Genes, the environment, and ties between twins

The Twin Method

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The debate over whether our behavior is more strongly influenced by genetics or the environment has been going on for years. One way we can gain insight into their relative impact is by studying pairs of twins

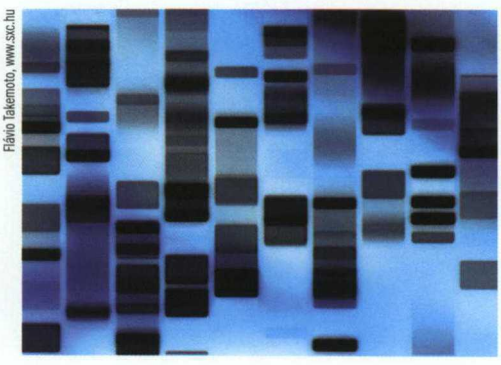
Twins are a special case of siblinghood. They differ from other sibling pairs in that from birth they live and develop alongside an ever-present brother or sister, who shares similar needs and environmental demands. Studying populations of twins offers an opportunity to determine the relative impact of genetic and environmental factors on human behavior, both normal and pathological. Studies of monozygotic (MZ) and dizygotic (DZ) twins brought up together are based on the comparison of phenotypic differences within pairs of MZ and DZ twins. By definition, MZ twins are genetically identical; therefore any differences between them are a result of environmental influences. DZ twins share half of their genes; therefore phenotypic differences can be explained by influences of both genetic and environmental factors. If the environmental influence on twins in both groups is equivalent, then the greater similarity between MZ twins compared with DZ twins suggests a genetic basis to the studied behavior. A variation of this "twin method" involves comparing twins brought up together/separately (if twins living in different environments share common traits, it follows that genetics is decisive in influencing behavior).

Polish twin studies started in 1991 with the Polish-German twin research program (*the Bielefeld-Warsaw-Twin Project*) led by Jan Strelau from the University of Warsaw (Poland) and Alois Angleitner from the University of Bielefeld (Germany). Between 1991-1994 we studied a total of 27 personality traits in adults, and in later years also in children.

Genes vs. environment

Today it seems that 40% of the variability in personality features can be ascribed to genetic factors, 60% to the environment. When studying the influence of these factors on human behavior, much depends on the life phase under examination. Our studies have shown that individual personality variations in adults can be explained more by specific environmental factors than by genetic ones. However, studies in children have provided a different result. In children genetic influences explain most personality variations, while environmental factors are of lesser importance.

Personality can be said to be determined by both genetic factors and shared environment (this refers to the set of elements characteristic to the given family, either biological or adoptive, that cause similarities among family members), as well as by the specific environment (the life history of the individual - his personal characteristics and experiences linked with the family as well as gained outside of it). Results of most studies indicate that the greatest factor in the total variation in characteristics is the specific environment. It is possible, however, that certain per-



