

## FACTORS INFLUENCING INTELLIGENCE

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**Abstract:** *Genetically, a person actually carries more of his/her mother's genes than his/her father's. The reason is little organelles that live within cells, the mitochondria, which are only received from a mother. Mitochondria is the powerhouse of the cell and is inherited from the mother. These are energy-producing factories of the cell, and without them, a cell can't generate energy from food. On the contrary, the father's genes are more aggressive and gain prominence in manifesting in the person. It is also a known fact that the sex of the baby completely depends on the father as the mother only carries an X-chromosome. Our genetics is determined at the time of conception. Intelligence is inherited from both parents, and each parent contributes to the genetic code to their offspring. Genes do influence intelligence and IQ which are complex traits and are influenced by both genetic and environmental factors. Studies on twins show that individual differences in human intelligence can largely (50%–80%) be explained by genetic influences. Part of this code includes genes for intelligence. The link is due to multiple genes working together to impact several traits.*

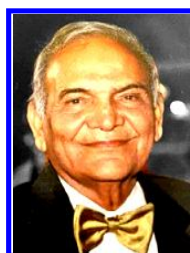
**Keywords:** Intelligence Factors

### INTRODUCTION

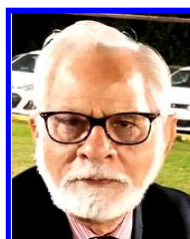
Intelligence is a complex trait that is influenced by both genetic and environmental factors. Studies on twins show that individual differences in human intelligence can largely (50%–80%) are explained by genetic influences [1]. Intelligence is inherited from both parents, and each parent contributes to

the genetic code to their offspring; part of this code includes genes for intelligence. Further, studies have shown that the influence of genetics on intelligence is 50% to 80%. The link is due to multiple genes working together to impact several traits [2,3]

**Factors affecting intelligence:** Intelligence is a complex construct that is influenced by a variety of



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factors. It is always said that Nature and nurture both affect intelligence. Nature refers to heredity and nurture to the environment. At present, researchers agree that individual differences in intelligence are clearly the result of the interplay between genetic factors and the environmental conditions. Intelligence is not determined solely by any one of these factors, but by the interplay and combination of many factors. Additionally, intelligence is a dynamic construct that can change and develop over time. Today, scientists agree that both genetics and environment impact the physical development of the brain and the cognitive development of the mind which ultimately determines intelligence. Our genetics may provide us with an intellectual capacity but our environment determines if we reach our potential.

**Genetics:** No doubt genetics determines intelligence. Brain structure and function depend partly on genetic factors, in other words, the biology one inherits from parents. Much like any variable human skill, the intellect appears to be something that can be exercised and developed: learning languages or an instrument, puzzles or strategy games and regular reading have all been shown to boost IQ. So, is intelligence due to our “nurture”? The answer is also yes [4]. Researchers have conducted many studies to look for genes that influence intelligence. Since it is difficult to separate the genetic and environmental influences of a trait like intelligence, these studies can be complicated. Many of these studies have focused on similarities and differences in IQ within families, particularly looking at adopted children and twins. Other studies have examined variations across the entire genomes of many people (an approach called genome-wide association studies or GWAS) to determine whether any specific areas of the genome are associated with IQ. Studies have shown that intelligence has a genetic component, but they have not conclusively identified any single genes that have major roles in differences in intelligence. It is likely that intelligence involves many genes that each make only a small contribution to a person’s intelligence. Other areas that contribute to intelligence, such as memory and verbal ability, involve additional genetic factors. Intelligence is challenging in part because it can be defined and measured in different ways. Most definitions of intelligence include the ability to learn from experiences and adapt to changing environments. Elements of intelligence include the ability to reason, plan, solve problems,

think abstractly, and understand complex ideas. Many studies rely on a measure of intelligence called the intelligence quotient (IQ). Intelligence is partially influenced by genetic factors. Certain genes may be associated with higher levels of cognitive ability and thus higher intelligence. The genetic influences on intelligence are an ongoing area of research [3].

**Environmental factors:** Genetics can be changed with environmental factors such as good nutrition and strong educational opportunities help optimize brain development [5]. Malnutrition, poor education, and chronic stress can impair brain development. In other words Intelligence is also strongly influenced by the environment [6]. During a child’s development, factors that contribute to intelligence include their home environment and parenting, education and availability of learning resources, healthcare and nutrition. Intelligence is also strongly influenced by the environment. During a child’s development, factors that contribute to intelligence include their home environment and parenting, education and availability of learning resources. A person’s environment and genes influence each other, and it can be challenging to tease apart the effects of the environment from those of genetics. For example, if a person’s level of intelligence is similar to that of their parents. The similarity is due to genetic factors passed down from parent to child which also share environmental factors, or (most likely) to a combination of both? Thus both environmental and genetic factors play a part in determining intelligence.

