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Chapter 8

EXPLORING GIFTEDNESS

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INTRODUCTION

No more intriguing and provoked subject is in science as the study of human giftedness. The great attention to this subject is understandable: a poem well written, an extraordinary painting, an overture well played, a brilliant scientific idea, or sports' maneuver have always been attractive. Although studying of giftedness in visual arts and in music is very productive (Clark & Zimmerman, 1983; Winner & Martino, 1993), the greatest body of recent research is in studies of intellectual giftedness (Robinson & Clinkenbeard, 1998).

Intellectual giftedness is a very complex human phenomenon, influenced by factors both biological and environmental, but in different extent during personal development.

The key point of giftedness is novelty. The researchers tend to define giftedness and creative thinking as the combining of previous ideas into new and unusual combinations (Boden, 1996; Ward et al., 1997). That is, to integrate analogies or combinations of ideas that might not be readily apparent, or from the ordinary point of view seem odd or without sense (Ward et al., 1997). But what is actual definition of giftedness?

Before answering on this question, it is important to note (for the purpose of the following discussion), that creation of novel information is the means by which the frontal lobe (especially right frontal cortex – Vandenberhe et al., 1999) operates to achieve executive control over behavior (Duncan et al., 2000; Tanji & Hoshi, 2001).

DEFINITION AND BASIS OF GIFTEDNESS

How is giftedness defined? There is no one agreed-upon definition of giftedness or talent that dominates the field (Robinson & Clinkenbeard, 1998). Most definitions are psychologically based or educationally driven. The earliest and most conservative definition belongs to Terman (1925). He defines giftedness as the top 1% of general intellectual ability. More liberal conceptualization was made by Witty (1958), who tolled about gifted child "whose performance, in a potentially valuable line of human activity, is consistently remarkable". Later Sternberg made the set of conceptualizations where concentration was primarily on the psychological aspects of intellectual giftedness (Sternberg, 1986) or social context in which giftedness is developed (Csikszentmihalyi & Robinson, 1986). This and other sets include as main the following psychological constructs: intelligence, creativity and motivation (Robinson & Clinkenbeard, 1998).

Biological conceptions tend to focus on the heritability of giftedness. Researchers in these investigations still tend to use a high IQ definition. For example, it is well established that the heritability of general intelligence rises with age. Studies comparing identical and fraternal twins show that about 40 percent of IQ differences among preschoolers determined by genetic factor, but that heritability rises to 60 percent by adolescence and to 80 percent by late adulthood (McClearn et al., 1997; Bouchard, 1998). Moreover it has been shown that environments shared by siblings have little to do with intellectual giftedness (Plomin and Petrill, 1997; Petrill et al., 1998). It is a myth that social, psychological and economical conditions create lasting and marked differences in intelligence. Although many environmentalists have always believed that most psychological variability is probably shaped by experiences, those experiences, however, are largely self-selected, and that selection is guided by the steady pressure of the genome

(Scarr, 1992; Lykken et al., 1993) and biological factors of early ontogenesis (Fingelkurts & Fingelkurts, 2000).

These findings suggest the strong biological predisposition for intellectual giftedness. It is virtually guaranteed that more biological linkages will be made (Vernon, 1993). For example, Jensen (1998) has argued that fundamental research needs to uncover biological vertical paths and develop more ultimate explanations for giftedness. We believe, that not only genetic, but also inborn factors are crucial for development of gifted brain. The moderately high genetic contribution to mental and cognitive ability differences supports the search for the *brain's processing* features that can account for these associations (Deary, 2001).

We define giftedness as higher than average efficiency of brain functioning. Such a definition covers all categories of giftedness: general intellectual ability, specific academic aptitude, creative or productive thinking, leadership ability, visual and performing arts, and psychomotor ability (Ross, 1993). The effectiveness of human brain activity is determined by two major factors which "hardwired" with each other. First, is the special organization of individual semantic space, i.e. the system of personal connotations and their interrelations (Winter, 1992; Doise et al., 1993; Hart et al., 1997; Nekolaichuk et al., 1999; Tallent et al., 2001). Second factor is the number of neurons and the density of neuron' networks, which were organized during the prenatal period and which were active during crucial periods (first 4 years of life) of individual development (Kimura, 1994; Rakic et al., 1994; Clinton, 1996; Newman, 1997; Kornack, 2000). Experimentally it has been proven that nearly all aspects of nervous system organization (including cell growth, size regulation, its number, form, and neuron network density) are strongly influenced by androgens during prenatal development and immediately after the birth (Levy & Gur, 1980; Geschwind & Behan, 1982; Geschwind & Galaburda, 1987; Galaburda et al., 1987; Sholl & Kim, 1990; Dempster, 1991; Snyder et al., 1995; Collaer & Hines, 1995; De Bellis et al., 2001).

