

Opposite-Sex Twins: When They Marry; Research Reviews: Familial Twinning, Twin Study of Food Neophobia, and Monozygotic Twins Discordant for Phenotypic Sex; Human Interest: The Cave of Romulus and Remus, Twin Politicians in Poland, and Parents of Twins in Hong Kong

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A case of opposite-sex co-twins who married one another was recently reported. This case raises questions concerning the bases of mate attraction and adopted children's right to know their biological origins. This overview is followed by summaries of recent studies of familial twinning, food neophobia and monozygotic twins discordant for phenotypic sex. Several topics of general interest are also presented.

Opposite-Sex Twins: When They Marry

Early in January 2008 I received a large number of e-mail messages from colleagues and friends that included links to a remarkable news story (Bell, 2008; CNN, 2008). Reared apart male-female co-twins in Great Britain had met, fallen in love and married. The twins had each been told that they had no siblings.

The identity of the twins and their life history events have been kept confidential, despite attempts by the media to locate them. (I was invited to appear on a television talk show to discuss this case, but the program was cancelled when the producers failed to find the twins.) This event raises important questions concerning the basis of mate attraction, and adopted children's rights to knowledge of their biological origins. However, this extraordinary case is not the first of its kind.

While researching material for my first book, *Entwined Lives* (Segal, 2000), I discovered several articles

documenting marriages between reared apart opposite-sex twins. The first pair, Frederick and Susan Machell, learned of their true relationship in 1985, after 20 years of marriage (Amery, 1985). The Australian twins each knew that they had been adopted, and when they met were amused to discover that they also shared their date of birth; however, there was no reason to suspect that they were related. Eventually, one of their four children was diagnosed with an (unspecified) hereditary condition, resulting in a closer look at each spouses' medical life histories. Each wanted to learn whether a particular side of the family carried the gene for the genetic condition in their affected child.

When unrelated parents carry the same detrimental allele, there is a 25% chance that the associated disorder will be transmitted to a child. When full siblings mate, the chance that a child resulting from their union would be affected is also 25%.

However, the chance that two siblings carry the *same* detrimental gene is much higher than would be the case for unrelated individuals.

Each twin eventually received a letter disclosing the identity of their birth parents and the fact that they were twins. Despite their shock, the couple remained together. The Australian government considered prosecuting them for incest — had that happened the couple claims that they would have left the country.

A second case, first presented at a family therapy conference in Bern, and later reported in the press in 1985, involved a newlywed couple, Marguerite and Hans, from Switzerland (McMillan, 1986). Each knew that they were twins and had

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intended to search for their respective twin siblings. However, their true relationship was revealed after Marguerite showed her husband's aunt a baby photo of herself and her twin brother prior to her adoption at age 2 weeks — the photo was a copy of one that the aunt had in her own home. It turned out that the twin's mother had died, leaving them in the care of this aunt. However, the aunt lacked the financial resources to care for two young children, so she relinquished them for adoption.

Marguerite experienced profound depression upon learning that her husband was her twin. The couple dissolved their 3-month marriage despite strong feelings for one another. They had known one another for only 4 months when they decided to marry.

A third case, reported in 1990, came to light when a mother who had given up her boy–girl twins, Jeannie and Robert, attempted to find them (Beasley, 1990). Years earlier, at the age of 19 years, she had delivered the twins out of wedlock. When the 70-year-old woman finally located her 51-year-old twins, she discovered that they were married to each other and had had several children.

The twins had met when they were 20, unaware that they were part of a multiple birth set. They recalled enjoying the same activities (e.g., writing poetry), and feeling very surprised to learn that they were both adopted and born on the same day. They had three children, two boys and a girl.

News of their twinship was revealed only because their mother had decided to find her children. She located records showing their name, dates of birth — and who they had married. Realizing that her son had married his sister, she reported her discovery to the records clerk who informed the police. Two weeks later, Jeannie and Robert were visited by police who claimed that the couple was under investigation for incest. Demands for their divorce were issued, but they remained together.

It is possible that other separated opposite-sex twins have unknowingly married one another, but that news of these unions was kept quiet. It is also possible that some separated opposite-sex twins are happily married and may never learn the truth about their biological connection.

