CHAPTER - I

INTRODUCTION
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Humans, in common with all other species, have a developmental plan that individuals execute with varying degrees of precision. The physical and mental traits of every human being are to some extent determined by genes at the moment of conception. The genetic make-up is unique in that it cannot be altered after conception. The series of events starting in the fertilized egg, involving rapid mitosis, cell migration and differentiation to produce the complete infant represents an extra-ordinary complex process. It may seem nothing short of a miracle that the vast majority of children are normal at birth. Nevertheless, accidents of development do occur. Such accidents present at birth are known as congenital defects.

If all human beings were exactly alike, the science of human genetics would not exist. The variability that exist from one individual to another, and from one group of people to the next, makes it possible to study the basic mechanisms responsible for the transmission of characteristics from parents to offspring. All of us carry heritable differences; perhaps sex is the best known of the differences. A small percentage of the population shows abnormalities in their genetic constitution resulting in various disabilities. More
information about human genetics comes from such studies. The contribution that a specific human type may make is quite independent of its overall frequency in the population. In many cases a single pedigree or even a single individual may clarify a puzzling problem (Novitsky, 1977).

Some congenital disorders like cleft lip, cleft palate are obvious at birth. Some are obvious in early life like congenital dislocation of hip which may escape detection until walking should commence. Some become obvious only later in life like Phenylketonuria, Tay Sach’s disease and mental retardation. Congenital malformations include not only anatomical defects but also molecular and cellular abnormalities present at birth (Park, 1997). The world-wide incidence of congenital disorders is estimated at 30-70 per 1000 live births. Population and hospital based studies from different parts of India show that 2.5% of newborns have a birth defect, and the figure rise to 4% if the children are followed up to 5 years of age (Park, 1997).

Over 3000 hereditary diseases have been identified so far and more are added to the list every day. Because there are many legal, religious and social taboos preventing human manipulation, it is
not possible to use humans for the study of many specific types of genetic diseases. It is also difficult to demonstrate genetic ratios resulting from Mendelian pattern of gene transmission in humans. The inheritance of multi-factorial diseases is complex because environmental factors are also involved. Environmental agents and genetic constituents usually interact closely in producing such abnormalities. A study of genotype and phenotype becomes necessary. The term genotype refers to the total genetic constitution of an individual and the term phenotype to the outward expression of the genetic constitution. Certain phenotypic characters of an individual can change from infancy to adulthood. But some phenotypic characters never change once they are formed. One such character is the epidermal ridges which appear on the palms of the hand and soles of the feet. The study of these epidermal ridges is called "Dermatoglyphics". Dermatoglyphics is widely used in various fields of genetic research, psychiatry, pediatric medicine, anthropology and population studies. The word dermatoglyphics was coined in 1926 by Harold Cummins.

The palmar and plantar surfaces of the human hand and foot are clothed by skin which is different from that covering other parts of the body. These structural specializations of the skin are
advantageous in the functioning of contact surfaces. Corrugation of the surface, moistening by sweat and absence of hair counteract slipping; this adaptation being recognised in the term “Friction Skin”. Like the milling on the handle of a tool or the tread on an automobile tire, the ridging serves as an anti-slipping device. Abundant nerve endings in the skin of the palmar and plantar surfaces serve the sense of touch. Their functioning is aided by corrugation of the skin. The effectiveness of epidermal ridges in heightening frictional resistance is increased by the arrangement of ridges in patterns. The epidermal ridges form definite local designs on the terminal segments of digits and in consistent sites on the palms and soles. The high variability of these configurations makes them useful in personal identification, studies of heredity, racial variation and other biological aspects of dermatoglyphics.

Every human being has a wholly distinctive set of finger prints. So finger prints are employed in personal identification. Although finger prints and hand prints are widely used in Criminology, it is only recently that this approach has been applied to the field of medical and genetic diagnosis. Dermatoglyphic pattern remain unchanged throughout the life of an individual. Development of epidermal ridges is under genetic control and is influenced by
environmental factors. So dermatoglyphic study is used widely in chromosomal disorders and in diseases where exact etiology is obscure.