Thus, the prenatal level of androgens might be the essential link in the organization of the gifted brain.

GIFTED BRAIN AND TESTOSTERONE

According to Geschwind and Behan, if the fetus gets an increased dosage of testosterone during the crucial period (!) of prenatal development or if it is more sensitive to this hormone, then the brain of such a fetus starts to develop the right nondominant hemisphere more intensively (Geschwind & Behan, 1982); but in ordinary conditions the left hemisphere develops faster and stronger (Thatcher et al., 1987). It has been suggested that the left hemisphere in humans has a very strong potential to manifest its dominant abilities (Annett, 1997). At the same time, in order to give equal opportunity in the dominant competition, – there must be special conditions allowing the peculiarities (morpho-functional) of right hemisphere forming (Bogdanov, 1997; Fingelkurts & Fingelkurts, 2000). Annett suggests the right shift (RS) theory according to which normal human cerebral specialization (left dominance) is caused by a gene with the instruction to impair the right hemisphere (Annett, 1978; Annett, 1997). On the basis of meta-analysis she noticed that expression of the rs+ gene is more effective in females than in males and less effective in twins than in single born children (Annett & Alexander, 1996). Moreover, this disadvantage for rs+ gene leads to high intelligence (Annett, 1999). This suggests that the expression of the rs+ gene might depend on factor(s) influencing cerebral maturation in early fetal life (Annett, 1996). Evidently, these studies are consistent with the idea that testosterone may be such factor which suppress the rs+ gene expression.

Selected influence of testosterone on the right hemisphere is explained by a significantly higher average concentration of androgen receptors (AR) in the right hemisphere compared to the left (Diamond, 1991). At the cortical level, the right frontal area is in many of those areas, which significantly overloads the left cortical areas by numbers of AR's (Sholl & Kim, 1990). This irregularity in AR density across the human brain is shown only in males. Evidently, the described particular development of morpho-functional brain organization must strongly influence the human cognitive abilities (Hellige, 1993; Halpern, 2000). This data is in agreement with the results of the research of Levy and Gur, which show that an increased level of embryonic sex hormones lead to the faster maturation and cognitive development of the right brain hemisphere only (Levy & Gur, 1980). Moreover, a high level of testosterone establishes the special relation

between the two brain hemispheres of the embryo (Galaburda et al., 1987; Geschwind & Galaburda, 1987; Collaer & Hines, 1995). This means an extremely high coordination and distribution of the brain cortical resources within and between the hemispheres (Alexander et al., 1996). These processes most likely result from unusually strong developed corpus collosum (Habib et al., 1991), which probably compensates for the unusual dominance of the right hemisphere. All these supposed to be the causes for intellectual giftedness (Benbow, 1986; O'Boyle et al., 1995; Alexander et al., 1996; Fingelkurts & Fingelkurts, 2000; Fingelkurts & Fingelkurts, in submition).

Recent research has shown that testosterone (and estrogen) continue to play critical role in cognitive abilities even throughout the human life span (Halpern & Tan, 2001). For example, the spatial skills of normal males fluctuate in accordance with daily variations (Moffat & Hampson, 1996) and seasonal variations (Kimura & Hampson, 1994) in testosterone levels. It has been also shown the cognitive consequences of testosterone replacement therapies: testosterone treatment in men with naturally low levels improved both their spatial and verbal performance (Cherrier, 1999). Additional support for the role of testosterone levels in cognitive functioning comes from unique studies with female-to-male transsexuals, who were given high doses of testosterone in preparation for sex-change therapy (Van Goozen et al., 1995).

Taking into consideration all that is mentioned above, it is possible to conclude that *the brain of a gifted person is organized differently* than the brain of people with average abilities (Alexander et al., 1996; Halpern et al., 1998).

HOW DOSE RIGHT BRAIN HEMISPHERE RELATE WITH GIFTEDNESS?

