CHAPTER-I

GENERAL INTRODUCTION
Most people believe intuitively that even the most physiologic function is controlled in some part by genetic factors. A complex physiologic function is the result of a number of biochemical reactions, some dependent and some independent. The controlling agents that are involved in these reactions are coded for by the host genome; thus, genes control the final phenotype. On the other hand, it is believed that genes do not work in vacuo, and that they are subject to significant modification by environmental factors in the determination of phenotype. These hypotheses are easily stated, but considerable difficulty arises in the attempt to determine the relative contribution of genotype and environment to the final phenotype. This is important for situations in which the ultimate phenotype leads to diseases. Since we may be able to address issues of prevention and therapy with such information.

When we determine that environmental factors are especially important, we can take steps to minimize exposure. If we find that the interactions of major components of both environment and genotype determine the final phenotype, we may devote our efforts to identifying individuals with the susceptible genotype and to minimizing exposure to the environmental factors in only those individuals. Thus, we might conduct antismoking efforts in populations that are genetically liable for the development of chronic lung disease or lung cancer rather than in the population at large. Moreover, having established the role of genotype and environment, we can then try to identify the specific genetic and environmental factors that are operative (Tishler et al., 1987).
The question is frequently raised concerning the genetic contribution to lung function and exercise performance. Genetics is a modern science. Therefore, innovation and talent search specially in the genetics has dramatically increased in recent years. Twin methods are useful for determining physiological states in which genetic and environmental factors are involved in different ways such as physique, cardiovascular performance, usual habit, geographic condition etc., because twins share common environmental factors (Kawakami et al., 1980).

In specialist literature we may find a few amount of information on the genetic and environmental conditioning of man's level of lung function and physical fitness. In order to better elucidate the genetic and environmental influence in the determination of individual's lung function and physical fitness, we based our conclusions on the results of cross-sectional investigations of MZ (monozygotic) and DZ (dizygotic) twins. Hence, our observations are restricted to finding out the within-pair differentiation and within-pair correlation of lung function and physical fitness, as present at the time of investigation, in individuals with identical and differing genotypes (Sklad, 1977).

The children with greater physical activity are scheduled to have greater lung function. It has been accepted by the scientists that the lung function during normal growth is enhanced by greater physical activity. This important aspect, i.e., pulmonary function measurement is beneficial not only for detection for respiratory diseases but also for the use in pre-employment and for the detection of sports and state of training (Lange and Mange, 1970; Engstrom et al., 1971; Cotes et al., 1974; Palka, 1982; and Chatterjee et al., 1993).
The athletic traits and characteristics of an individual mainly depend upon muscular strength and endurance, cardiorespiratory functional capacity and endurance, flexibility and motor fitness. Their interaction under a wide range of conditions like genetic inheritance, morphology, personal interest and habitual physical activity also play an important role for the same. In order to determine the genetic/environmental influence on individual physiological status, the young twins are endowed with a series of tests comprising spirometric measurements and alongside physical and motor fitness measurements. This study can give an idea about the genetic versus environmental determination of respiratory disease (Kawakami et al., 1980; Webster et al., 1979) and sports and athletic potentiality (Bouchard et al., 1986; Palamarchuk, 1986; Sklad, 1975; Kagmimori et al., 1984) of an individual.

Anthropometric measurements play on a pivotal role in the physique assessment of an individual. Anthropometric characteristics depend upon genetic and different nongenetic factors. Twin studies of different anthropometric measurements have been reported by some workers of different countries (Bakwin, 1973; Hoshi et al., 1982; Kramer et al., 1986) and of India (Sharma et al., 1984) and they suggested that major anthropometric measurements are genetically influenced variables.

The spirometric measures are most commonly used in the assessment of lung function. The lung function characteristics of an individual may be influenced by the genetic and different nongenetic factors. Genetic studies of lung function have carried out by different investigators. Among them, at first, Jackson (1842) states that occurrence of pulmonary emphysema is higher in parents of patients than parents of healthy subjects. Apparently
genetic factors are responsible, at least partially, for the variability of respiratory functions in normal subjects. Pulmonary function tests of twin pairs are beneficial for detection of genetic role in determining pulmonary mechanics, lung volumes, gas exchange and ventilatory responses to hypoxia and hypercapnia (Kawakami et al., 1980). Analysis of a twin family model reveals that phenotypic similarities in pulmonary function relate directly to genetic similarities, and are consistent with a multifactorial mode of inheritance (Redline et al., 1989).

Several investigators have reported that genetic and environmental studies of different physical fitness measurements. Fagard et al. (1987) stated that at rest, heart rate was found to be genetically determined but cardiac factors were not significantly involved in the inheritance of aerobic power, where cardiac hypertrophy in athletes is secondary to training. Sensitivity of maximal aerobic power to endurance training is largely genotype dependent (Prud'homme et al., 1984). Physical work capacity is a more environmentally influenced variable than either vital capacity or muscular strength (Engstrom and Fischbein, 1977).

Many scientists have demonstrated that age, sex, physical characteristics, physical habit, nutritional and socio-economic status, smoking status, race, ethncity, cultural factors etc. are closely associated with human variation in different lung function and physical fitness measurements (Andersen et al., 1984; Chatterjee and Mondal, 1991; Jain and Ramiah, 1968; Cotes et al., 1979; Krishnan and Vareed, 1932; Patric and Patel, 1986; Chatterjee et al., 1988, 1993; Engstrom and Fischbein, 1977; Astrand and Rodahl, 1970; Monotoye et al., 1972; McMiken, 1976; Gettman et al., 1987). Hence, the normal standards
of various lung function and physical fitness measurements and their relationship with different anthropometric measurements have been reported by many investigators. But, there is still a dearth of investigation of genetic and environmental influence on lung function and physical fitness, dependent or independent of anthropometric relation, in different parts of the globe. Nevertheless, any information did not available in India for the same, but this investigation remains to be explored as yet.

The objectives of the present investigation are, therefore, summarized as follows:

1. To evaluate the genetic versus environmental determination and heritability estimates of anthropometric measurements.

2. To compare the genetic versus environmental influence on lung function measurements independent of anthropometric potency and to assess the heritability estimates of lung function measurements.

3. To evaluate the genetic versus environmental influence on physical fitness measurements independent of anthropometric potency and to assess the heritability estimates of physical fitness measurements.