A genetic disease which was first noticed because of several dermatoglyphic peculiarities was the Down syndrome (DS). In 1939, long before the chromosomal basis of Down syndrome was established, Cummins pointed out characteristic differences in dermatoglyphic features in persons with DS compared to the control group. These original findings have since been confirmed by many investigators, even in patients of different racial and ethnic stock, and additional dermatoglyphic abnormalities have been identified. A marked increase of ulnar loops on the fingertips is virtually a constant feature of dermatoglyphics of DS. The total finger ridge count is lower and its variability is smaller than in the normal population. A distally displaced axial tri-radius is another typical dermatoglyphic trait in DS. The trisomic conditions all have characteristic pattern distortion (Penrose, 1969). Dermatoglyphic peculiarities have also been noticed in sex chromosomal aberrations like Turner syndrome and Klinefelter syndrome. In Turner syndrome palmar skin is very thin and wrinkled which produces the appearance of multiple secondary creases. The total finger ridge count and a-b ridge count also showed an increase
compared to controls. Dermatoglyphic peculiarities have been reported for Klienfelter syndrome by several authors (Thomas et al., 1998). Thus dermatoglyphics was used in identifying specific syndromes of genetic origin. Several chromosomal abnormalities are now known to produce unusual dermatoglyphic pattern (Suzumori, 1980).

Chromosomal aberrations involving both the autosomes and sex chromosomes also show characteristic dermatoglyphic deviations. Since these alterations are frequently diagnostic in nature, the question arises as to the earliest time in embryogenesis when such findings can be analysed. The dermatoglyphic pattern in fetuses therapeutically aborted because of a prenatal diagnosis of chromosomal abnormality was studied. Corresponding to the chromosomal anomalies, differences in dermal ridge development were noticed as compared with chromosomally normal fetuses. Dermatoglyphic studies were performed in 24 aborted human embryos in which major chromosomal aberrations had been revealed by amniocentesis (Katznelson and Goldman, 1982). Out of 24 embryos, 22 showed dermatoglyphic variations that co-related well with the cytogenetic diagnosis. Foetal dermatoglyphics can play a key role in the recognition of several chromosomal aberrations. Amniocentesis
performed in suspected cases of chromosomal aberrations can be confirmed by such studies.

Since the first report of unusual combinations of dermatoglyphic patterns in Down syndrome came out, dermatoglyphics has been used clinically to provide diagnostic clues to many syndromes with obscure clinical manifestations. A study of dermatoglyphics in Epilepsy showed differences between Epileptic persons and control group (Mondal, 2000). The association of dermatoglyphics with different types of congenital heart defects has been studied (Nair, 1986). A clear association of Congenital Heart Defects (CHD) with different dermatoglyphic variables supports the proposition of genetic etiology in CHD as well as its multi-factorial nature. The study has shown that some common loci may be involved in the etiology of CHD and different types of the disease may be the result of genetic heterogeneity. In addition, the sex of the individual and the environment may also have a role in the expression of the disease.

Dementia of the Alzheimer type is a degenerative neurological disorder of unknown cause. Dermatoglyphic similarities between Down syndrome and Alzheimer’s have been reported

During the last 10 years, research is focused on determining the time when dermatoglyphic features are formed, the genetic and environmental factors that can influence the ridge formation during embryogenesis and fluctuating asymmetry of dermatoglyphic characters. It all started with the dermatoglyphic study of Schizophrenia.

Schizophrenia is a serious psychiatric disorder that has a genetic basis, but this does not rule out the possibility of genetic heterogeneity and environmental risk factors (Fananas et al. 1990). Monozygotic twins have a 50% discordance rate, thus implying that there is some interaction between the environment and the
development of Schizophrenia (Kaplan and Sadock, 2000). While there is no single neuro-developmental theory of Schizophrenia, dermatoglyphic anomalies imply pre and peri-natal developmental disturbances to which the developing central nervous system is likely to be exposed (Markow and Gottesman, 1989). Epidermal ridges appear on the surface of the hand by the end of the fourth foetal month, when significant and critical growth and development of another ectodermal derivative, the brain, are also taking place (Babler, 1991). Epidermal ridges develop until the 16th week. After this period, the dermatoglyphic patterns remain unchanged. Therefore, unlike other potential markers, such as cerebral ventricle dimensions, the 'time window' associated with the experience of risk is relatively narrow and certain to occur within the period of foetal development (Fananas et al., 1990; Bracha et al., 1991; Bracha et al., 1992).