The hypothesis about unusual brain organization of gifted person is strongly confirmed by the longitudinal investigation of O'Boyle' group (O'Boyle et al., 1995). Using many experimental methods this group has shown that increased involvement of the right brain hemisphere (and a special level of coordination of information resources between the right and the left hemispheres) in the process of insurance of higher psychic

functions is *directly* related with intellectual giftedness and may serve as a physiological basis of giftedness (Alexander et al., 1996).

Authors have used operational notion of giftedness. All intellectually gifted subjects had maximally high scores of common test SAT (Scholastic Aptitude Test). Extremely high scores were observed in SAT-M (Mathematical part). Scores in SAT-V (Verbal part) were slightly lower. Nevertheless these SAT-V scores significantly exceed the analogous scores of subjects with averaged abilities, and females too! (O'Boyle et al., 1995). "This highly selected talented [subjects] performs as well as college-bound high school seniors on tests used for college admission, despite the fact that they have not taken the advanced course work that is provided in high school" (Halpern et al., 1998, p. 91). It is mean that their high scores do not indicate that they are exceptionally good at the recall of factual knowledge, "[…] instead, they are 'creating' or 'discovering' new knowledge on their own" (Halpern et al., 1998, p. 91).

These findings are consistent with the data of another research group that showed that "there is indeed generality in human intelligence in a wide range of talent. That is, common […] processes run though mathematical, spatial, and verbal abilities, […]" (Humphreys et al., 1993, p. 254). This is actually the concept of "general intelligence" or *g*, according to which people performing better on one task will tend also to perform better on another (Deary, 2001a). It is important that *g* may reflect the function of some particular information processing system, contributing in part to the organization of many different activities and hence producing some positive correlation between them (Duncan et. al., 1996; Deary, 2001b). Moreover, it was postulated that in large part *g* reflects the action control functions of the brain's frontal lobes (Duncan et. al., 1996; Duncan et al., 2000). In our investigations it has been shown that behavioral functions (memory retrieval and encoding, attention) reflected in *g* arise from joint or cooperative activity in a variety of distinct frontal systems, i.e., through a so-called "operational synchrony" of different neuronal systems (Fingelkurts, 1998; Fingelkurts et. al., 1998; 2000).

The evaluation of functional states (FS) of the frontal cortical areas is significant, because it has been shown that the synthesis of two types of information – current and retrieval – which create the basis for the emergence of subjective feelings (Ivanizky, 1997), takes place in frontal cortex (Crick & Koch, 1995; Goldman-Rakic, 1996). It has been well documented through experiments using EEG, PET and fMRI that frontal

cortical areas play the main role in the mechanisms which provide and regulate working memory (Stuss et al., 1982; Goldman-Rakic, 1996), and conscious perception (Crick & Koch, 1995). It is supposed that information stored in the temporal and parietal cortex, is reread on the neurons of the frontal cortex (Goldman-Rakic, 1996).

Therefore, frontal asymmetry with the dominant right cortical area is supposed to be the *physiological marker* of a "gifted brain" (Fox et al., 1988; O'Boyle et al., 1991; Bell and Fox, 1992; O'Boyle et al., 1995; Fingelkurts & Fingelkurts, 2000). It is interesting that patients with the left-sided temporal lobe variant of frontotemporal dementia (FTD) showed the emergence of visual and musical talents (Miller et al., 2000). Evidently, these studies are in consistent with the idea that for facilitation of new skills and talents the dominance of right frontal area is very important (Fingelkurts & Fingelkurts, 2000).

It is well established that the right hemisphere (and frontal area in particular) is primarily responsible for nonverbal image thinking, formation of associations using nonlinear principle, unconsciousness functions, and for higher emotions (Nakamura et al., 1999; Sidorova, 2000; Fingelkurts & Fingelkurts, 2000). These are the exact functions necessary for the realization of the creative process and of scientific insight. It is generally accepted that the new ideas and artistic images are not the result of someone observations and reflection, – they come to the mental sight at once in complete internal integrity. The reports of highly creative people about their thought processes suggest that a great part of their cognitive work goes on "underneath", beyond the conscious control of the person (Ghiselin, 1952; Dorfman et al., 1996; Monsay, 1997). Many scientific discoveries have come to their creators' as momentary intuitive knowledge (e.g. the discovery of periodic system of elements by D.I. Mendeleev or the structure of benzol ring – by F.A. Kekulé), which were only systematically proven after the fact. Perhaps the unconscious nature of these early stages in the creative process serves to protect the birth of a hypothesis and new ideas from the conservatism of consciousness (Fingelkurts & Fingelkurts, 2000). A similar phenomenon can be observed, for example, in the reports of split-brain patients when information presented to the right hemisphere (Koriat & Levy-Sadot, 1999; Koriat, 2000).