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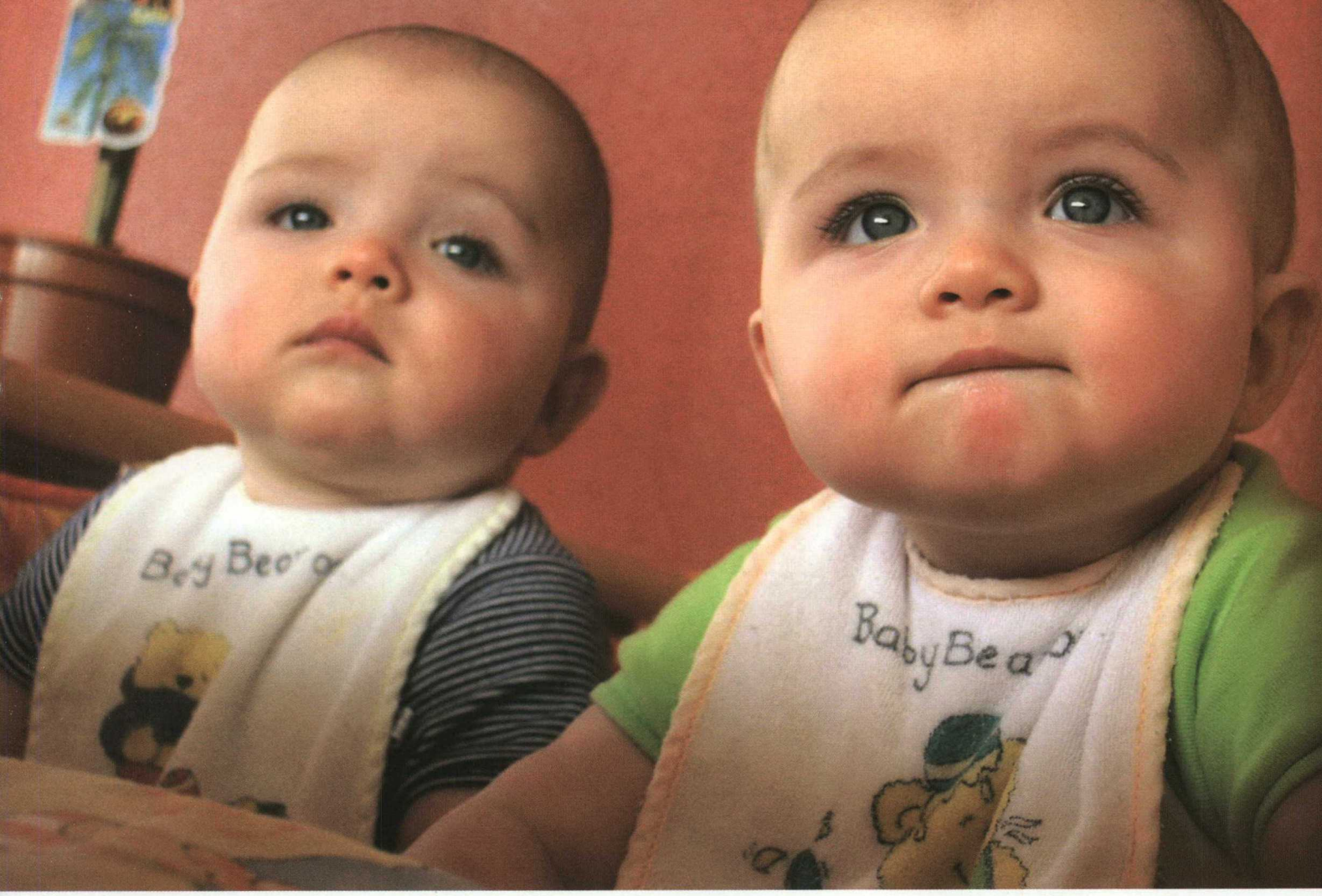
DNA-based research indicates a relationship between polymorphisms of various genes and several personality traits (temperament)



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sonality traits are determined more by the shared than specific environment. This is where studies involving MZ and DZ twins are of great importance.

Religion in the genes

Using twin studies we investigated the influence of genetic and environmental factors on an individual's behavior. We have shown that genetics can be used to explain certain aspects of mental health, such as psychological discomfort or being in a good mood. Genetic factors also determine the style of dealing with stress and the subjective intensity of life changes. For example, genes influence levels of hormones such as adrenaline and cortisol, secreted at times of stress. They also determine fear levels in stressful situations, levels of lipids in blood plasma, and blood pressure.

Interestingly, recent studies on twins point to an influence of genetic factors on social and political attitudes, and even religious fundamentalism, whereas earlier studies had suggested the influence of shared environment.

For the past five years we have been conducting research based on DNA analysis, which represent something of an extension of the twin studies research. Our results indicate that polymorphisms in various genes is related to many personality (temperament) traits, such as liveliness, sensory sensitivity, emotional reactivity, endurance, activity, anger, neuroticism and conscientiousness.

Common genes

Twins are interesting to researchers not only because of the opportunity to observe the influence of various factors on an individual's behavior and development, but because it is also intriguing to study the shaping of emotional bonds between siblings or between them and other society members, as well as to analyze the role of genes and shared environment in the formation of these bonds.