Because both the brain and dermatoglyphic features are derived from the ectoderm, there is a rational for using dermatoglyphics as indirect markers of developmental disturbances occurring during the second trimester of prenatal life. The second trimester is the critical period of massive neural cell migration to the cortex. Finger tip dermal cells also migrate to form ridges during this trimester. Differences between monozygotic twins in the anatomical
dermal feature called finger ridge count may serve as “fossil” (chronomarker) evidence for any of a variety of factors that might affect one foetus differentially during the second prenatal trimester.

The epidermal ridges are not exclusively influenced by heredity. On the corresponding hands of identical twins dissimilarities can be attributed to environmental modifications. They differ about as much from one another as do normally the right and left hands of a single person (Penrose, 1969). The study of discordant monozygotic twins is used now for sorting out the relative roles of genetic and environmental factors in the expression of certain diseases like Schizophrenia. Recent studies indicate that many prenatal insults do not always affect both monozygotic twins to the same extent. Monozygotic twins with chronic schizophrenia have larger ventricles and smaller temporal lobes than the non-affected twin. Such important findings in Schizophrenia may localize the insult in space, but not in time, that is, the brain cell loss could have occurred at any time prior to the examination. But a co-twin study employing the use of selected developmental markers associated with narrow and specific pre-natal period can narrow down the time of the insult during development. Several dermatoglyphic measures can provide such information about the foetal time periods most associated with schizophrenia (Brahca et
The developmental time lines and the estimated gestational ages for completion of finger patterns, finger ridge counts, a-b ridge counts and 'atd angles' have been assessed.

The above four dermatoglyphic markers are affected by foetal growth complications. For example, a higher number of finger whorl patterns were associated with pre-natal infections (Alter and Schulenberg, 1966). This is in agreement with the work of Ross (1996) that exogenous Gamma Globulin can influence the prenatal development of finger tip ridge patterns and that this influence is responsive to the gestational timing and dosage of Gamma Globulin administered. Other examples of dysgenesis included lower a-b ridge counts and wider 'atd' angles in subjects selected for prenatal exposure to rubella (Alter and Schulenberg, 1966). In addition, greater 'atd' angles, a-b asymmetry, finger pattern asymmetry and ridge count asymmetry were reported in dyslexia. In the monozygotic co-twin study by Davis and Bracha (1996) the neurological and epidermal differences have been interpreted as evidence of a second trimester influence in schizophrenia, as they share many developmental features. Both develop from surface ectoderm and experience rapid development between 12 and 16 weeks estimated gestational age. The second trimester has been hypothesised to be a likely time period
during which a distal but critical neuro developmental disturbance takes place in schizophrenia (Bracha et al., 1992).

Environmental and genetic stressors may cause a breakdown in the development of an organism. Genotype is buffered in such a way that development is ‘canalised’ and ordinarily proceeds along evolved developmental tracks. Developmental pathways vary in their stability depending on the degree of canalization. Some are more readily displaced from the normal phenotype by genetic and environmental trauma than others. Canalization or its approximate equivalent, developmental homeostasis, depends on evolved balanced genomic and chromosomal systems and their derivatives-regulated metabolic pathways. It has been suggested that the extra chromosome in trisomics upsets this evolved balance and canalization of development in general is diminished. There is a generalised amplified instability of development in Down syndrome (Shapiro, 1975). A disruption of developmental processes cause congenital disorders and susceptibility to various diseases (Livshits and Kobyliansky, 1987).

Asymmetry may be defined as a deviation of an organism, whole or part from perfect bilateral symmetry. Fluctuating asymmetry is considered to be random differences between two sides
of a trait in an individual when the means of the two sides in a population are equal (Livshits and Kobylianksy, 1987). Human examples of traits showing fluctuating asymmetry are the lengths of corresponding limbs or facial structures. In fact, anything that is normally considered identical on both sides of the body may exhibit fluctuating asymmetry. Fluctuating asymmetry has long been used as a measure of the success of developmental homeostasis in countering environmental stress. The phenotypic expression of fluctuating asymmetry is presumably due to a complex series of interactions between the physical environment and the genetic constitution during ontogeny (Naugler and Ludman, 1996a).