An intriguing case study has been conducted by Anderson, who studied Albert Einstein's brain (Anderson & Harvey, 1996). In contrast to a control group of autopsied men, the *right frontal cortex* of Enstein's brain possesses a significantly greater neuronal

density! Thus, it has been suggested that dendritic arborization is correlated with *g* and giftedness (Anderson, 1993). Moreover, it was shown that reversed hemisphere dominance (right) is related with musical talent and left-handedness (Hassler & Gupta, 1993).

ARE ALL MALE-TWINS GENIUS OR ALL GENIUS ARE MALE-TWINS?

Among gifted subjects the proportion with dominant left hand is higher than among subjects with averaged abilities (Geschwind & Behan, 1982; Benbow, 1986; O'Boyle & Benbow, 1990). But percentage of left-handers is higher among the twin population than among single-born individuals (Dobrohotova & Bragina, 1994; Derom et al., 1996; Neimark, 1997; Segal, 2000). This has caused some researchers to postulate that the majority of single-born people with a dominant left hand (including "hidden" left-handed and non-right-handed) are survivors from a twin-set (Neimark, 1997).

Furthermore, it is possible to hypothesis (Fingelkurts & Fingelkurts, 2000) that male-twins during prenatal development have an increased exposure to testosterone that leads to a more complicated (see above) development of the right hemisphere which becomes dominant. These peculiarities of male-twins development result in potential giftedness. However, male-twins rarely realize this potential due to unfavorable *socio-psychological* conditions during postnatal twins development. This hypothesis was described in detail elsewhere (Fingelkurts & Fingelkurts, 2000; Fingelkurts & Fingelkurts, in submition). Hence, among gifted males there may exist a high percentage of twins "by conception" (only one from the embryonic MZ twins' pair is usually born), because in such cases the biological basis for high intelligence was present, but the negative factors of joint twins' postnatal (socio-psychological) development were absent. However, this point could only be proven through specially organized investigations.

SOCIAL CONTEXT OF GIFTEDNESS

These findings support the believe that the social context of giftedness includes the opportunities that make it possible for gifts and talents to develop (Robinson and Clinkenbeard, 1998). An exceptional example of the social and cultural importance is found in child prodigies (Feldman and Goldsmith, 1991). According to Feldman, prodigies occur when several factors "co-incide" to provide optimal conditions. These factors are the extraordinary abilities of the child, the development of the domain in which the prodigy excels, the family context and learning opportunities (Feldman, 1993).

Here it is important to stress that social context is important only in early stages of individual development when cognitive and other mental processes (including the individual semantic space with personal constructs) are organized (Kimura, 1994; Rakic et al., 1994; Clinton, 1996; Newman, 1997; Fingelkurts & Fingelkurts, 2000). These processes are associated with neurodevelopment (De Bellis et al., 2001). Cross-sectional studies suggest that cerebral gray matter (GM) volume decrease progressively after age 4 (Pfefferbaum et al., 1994; Reiss et al., 1996), in relationship to the regressive progresses of synaptic and axonal pruning during development (Giedd et al., 1999a). Recent results have confirmed these age-related increases in cerebral white matter (WM) and corpus collosum (CC) area (Giedd et al., 1999b; Thompson et al., 2000). It is interesting that both WM and CC normally are more developed in males (De Bellis et al., 2001).

It has been also shown that neuronal synapses are grow stronger with regular stimulation in crucial periods of ontogenesis (Rakic et al., 1994; Clinton, 1996; Newman, 1997), suggesting that an environment rich in variety, stimulation, and activity may be helpful background for development of intellectual giftedness. We don't assume that genetic and biological architecture of brain functioning is the same in infants, teens and adults. Recent studies suggest that in children brain functioning is more sensitive to environmental influences than to genetic factors and vice versa (McClearn et al., 1997; Newman, 1997; Bouchard, 1998). But environmental factors could be biological, – and the testosterone is one of such factors (Fingelkurts & Fingelkurts, 2000).