We may be genetically predisposed to a certain brain volume, structure and pathways — a certain level of intelligence set by our biology — but how much we achieve isn’t based in biology alone. Intelligence is also strongly influenced by the environment. During a child’s development, factors that contribute to intelligence include their home environment and parenting, education and availability of learning resources, and healthcare and nutrition. Environmental factors such as nutrition, stress, and exposure to toxins can impact the development of the brain and therefore affect intelligence. There is evidence that environmental deprivation lowers intelligence while rich nutrition, quality schooling, and good family background increase intelligence [7]. Many clinical studies suggest that breast-fed children score higher on tests of cognitive function than do formula-fed children [8].

**Brain development:** The development of the brain, including the growth of brain structures and the formation of neural connections, can significantly impact intelligence [9].

**Health and well-being:** Good health and overall well-being, including proper nutrition, exercise, and sufficient sleep, can contribute to higher levels of intelligence. A healthy diet will lead to better mental health and intelligence [10].

**Learning experiences:** Formal education and informal exposure to new information and ideas can have a significant impact on intelligence. With new learning and better ideas, the person becomes more intelligent [11].

**Emotional and social intelligence:** Emotional intelligence, the ability to understand and regulate emotions is important. Social intelligence, the ability to understand and navigate social relationships, is also an important component of overall intelligence [12].

### Theories about intelligence

1. Charles Spearman, an English psychologist, developed the two-factor theory of intelligence in the early 20th century. Central to his theory is the concept of the g-factor (general intelligence) and the s-factor (specific intelligence). To explain the differences in performance on different tasks, Spearman hypothesized that the “s” component was specific to a certain aspect of intelligence. The traits that constitute the five-factor model are extraversion, neuroticism, openness to experience, agreeableness, and conscientiousness [13]. Extraversion, sometimes referred to as surgency, is indicated by assertive, energetic, and gregarious behaviours. “The identified intelligences include linguistic, logical-mathematical, spatial, musical, bodily-kinesthetic, naturalistic, interpersonal and intrapersonal [14]
2. Robert Sternberg’s triarchic theory of intelligence describes three distinct types of intelligence that a person can possess. These three types are practical intelligence, creative intelligence, and analytical intelligence. Intelligence quotient is determined by a number of factors which include both genetic as well as non genetic factors. Even though genetic factors play the major role in determining IQ, various other

modifiable environmental influences can influence the IQ of an individual [15].

3. The theory of fluid vs. crystallized intelligence was first proposed by psychologist Raymond Cattell; he further developed it along with his student John Horn. The theory suggests that intelligence is composed of different abilities that interact and work together to produce overall individual intelligence. Fluid intelligence is our ability to learn, assess, and navigate new situations. Crystallized intelligence is accumulated knowledge you can recall as needed. Problem-solving uses both intelligences. Although they’re different, fluid and crystallized intelligence are both equally important and in some ways connected [16].
4. Thurstone’s theory Louis Leon Thurstone proposed a theory in 1930’s that suggests that intelligence is composed of seven primary mental abilities: verbal comprehension, word fluency, number facility, spatial visualization, associative memory, perceptual speed, and reasoning. These abilities are independent of each other [17].

**Twin studies:** The logic behind twin studies is that it allows disentanglement of the shared genetic and environmental factors for the trait of interest. Twin studies are powerful tools to discriminate whether a complex disease is due to genetic or environmental factors. High concordance rates among monozygotic (MZ) twins support genetic factors being predominantly involved, whilst low rates are suggestive of environmental factors.

Researchers can estimate the proportion of variance in a trait attributable to genetic variation versus the proportion that is due to shared environment or unshared environment. To form identical or monozygotic twins, one fertilised egg (ovum) splits and develops into two babies with exactly the same genetic information. To form fraternal or dizygotic twins, two eggs (ova) are fertilised by two sperm and produce two genetically unique children. Twin study allows researchers to examine the overall role of genes in the development of a trait or disorder. Comparisons between monozygotic (MZ or identical) twins and dizygotic (DZ or fraternal) twins are conducted to evaluate the degree of genetic and environmental influence on a specific trait [18]. The Minnesota Study of Twins Reared Apart suggests that intelligence has a genetic component. The

Minnesota researchers found that natural contrasts account for 30% of the IQ variation among twins and that approximately 70% of the variation is due to inherited differences between individuals. Bouchard's research sample comprised monozygotic (identical) twins because they shared 100% of their genes in common. Bouchard's team concluded that while genetics may affect how environmental factors affect development, genetics and environment were influential in a person's development. Early twin studies of adult individuals have found a heritability of IQ between 57% and 73%, with some recent studies showing heritability for IQ as high as 80%. The 244 individual twins' IQ's are normally distributed, with the mean = 96.82, SD = 14.16. The mean absolute difference between twins is 6.60 (SD = 5.20), the largest difference being 24 IQ points. The frequency of large twin differences is no more than would be expected from the normal probability curve [19-22].

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