Within the last 10 years, fluctuating asymmetry has attracted increasing interest in the fields of behaviour ecology, conservation biology and quantitative genetics (Naugler and Ludman, 1996a). Increased fluctuating asymmetry of morphological traits occurs under environmental and genomic stress. Such conditions will therefore lead to a reduction of developmental homeostasis (Parsons, 1992). Fluctuating asymmetry of an anthropomorphic trait might be a useful and sensitive measure of developmental instability in human ontogeny. It should be possible to use fluctuating asymmetry to predict appearance of or predisposition to congenital anomalies in
ontogeny (Livshits et al., 1988). Perhaps the most promising application of fluctuating asymmetry in clinical medicine is in the analysis of liability for multi-factorial disorders that fit a polygenic threshold model (Woolf and Gianas, 1977).

Dermatoglyphics and odontometrics have been used in studies of fluctuating asymmetry. Odontometrics require a prolonged developmental time frame while dermatoglyphics require a short period (Naugler and Ludman, 1996a). Anthropomorphic traits like ear length, foot breadth, facial asymmetry etc. also require long developmental time. It is also not clear if fluctuating asymmetry in these traits remain constant as the individual grows. Role of fluctuating asymmetry as a risk marker for disorders of developmental origin have been reported by Naugler and Ludman (1996b) for developmental delay, by Markow and Wandler (1986) for Schizophrenia, Woolf and Gianas (1977) for cleft lip with or without cleft palate and by Livshits and Kobylianksy (1991) for preterm births.

A study of dermatoglyphic asymmetry and behavior discordance of monozygotic twins by Rose et al (1987) showed that twin pairs asymmetric for palmar a-b ridge count were significantly
less similar in performance on many psychological tests. The total variance of these scales tended to be greater among individual twins with extreme left-right asymmetry. Study by Reilly and Gottesman (1999) also support dermatoglyphic fluctuating asymmetry as a risk marker for liability of schizophrenia.

Epidermal ridges are a unique non-neural tissue reflecting the outcome of a multi faceted genetic process completed well before birth. At present, no information is available regarding the environmental factors affecting the genetic program of an embryo that develops inside the uterus. Information is available only regarding some environmental factors causing upsets in embryogenesis like infection caused by bacteria and viruses, some chemicals like valproic acid, methadone, thalidomide, drugs for epilepsy etc.

Each day new environmental pollutants are added to our living environment. Whether any of these can cause damage to the developing embryo is still a mystery. The study of dermatoglyphics can provide information about some “upset” during the first half of pregnancy. Once an upset is detected, an analysis can be made about the time of upset. A detailed study regarding the time period at which the upset has occurred, any particular event like a maternal infection
or drug that was taken *etc* can be made. From this, the agents causing developmental upsets can be identified. This can lead to awareness among the public to such deleterious agents. At present this is the only method by which environmental factors responsible for upsets in genetic program can be identified.

**Need and significance**

In matters of health everyone should be treated equally. Yet people with disabilities have been discriminated against throughout history. According to WHO estimates there are about 500 million people in this planet who live with disabilities. The vast majority of these people live in developing countries, where only two percent have access to the necessary rehabilitation services. As regards access to medical care including the presence of qualified staff, there are major disparities between developed and developing countries and also between urban and rural areas within the countries. This is not the case with medical care alone, with research the situation is worse. Studies associated with disability, epidemiology of these groups etc are few. Studies reported from Kerala are even less.

The developments in the field of medicine and genetics have reduced the incidence of many diseases. But at the same time
multi-factorial diseases has increased. Diseases like congenital heart disease, Diabetes mellitus and Hypertension is on the increase. Similarly Autism, Learning disability, Fragile X- syndrome etc which were rare earlier, are now in the fore front. Mental disorders also have increased. Recent epidemiological research has demonstrated that mental retardation cause considerable burden on individuals, communities and health services and it is projected that the burden will increase in the coming years. Preliminary studies from India confirm these findings according to Saxena and Sharan (2003).