Here we stress that social and cultural context are heavily influenced by and even limited by human's biological nature. Any cultural characteristic takes as a given, as a starting point, the biological innate characteristics. Many of these characteristics are exist

in potential form and can be realized only in interaction with environment. “For example, imagine how different all human societies would be if our biological nature was different in any of the following […]:

(a) Suppose all human females had an annual estrus cycle leading both males and females to be interested in sexual relations only during several weeks in June. […]
(b) Or imagine the impact on family structure, as well as marriage partnerships and their duration if human infants could care for themselves and live independently after their first year of life.
(c) Or suppose that humans typically gave birth to litters of six to ten infants at a time.
(d) Or consider the consequences if human males sought a solitary existence, apart from other males as well as females, except during the mating season.
(e) Or suppose both males and females could reproduce at any age in their lifespan” (LeCroy & Moller, 2000, p.5).

Support for this idea we can found in Schneider et al’s (1995) attraction-selection-attrition (ASA) model and gravitational hypothesis (Wilk & Sackett, 1996; Dunnette, 1998). The basic idea of these studies is that people select environments congenital to their personal *innate* attributes and shift from those environments that are not good fits. This is in agreement with Scarr (1992, 1996; Scarr & McCartney, 1983) who has developed the theory of genotype-environment (GE) correlations. According to this framework, people (especially as they mature) seek out or strive to create environments for themselves – environments that are congruent with their *innate* personal characteristics, and which, in large part, reflect their abilities, interests, and personality.

PERSONAL ATTRIBUTES OF GIFTS AND THE ROLE OF TESTOSTERONE

One of the common features of gifts is their passion for work. They are exceptional in their fixation on work. This is well known about genius that the sheer amount of time they devoted to their area of excellence (Wilson, 1998) sometimes to the exclusion of other aspects of life (Gardner, 1993). Moreover, it has been shown in longitudinal study that preferences of intellectually gifted individuals are sufficiently crystallized very early in the lifespan (Achter et al., 1999). Additionally, the intellectually talented tend to develop the eventual adult structure of their cognitive and mental abilities at an early age (Lubinski & Benbow, 2000) and appear to think seriously and meaningfully about educational and career choices at an earlier than typical age (Achter et al., 1996). They are exceptionally energetic, have increased focus of attention, and a task orientation, they are strikingly independent and prefer to act (Eysenck, 1995).

It is obvious that exceptional forms of giftedness is "emergenic phenomena" (Lykken et al., 1992), when biological potential find supportive environments. We agree with Jensen (1996) who suggest that:

Genius = high ability x high productivity x high creativity, where (Lubinski, 2000):

Ability = brain information efficiency,
Productivity = endogenous cortical stimulation,
Creativity = trait psychoticism (unconventiaonal ideation)

One can see that all three parts of this equation depend on the brain effectiveness which requires complicated neuronal structures, number of connection between them and degree of myelination (Miller, 1994), requires much energy to function and carries out those functions at a higher speed. As we discussed above, these are properties which depend on testosterone: testosterone controls brain construction and maturation (Levy & Gur, 1980; Geschwind & Behan, 1982; Collaer & Hines, 1995; De Bellis et al., 2001), high testosterone levels increases energy, focus of attention, and task orientation (DePaulo, 1992; Dabbs et al., 2001), and also influences expressive behavior (Ambady et al., 1999, 2000). Moreover, high testosterone individuals are oriented toward action (Dabbs et al., 1997) and are strikingly independent (Strong & Dabbs, 2000).

PROBLEMS ACCOMPANYING GIFTEDNESS

Unfortunately there is the back side of the same (giftedness) coin. The owner of intellectual gifted brain has a significant number of accompanying problems, – a so-called "physiological price" (Fingelkurts & Fingelkurts, 2000). The "physiological price" may be defined as the volume of the physiological and psychological expenditures, which provide the normal vitality on the given level. It has been demonstrated that increased levels of testosterone in the critical period of human prenatal development, leads not only to the development of the right hemisphere and as a consequence – to intellectual giftedness, also have a negative influence on the thymus gland. This leads to the increased risk of the immune disorders, such as allergic and autoimmune reactions (Geschwind & Behan, 1982; Benbow, 1986). For example, it was shown significant correlation between the giftedness and myopia (Ashton, 1983). This data were confirmed in recent research. Approximately 10.000 gifted students were tested. It was shown a relation of myopia with giftedness (Lubinsli & Humphreys, 1992). Also it was shown the positive correlation between giftedness and allergy, when a child reported being told by a physician that he or she had an allergy (Lubinsli & Humphreys, 1992). It is interesting that the autoimmune diseases are more prevalence in MZ twins (Jarvinen et al., 1992) and associated with non-right-handedness (McManus et al., 1993).

