

many twins can be correctly determined by responses to simple questions (e.g., Are you as alike as two peas in a pod?), not all peas are precise duplicates and some that seem so may hide essential discrepancies.

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Finally, MZ twins' faces may be windows into features associated with human reproductive fitness. This is illustrated by the creative efforts of Australian researchers who linked MZ twins, facial appearance (physical attractiveness, specifically) and evolutionary psychology (Mealey et al., 1999). The study was a test of fluctuating asymmetry (FA), defined as departure from left-to-right body consistency. FA has been assessed by sidedness differences in wrist circumference, facial width, ear length and other measures. Greater FA is believed to reflect developmental instability associated with stressful biological and

environmental events. Greater body symmetry (reduced FA) is an established correlate of physical attractiveness. A recent controversy has been the extent to which FA may be a marker of reduced biological fitness (ability to produce viable children). Studies concerned with relationships between physical attractiveness and body symmetry have not, however, controlled for various factors linked to attractiveness, such as age and skin tone — until now.

The research team capitalized on the availability of standardized photographs of MZ twins to further explore physical attractiveness – facial symmetry relationships. Photographs were cut and reconstructed to obtain Left-Left and Right-Right composites of each co-twin. Judges indicated if the two facial composites were more similar for Twin 1 or for Twin 2. This response provided the measure

of which co-twin was more symmetric/asymmetric. Judges also rated the similarity of each Left-Left and Right-Right composite. This rating provided an index of facial symmetry between pairs. A different panel of judges then assessed the physical attractiveness of each individual twin, relative to his or her co-twin. Major findings were that (1) the more symmetric twin was viewed as more attractive physically and (2) the size of the co-twin difference in physical attractiveness was related to the size of the difference in facial symmetry. These findings pave the way for further analyses along these lines. It would, for example, be important to know if the less symmetric MZ co-twin were less healthy, less likely to reproduce and/or less successful in other life history domains relevant to biological fitness.

Research Reviews

Male-Female Twins in Utero

There has been renewed interest in male-female twins as a model for determining if, and how, prenatal exposure to cross-sex hormones affects physical and behavioral development. This interest has been inspired by a wealth of findings from the non-human literature. Studies of mice (Kinsley et al., 1986) and gerbils (Clark & Galef, 1994) have reported increased masculinization of the behaviors of females positioned between male fetuses in utero. Other evidence comes from opposite-sex cattle twins that display the well-known freemartin effect in which female co-twins become sterile (Miller, 1994). Findings are mixed with respect to humans, but the weight of evidence does not appear supportive.

Most behavioral researchers are, however, aware of the difficulty in disentangling possible prenatal hormonal influences from social-interactional effects. Elsewhere, I have suggested that this might be accomplished by

contrasting the behaviors of same-age opposite-sex unrelated siblings (children adopted as infants into the same family who share rearing environments, but not prenatal environments) with opposite-sex twins reared apart from birth (twins adopted separately as infants, who share prenatal environments, but not rearing environments) (Segal, 2000). The only research more fully supportive of the prenatal hormonal exposure hypothesis found reduced frequency of spontaneous otoacoustic emissions (SPOEs: continuous tones in the inner ear intended to amplify the volume of weak sounds to make them audible) in females with twin brothers, relative to other female twins and non-twins (McFadden, 1993). Female twins did not differ in SPOE frequency relative to their twin brothers. This pattern of findings is difficult to reconcile with reference to the twins' social relations or rearing.

Recent work by Danish investigators has extended this work (Gaist et al., 2000). Middle-aged twins completed tests of handgrip strength,

height, weight, body mass index and weight circumference. Values were comparable among DZ same-sex, DZ opposite-sex and MZ twin pairs, thus contributing to the body of non-supportive evidence.

Transsexualism in MZ Female Twins

MZ twin concordance for a rare behavior may encourage researchers to rethink current explanations. Female transsexualism is estimated to occur in approximately 1 in 100,000 women; thus, the identification of an eighteen-year-old apparently MZ female set concordant for this condition was of interest (Sadeghi & Fakhrai, 2000). (The twins' zygosity was based on their identical appearance, but was not confirmed by objective testing.) The first twin who drew medical attention to the case indicated a desire for male activities and attire beginning at age three. In her social relations with other females she fantasized the role of male dating partner. She believed she was destined to have been male and requested surgery for

sexual reassignment. Her twin sister expressed similar feelings. Both twins showed borderline intelligence, and neither were considered delusional. Physical examinations indicated normal female development. Their admission to a psychiatric institution for evaluation was upon request and they were discharged following the initial visit. They were unavailable for follow-up.