Finger prints along with palm prints known as “Panja” were used for some centuries in India. It was Sir Henry who just developed a system of finger print classification. The first Finger Print Bureau was established in Calcutta in 1897. Finger prints have been used for personal identification since then. The technology of identification by finger prints have developed further and now in banks and high security areas, scanners with details of finger prints are used.

The dermal configuration are perhaps the most effective ones in the study of population variation owing to their high variability associated with no post-natal modifications (Reddy et al,
So these dermatoglyphic studies are useful in ascertaining intra and inter population variations and affinities. In India and outside numerous investigations have been made to study populational, geographic, linguistic and cultural variations in caste and tribal populations. The Anthropological Survey of India launched the project People of India in 1985 with the idea of generating an anthropological profile of all communities of India. Genetic markers like serological and biochemical markers and dermatoglyphics were used for the population studies (Singh et al 1994). According to the data of the survey the distribution of finger patterns in the Indian populations generally show a preponderance of loops over whorls. The average incidence of whorls ranges from 32.49% in the Indo-Aryan speaking community of Karnataka to 56.97% in the Dravidian speaking tribe of West Bengal. The data from different states of India and that of tribal populations have been obtained in the survey, but the dermatoglyphic value of population from Kerala State is not available. The dermatoglyphic studies can help in measuring the genetic distances of different populations and can also clear disputes regarding scheduled castes and scheduled tribes.

A study of dermatoglyphics will help Clinicians and Professionals. Better understanding of inheritance of dermatoglyphic
pattern would make it more useful in clinical medicine. It is also useful in screening children with undiagnosed Multiple Congenital Anomalies (MCA) syndromes and/or unexplained mental retardation. In some instances, the pattern will suggest a diagnosis, and in the case of Down syndrome, specific indices can be utilised. In rare instances, where consent for chromosome analysis is refused or where there is failure to obtain a satisfactory chromosome analysis, dermatoglyphics study may be the only objective means of diagnosing Down syndrome or other conditions. Since there are many different chromosome banding technique that cannot all be used on every patient, dermatoglyphics can help suggest when additional studies might be appropriate for identification of chromosomal aberrations.

Identical twins furnish an unusual opportunity for observing two genetically homogeneous human beings, which might in turn provide a pointer to disability studies. Since genetic differences between these twins are absent, observed differences in phenotype can be considered as purely environmental in origin. Recent studies have shown that in multi-factorial disorders, concordance / discordance in monozygotic twin indicates environmental influence on genetic factors (Jameela 2003). The most important factor about these studies is the determination of zygosity. Finger print patterns of monozygotic
twins are quite similar and on the basis of this criteria alone zygosity can be diagnosed correctly in about 86% of all cases according to Novitsky (1977). The use of DNA methods is now the standard for twin zygosity determination. But the DNA marker testing is quite expensive. The dermatoglyphic method is simple and inexpensive, which adds up to the relevance of the extensive study of latter. According to Reed and Christian (2003) if dermatoglyphics are combined with questionnaire assessment of zygosity, there is only very small chance for errors to be made. Thus dermatoglyphics become important in twin zygosity determination.

The most important aspect about dermatoglyphic study is the early detection of certain multi-factorial disorders. The dermatoglyphic asymmetry is associated with a perturbation during embryonic development. Studies in Schizophrenia have confirmed the association of fluctuating asymmetry with later development of the disease. Computer assisted studies reported from Ireland showed that young children who are prone to develop Diabetes mellitus can be identified early using fingerprints (Mandasescu et.al. 2004). In humans, high levels of fluctuating asymmetry were documented for children whose mothers had poor health status and among individuals with some developmental disorders (Naugler and Ludman 1996 a,b).
All this stresses the association of fluctuating asymmetry with multifactorial disorders. If a meaningful association can be established between dermatoglyphic pattern and later onset of any disorder, then the study of dermatoglyphics becomes relevant.

Fluctuating asymmetry has been studied with respect to other characters like odontometrics and bone growth in human beings. But studies have shown that the best method for measuring fluctuating asymmetry is the method of dermatoglyphics. Compared to odontometrics or bone growth, dermatoglyphics do not change once it is formed and the developmental time period is short.

