtained with these tests was .49. No consistent or significant difference was found between mother-child and father-child correlations, nor did the correlation of sons and daughters with their like-sex parent, differ from the correlation with their unlike sex parent. It might be argued that if environment is important in producing these familial resemblances, then children should resemble their mother more closely than their father. It is true that the mother—generally has closer contact with the children than does the father.

Roff (1941) had reported that the parent-child correlation of approximately .50 in intelligence test scores is not found until the child is about 5 years of age. The correlation is considerably lower at earlier ages and approaches zero in infancy. It will be recalled that a similar lack of correlation was found between the individual’s score in infancy and his own later performance. A principal factor in such an explanation is undoubtedly the difference in behaviour functions tested among pre-school children and among older children or adults.

Conrad and Jones (1940) administered a intelligence test on 644 individual siblings in 225 families. The correlation was
identical with that found between parents and children in the same study, namely .49. That the sibling correlation on most intelligence tests is in the neighbourhood of .50 has been repeatedly confirmed. The correlation between 384 pairs of siblings tested during the standardization of the 1937 Stanford-Binet (McNemar, 1942) was found to be .53. The same sibling correlation was obtained with 1163 children tested in England with a group scale (Roberts, 1940). The latter group was especially free from limitations of sampling, since it included all siblings located during a project in which every child born in city of Bath within specified dates was tested.

Hildreth et al. (1925) found that sibling correlations in intelligence test scores may drop as low as .30 or rise to nearly .70. As in the case of parent-child correlations, the more verbal types of tests tend to give higher correlations (Willoughby et al, 1927). Heterogeneity of samples is also undoubtedly a factor in producing some of the differences. For example, among college students who represent a relatively homogeneous group, the sibling correlation in intelligence test scores is closer to .40 than to .50 (Thorndike et al, 1944). At the same time, when siblings attending a single school are tested, the influence of common school environment, together with certain selective
factors may tend to raise the sibling correlation. Thus if one member of a sibling pair is attending high school and the other is not, such a pair would automatically be excluded from the study. In one high school sample, for instance, the sibling correlation on an intelligence test was .60 (Thorndike, 1928). In this case it is probable that selection of sibling pairs, as well as common school environment, had more effect than did the reduction in heterogeneity.

Loehlin et al. (1987) considers the estimation of various forms of genotype-environment (GE) correlation. Two methods of estimating "passive" GE correlation from adoption studies are presented and illustrated with I.Q. data from 5 adoption studies. One method involves comparison of variances in adoptive and non-adoptive families whereas the other compares parent-child correlation in such studies. The 2nd method yields more precise results for given sample sizes. Ignoring measurement errors leads to marked underestimation of GE correlations. Application of these methods to available adoption data on I.Q. suggests that typical passive (GE) correlations for I.Q. lie in the neighbourhood of 0.30.

Flynn et al. (1988) examined ethnographic data from 112 residential units in a rural Trinidadian village, to test for
differences in step and genetic parent/offspring relationships. Data indicate that when both step and genetic offspring were co-resident in the same household, fathers interacted more frequently and less agonistically with genetic offspring than they did with step offspring. Data also indicated gender differences in step and genetic parent/offspring relationships, higher rates of 'foster age' for step offspring, higher rates for emigration from the village for step offspring and lower reproductive success for individuals raised by step parent.

Caruso (1983) investigated possible causes of the heterogeneity of parent-offspring and sibling I.Q. correlation based on a review of the world literature. A meta-analysis of the parent-offspring data indicated that simple differences in the size of the I.Q. correlations are due to sampling error, test unreliability and differences in the distribution of IQs. A similar analysis of the sibling data failed to reveal the cause of the variability in sibling correlations.