Twins provide researchers with a very interesting opportunity to observe the influences of various factors on individual behavior and development. It is also extremely interesting to research the shaping of emotional bonds between siblings and other members of society

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Everyone's personality is determined by both genetic factors and by shared environment

The awareness of full genetic commonality may be one of the most important factors influencing the formation of bonds between monozygotic twins. The second most important factor is the shared (family) environment. Dizygotic twins, just like ordinary siblings of the same or different sexes, share half of their genetic material. However, they develop from birth accompanied by a brother or a sister. In the case of ordinary siblings, the age difference means that the next child is born into a family environment which is already different, and the older child has a certain "advantage" over the younger, resulting from personal experience.

Sibling roles

Many studies into twin sibling relations indicate that twins may take distinct positions in their (often asymmetric) interactions and play roles that complement each other. Role division seems to be of great importance to their development during childhood and adolescence. It prevents conflict, facilitates cooperation, and also fosters a sense of being distinct from the other twin, shaping separate personalities linked to these roles.

For example, one such a relationship involves domination and submission. Hanna Ebeling and colleagues from Oulu University in Finland have demonstrated that school-aged and adult male twins are usually more physically dominating than female twins. However, female twins were shown to be more dominating during preschool and school years (especially psychologically and verbally). The differences usually disappear by adulthood, and the majority (around 81%) of twins between the ages of 22–30 had similar dominating tendencies. If psychological submissiveness develops in one of the twins during this life stage, it may lead to depressive disorders, neurological ailments, and psychosomatic

symptoms. Interestingly, females are more likely to show submissiveness towards a twin brother. Submissiveness of a sister towards a sister, or a brother towards a brother or sister, is very stressful. However, individuals dominating in same sex pairs have shown a greater nervous tension than the other twin. Such an excessively asymmetric domination/submission relationship may be a source of stress. Frequently it reflects existing social or health-related problems (twins who experienced medical problems during or soon after birth turn out to be more likely to be submissive).

Broken bonds

Twins often feel they will never be lonely in life, and so they experience the loss of a twin brother or sister in a specific way. Death of a twin sibling at any age results in a feeling of being orphaned and having lost a constant life companion. Many researchers feel that the effect of such a broken bond on the remaining twins is not fully appreciated. Twins bereaved during childhood sometimes attempt to recreate their relationship with their twin, tightening bonds with other children and selecting friends who in some way remind them of their lost sibling. Grief for a lost twin is a very intense experience and difficult to adapt to. Sometimes they a surviving twin does not want to live any longer than their lost brother or sister. According to Nancy Segal from California State University, Fullerton, twins immersed in grief (the younger the twin, the more intense the grief) experience suffering much more strongly than others. MZ twins have a greater sense of responsibility for the death of their sibling. The death makes them aware of their own fragility and inclines them towards preoccupation with their own health.

Twins' friends

Many suspect that ties betweens twins are so close they practically eliminate the need to form relationships with individuals outside of the pair, which might incline them towards social isolation and make the process of social adaptation more difficult. Twins (especially MZ) do in fact spend a lot of time together and engage in social activities together. Apart from genetic factors this is influenced by such things as sharing a bedroom, playing the same role within the family, attending the same class at school, etc. Australian researcher Karen Thorpe from the Queensland University of Technology in Brisbane and her British collaborator Karen Gardner from the University of the West of England in Bristol studied friendships formed by twins. Working with a group of twins 6-12 years old they determined that the number of shared friends depends on the type of twins. MZ twins shared around half of the same friends, same-sex DZ twins shared around 25%, and different sex DZ twins only around 5%. The last result comes as no surprise - at that age gender is of great importance in developing friendships. Interviews conducted with children have shown that twins who are most alike (MZ) were also most positive and accepting of mutual friends. Answers of same-sex DZ twins varied. At times they even expressed negative feelings towards each other's friends. It seems that bonds between twins may be stronger than between other sibling pairs. However, this information comes mainly from reports of the twins themselves, which is of limited research value. Few studies verify this hypothesis empirically. What occurs between twins is more likely to be felt than known... ■

Further reading:

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