Another instance of occurrence of disability is the extensive use of drugs. In fact the use of drugs in pregnancy is a major world-concern today. There is a need for good accurate information regarding usage of drugs during pregnancy to avoid indiscriminate use of drugs with disastrous consequences. At present no information is available regarding the upsets occurring to the human embryo in the early prenatal period. Research directed to exploring the relationship of developmental timing to differences observed in human development patterns is limited (Morris, 1991). Davis and Bracha (1996) had prepared time scales for the development of
dermatoglyphic characters like finger patterns, a-b ridge count, 'atd angle, finger ridge count etc. An anomaly of any of these parameters can be linked to a particular time period between 10\textsuperscript{th} and 16\textsuperscript{th} week of gestation as development of dermatoglyphics are confined to this period. It helps in identifying the time period when insults to the embryo occurs. An evaluation of any drug the mother has taken, an infection like influenza at this period, a stress in the form of an accident or death in the family, all these can help in associating the insult with dermatoglyphic characters. Case controlled studies of such nature can give insight into environmental stressors that can affect the developing embryo. Such efforts might clarify the timing and nature of what may be preventable non-genetic influences in the development of some disorders.

Both the skin and nervous system develop from the same ectoderm. An insult during the developmental period will be reflected in the skin and the nervous system. Defects in the skin will be obvious from the moment of birth. The peculiarity about the ridges is that it never changes once it is formed. The nervous system abnormality is more elusive, being ordinarily not manifested until months or years after birth when the child fails to attain developmental milestones at the expected times. So any dermatoglyphic anomaly is related to
nervous system and a closer watch may help in detecting the anomaly much more earlier.

Due to greater family size, inadequate spacing between successive children, and ignorance / lack of knowledge, it is common to find two to three similarly affected members in the same family in India. These disabilities exhaust the financial resources of the family and/or create psychological tension. Dermatoglyphic studies of certain disorders have shown the dermatoglyphic anomalies in parents as well as affected child. This is evident in the case of Down syndrome due to mosaicism. In such cases dermatoglyphic study of parents can help in identifying the parent responsible for mosaicism and also in preventing further occurrence of similar condition by genetic counseling.

In Europe and America, newborns are subjected to various tests to detect congenital diseases. In Asia, except India, babies are screened for genetic diseases. Compared to other countries, genetic diseases are more in Asian countries. But in India, no programs are made for such studies. Many of the genetic diseases can be controlled, if the treatment starts as soon as the child is born. A study of dermatoglyphics can help in this regard, and if any anomaly
is detected, then child can be monitored and consequently treated for disability. Early identification of developmental disabilities in children leads to effective therapy of conditions for which treatment is available, even though the condition cannot be fully reversed. The emphasis is on screening of infants 0 to 2 years, an age when the pediatrician is very closely involved with children and their family. In the Indian scenario, although the survival of high-risk infants has shown improvement during the last decade, we still have a high incidence of birth asphyxia, low birth weight and peri-natal infections that necessitates a need for screening of such infants. The distinction between variation of normal behavior and early signs of illness become more difficult in low birth weight and pre-term infants. A neurological examination along with identification of any asymmetries can warn the pediatrician of later onset disorders.

The procedure followed to take finger prints is simple and inexpensive. No additional equipment is required. Laboratory facilities are not needed. The prints can be obtained without any trauma to the child. A record of such an important human character is a necessity as genotype and phenotype are important characters.
Fluctuating asymmetry (FA) of bilateral traits indicates developmental stability. Study of fluctuating asymmetry of dermatoglyphics traits has not been found reported from India. The developmental stability of man has been assessed by the magnitude of FA. Individual with decreased developmental homeostasis is on the rise during the last few generations in the human population of developed countries. From a biological point of view, contemporary society differs from the societies of past generations in the markedly increased life span. This has resulted from increased probability of survival from various kinds of morbidity and especially from decreased mortality in early childhood. The infant mortality rates have decreased in the developed countries. Early mortality among preterm infants decreased even more dramatically. The natural stabilizing selection favors the morphologically average newborn infant and eliminates the deviant. The revolutionary progress in health care has dramatically curtailed the intensity of stabilizing selection. Consequently we can expect a relatively high proportion of individuals with decreased developmental homeostasis in present human societies according to Livshits and Kobyliansky (1991). This means that individuals who are genetically less stable are on the increase. So in the coming years there will be an increase of multi-
factorial diseases. A study of the FA of dermatoglyphics will provide more information about the developmental stability of the normal population and that of the various disability groups. The study of FA in the different disability groups may help in identifying them at an earlier period. Early intervention improves the outcome. The impact of early intervention results from developmentally appropriate interaction between the parent and the child. Early detection can also lessen the pain caused by the affected child and adjust to the disability.