Moreover, gifted people are also frequently suffered from depression or depressive episodes (Post, 1994). This is in agreement with findings which showed the increased involvement exactly of the right frontal area in ongoing activity and decreased involvement of the left (the diagnostic criteria was EEG) in depressive subjects (Hitt et al., 1995). However, it has been shown that right frontal activation is related to coping strategies in men when depressed, while left frontal activation is related to coping strategies in females (Nolen-Hoeksema, 1987). For instance, highly defensive men are more likely to isolate themselves, whereas highly defensive women are likely to do opposite (Kline et al., 1998). These findings suggest that gifted individuals might prefer solitary activities, which on one hand may represent a defensive coping strategy, and which on the other hand, may also help them to be creative. Several studies have

attempted to prove that extremes in mood are linked with creativity (Jamison, 1989, 1993; Post, 1994).

The highly creative people are also known to be difficult in interpersonal relationships, socially harsh, and abrasive (Lubinski, 2000). This supports Eysenck's view that highly creative are, on average, high on trait psychoticism (Eysenck, 1995). For example, it has been shown that highly gifted students showed greater negative affects, more physiological stress, self-oriented perfectionism and greater irrational beliefs (Roberts & Lovett, 1994). It is interesting that exactly right hemisphere and especially right frontal lobe plays a significant role in the generation of mystical and spiritual experiences (Newberg et al., 2001). It has been shown that the right frontal area "can" pray, swear and curse 'God' even when the "speaking" left cerebral hemisphere has been severely damaged and the patient is aphasic (Joseph, 2001). People, who suffer from periodic episodes of right fontal and temporal lobe hyperactivation, typically have seizures which almost indistinguishable from a trance state (Taylor et al., 1987; Joseph, 1999; Adachi et al., 2000). It is well known that Russian author F. Dostoevsky suffered right temporal lobe epilepsy (Joseph, 2001). He wrote, that when he had a seizure the gates of Heaven opened and he could see angels and even the God (Joseph, 2001).

At the same time, described negative aspects of intellectual giftedness more often occur with left-handed individuals (Benbow, 1986; O'Boyle & Benbow, 1990). Furthermore, left-handers are more frequently present among schizophrenics and epileptics than among the healthy population (Nasrallah et. al., 1981; Ginoyan, 1985, quotes on Dobrohotova & Bragina, 1994). Schizophrenia or schizophrenic features and epilepsy are frequent among gifted people (Post F., 1994). It is interesting that postmortem studies of brain anatomy in schizophrenics, "schizoid" and "shizotypal" people, and individuals with Asperger's syndrome have found reduced cortical volumes of the left hemisphere (Chiron et al., 1995; Bullmore et al., 1995; Weinberger, 1995) and especially in frontal cortex (McGuire & Frith, 1996; Ross & Pearlson, 1996). Described factors provide further indirect support for the hypothesis that among the gifted males there must be a high percentage of left-handed (Geschwind & Behan, 1982; Benbow, 1986; O'Boyle et al., 1995), who are possibly the surviving members of an embryonic twin pair (Neimark, 1997; Fingelkurts & Fingelkurts, 2000; in submition).

However, it has been shown that children with high intelligence (and left-handers) are physically healthier then their coeval with averaged abilities (Lubinski & Humohreys, 1992). The left-handed individuals also experience very quick reversal of pathological states, and slighter reestablishment of brain functions after trauma and disorders (Dobrohotova & Bragina, 1994). Possibly the described peculiarities may be the consequences of the special brain organization (Bogdanov, 1997) and, in particular, the right hemisphere (Fingelkurts & Fingelkurts, 2000).

CONCLUSIONS

Generalizing the data described in present chapter, we conclude that the potential for giftedness is an innate biological feature. Development of a talent is a biosocial issue, and the realization of a talent is a sociobiological issue. Indeed, the innate potential and experience interact and shape our skills, personality and giftedness in particular.

The understanding how does the precocity emerge helps to determine its barriers and to find the ways to cultivate its manifestation. Moreover, it helps to improve the educational system in which now adopted the notion that one curriculum fits all. But true meaning of education is "to provide *all* children with an equal opportunity to learn and develop to their full potential […]. " This means "to lead forth or to bring out something that is potentially present. This involves being responsive to, and building on, individual differences. A one-size-fits-all educational system is not effective and hence not equitable." (Benbow & Stanley, 1996, p. 257).

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