The twin literature on transsexualism reviewed in this paper reveals a series of scattered case reports. Most appeared in the 1970s, although one appeared in 1992. Among them are several MZ male and female sets, both concordant and discordant for transsexualism. According to the authors, most explanations of transsexualism have ignored genetic factors while focusing on sex of assignment and rearing. This most recent report does

not allow definitive conclusions as to the etiology of the condition, but rekindles interest in possible genetic explanations.

Twin Parenting Stress

Parenting young twins is known to be stressful, but specific pre- and postnatal determinants continue to warrant investigation. The central aim of a recent Belgian study was to determine whether parenting stress in mothers of twins can be predicted by their prenatal and postnatal well-being, marital support, social support and presence of other children in the family (Colpin et al., 2000). Researchers interviewed forty mothers at two key time points: 27 weeks into the multiple pregnancy and one year following the twins' birth. The General Health Questionnaire (GHQ-30) was completed by partici-

pants at both interviews, while the Parenting Stress Index (PSI) was administered during the second interview only. Mothers had a mean age of 31 years which was characteristic of mothers of multiples in the surrounding area.

Major findings were that (1) parenting stress one year after the birth of twins was predicted by mothers' personal well-being and marital support at the 27th gestational week, and (2) social support and the presence of other children in the family were not significant. These data offer meaningful guidelines to better prepare families for managing the challenges of raising twin children. In particular, the investigators urged setting aside quality time for self and spouse, and providing spouses with instructional materials.

Twin Stories

Clones: From One to Three

Now that farm animals have been cloned a key question is whether they can reproduce successfully. This ability would offer important advantages for both farmers and consumers. Matilda, Australia's first cloned lamb, just acquired the second distinction of being a mother of triplets ("Cloned lamb", 2001). Immature eggs were retrieved from Matilda when she was three months old, matured in solution, fertilized in a laboratory and gestated by six surrogate mothers, three of which became pregnant. Most lambs do not reproduce until age two so obtaining eggs at earlier ages would allow more efficient breeding. This process was made possible by JIVET (Juvenile In Vitro Embryo Transfer).

Note: Given that the three infants were gestated by different animal mothers, it could be argued that they are not truly triplets because they did not share their intrauterine environment.

A Twin Athlete Lost

Eighteen-year-old freshman twins, Devaughn and Devard Darling, played football for Florida State University, in Tallahassee. On February 26, 2001 Devaughn collapsed and died during an early morning workout session ("Autopsy of Seminole", 2001). His teammates, but not his coaches, were aware that he had experienced chest pains during previous practices. The exact cause of death has yet to be determined. Twin loss is a sorrowful event for surviving twins and family members (Segal, 2000). It may be compounded by unique consequences variously associated with the twins' appearance (e.g., living identical twins may be painful reminders of lives that were lost) and age (e.g., birthdays often become days of mourning). This case may prove especially difficult because Devaughn's twin brother, Devard, was witness to this tragedy.

Note: The zygosity of the Darling twins was not indicated in press reports. I learned that Devard (wide receiver) is six feet, three inches tall

and weighed 195 pounds, while Devaughn (line backer) was six feet, two inches tall and weighed 220 pounds (Online). According to a standard physical resemblance questionnaire, their heights are consistent with MZ twinning, but their weights are consistent with DZ twinning (Nichols & Bilbro, 1966).

Another Twin Perspective on Cloning

The debate over the relative similarity of MZ twins and clones continues. In an insightful essay on the implications of cloning for social science and society, Dr. Alan Krueger, Professor of Economics at Princeton University, noted that MZ twins would be more alike because "they receive the same mitochondrial DNA from the mother's egg" (Krueger, 2001). This would be true if adult donors used enucleated eggs donated by a surrogate, but not if she used her own. Furthermore, adult donors and clones would not be subjected to the stresses and strains of twin gestations that can leave MZ co-twins with lasting physical and/or behavioral differences.