In Kerala, despite the reputation of complete literacy, the awareness of genetic diseases is less. Background information and up to date knowledge of genetics and allied science is rather little in our State. Gene mapping and gene cloning have developed but it is not available to the common man. In the present study, out of several cases of Down syndrome, cytogenetic studies were carried out only in two cases. This shows that when a disease is identified, the families go for treatment but no study is made in on the exact cause of the disease.

A wide variety of potentially teratogenic agents may be encountered during pregnancy. These include viral infections like German measles and Cytomegalovirus, bacteria, physical agents like
radiation, heat, drugs, ethyl alcohol, tobacco smoking etc. According to recent reports mothers’ exposure to organic solvents like enamels, paints, adhesives etc. during pregnancy can lead to failure of neurocognitive functions in kids. Sufficient evidence is not available for the complete characterization of such agents and further information in this area is badly needed.

An endocrine disrupting pesticide, DDE, has been detected in the amniotic fluid of women living in the Los Angeles area. DDE is a waste product of DDT, known to interfere with male sexual development by disrupting the activity of the hormone testosterone. DDE can bind to and inactivate testosterone which plays an important role on the sexual development of boys. Researchers have expressed concern over the long term effect of DDE on male development and reproductive health (Hughaes 2005).

The present study is about dermatoglyphics in different disability groups. The sample included in the disability groups are persons with autism, with Cerebral palsy, with deafness and dumbness, with Down syndrome and with learning disability. Dermatoglyphic studies reported from Kerala state are only few. Among the samples, only individuals with Down syndrome have the
chromosomal aberration resulting in mental retardation. Cerebral palsy persons have neurological disorder. The exact reason is not known. Autism and learning disability are developmental disorders. Both genetic and environmental factors contribute to this disease. In deaf and dumb persons the exact cause is not known.

No study is available regarding the role played by environmental factors in multi-factorial diseases. Paucity of funds and man power and limitation in access to appropriate resources are the reasons for lesser research in this field. Even though human genome project has been completed, developing countries like India are still struggling with poverty, malnutrition, population explosion etc.

The concept of developmental homeostasis can explain the presence and the inconsistency of dermatoglyphic deviations accompanying various diseases. Hence detailed observations and recordings of the variability and asymmetry of dermal patterns in patients with congenital anomalies compared with healthy individuals can explain some of the genetic and environmental factors during development.

The present study is undertaken with the aim of studying dermatoglyphics in different disability groups. Very few reports are
available regarding dermatoglyphic studies from Kerala. However, dermatoglyphics associated with congenital heart defects, epilepsy and cancer have been reported from Kerala too. An extensive study of dermatoglyphics of different disability groups have not been done so far. All these prompted the investigator to take up the study of dermatoglyphics in Disability groups.

**Objectives of the Study**

1. To study dermatoglyphics of fingers and palms and use as a tool to screen the population for the pre-disposition of certain congenital disorders.

2. To study the configuration of ridges in persons coming under various categories of disability.

3. To study whether there is any significant difference in finger and palmar dermatoglyphics of persons belonging to various categories of disabilities.

4. To study whether a specific type of congenital anomaly in a disability group shows a significant pattern in finger and palmar dermatoglyphics when compared to control group.

5. To study whether the occurrence of Down syndrome is associated with an increase in maternal age.
Hypotheses

> There will be significant difference between males and females with respect to dermatoglyphics.

> There will be significant difference between children with autism and control group with respect to finger patterns and palmar patterns.

> There will be significant difference between children with Cerebral palsy and control group with respect to finger and palmar patterns.

> There will be significant difference between deaf and dumb children and control group in finger and palmar patterns.

> There will be significant difference between children with Down syndrome and control group in finger and palmer patterns.

> There will be significant difference between children with learning disability and control group with respect to finger and palmer patterns.

> Congenital anomalies are reflected in the finger and palmar patterns of various disability groups.