There is information to be learned from the events in these twins' lives. First, co-twins in each pair were strongly drawn to one another. In the world of adoption, this phenomenon has been termed genetic sexual attraction (GSA; Gonyo, 1987). More specifically, it refers to the powerful feelings of attraction experienced by some separated biological mothers and sons, fathers and daughters, and brothers and sisters toward one another, following reunion. Such individuals would not have experienced the Westermarck Effect, the feelings of sexual aversion that eventuate when young male and female children are brought up together, or when children are raised from birth by an opposite-sex parent (see Bridgeman, 2003). Studies have, for example, shown an absence of romantic attraction among males and females raised together in an Israeli kibbutz (Shepher, 1983). Otherwise known as the incest taboo, it is believed that this process lays the psychological basis for matings with individuals who differ genetically from the self. This would have the beneficial effect of avoiding the transmission of the same detrimental recessive alleles (e.g., genes coding for Tay-Sachs disease or for phenylketonuria) to offspring who would then express the trait.

No-one has studied sexual attraction between reunited opposite-sex twins. Systematically documenting their feelings toward one another at the time of reunion, and beyond, would clarify the nature and development of their relationship. Researchers have already reported positive assortative mating between couples for a number of physical and behavioral traits, for example, intelligence, education and

traditionalism (Plomin et al., 2001). It is, therefore, possible that male and female co-twins' perceptions of their similarities might drive their newly found relationship, placing it into a romantic context.

Marriages between opposite-sex twins raise other timely issues. In December 2007, Professor Lord Alton of Liverpool, who discovered the British case, addressed members of the House of Lords during a debate on laws concerning human fertility and embryology. Alton believes that adopted children should be fully informed about the identity of their biological parents. He is concerned that other separated sets of twins and siblings might marry and raise families if they are unaware of their origins. Several adoption groups believe that the recent twin case highlights the need for openness during adoption. In fact, many children conceived through sperm donation show intense interest in finding their biological father (Plotz, 2006). However, confidentiality policies surrounding adoption processes, as well as sperm and egg donations, make marriages between separated related individuals possible. When the sperm donor's identity is concealed, it is possible that opposite-sex half-siblings created via such techniques could meet and marry, especially if their families do not live far apart.

Relationships involving twins continue to yield an array of unintentional and compelling consequences. Many of them have been described in previous issues of *Twin Research and Human Genetics*. For example, monozygotic (MZ) twins who marry unrelated individuals produce children who are genetically half-siblings. MZ twins who marry MZ twins produce children who are genetically full siblings. Women who become pregnant following relationships with MZ male partners are unable to identify the child's true father. Opposite-sex twins who marry are yet another rare and intriguing occurrence.

Research Reviews

Familial Twinning

It has been known for some time that multiple ovulation has a hereditary basis. However, the extent to which multiple implantation might be affected by genetic factors was addressed only recently. In 2008, M. J. Lambers and colleagues, in the Department of Obstetrics at the Free University Medical Center, in Amsterdam, gathered birth history information on the families of 940 women who had become pregnant following double embryo transfer.

The women were organized into two groups: (A) women pregnant with a single child, and (B) women pregnant with twins. The incidence of single versus multiple births among the relatives of Group A women were 27.2% and 15.5%, respectively. The incidence of single versus multiple births among the relatives of Group B women were 29.5% and 17.8%, respectively. The same pattern of results emerged when family members were restricted to first degree relatives. It was concluded that multiple implantation is unaffected by genetic factors.

Twin Study of Food Neophobia

The genetic bases of food neophobia (fear of eating new foods) was examined in a twin study conducted by Cooke et al. (2007), from the Department of Epidemiology and Public Health at the University College of London. Parents of 5390 twin pairs completed a survey concerning their children's eating habits and food fears.

Results showed that 78% of the variance was explained by genetic factors and 22% was explained by nonshared environmental factors; shared environmental effects had no influence on fear of foods. This is important information for parents with young children whose diets may be deficient due to the children's concerns about unfamiliar food items. Identifying techniques to help children overcome their fear of certain foods is a significant future goal.

Results from this study are not surprising in light of twin studies showing genetic influence on food preferences (Teucher et al., 2007). Other twin studies have revealed modest genetic influence on odor preference and pleasantness, factors that could be associated with dietary choices.

MZ Twins Discordant for Phenotypic Sex

Virtually all MZ twins are concordant for sex, but rare examples of sex discordance in MZ pairs have been reported. According to the authors of a fascinating case study, there have been 15 reports of MZ co-twins discordant for sex and Turner syndrome (XO). The present case, investigated by Tho et al. (2007), raises that number to 16.

The twin's birth was uneventful. The twins were initially evaluated around the time of their birth, and on several subsequent occasions until age 21 years. One twin was phenotypically male and showed a 46,XY karyotype in the foreskin, scrotal skin and testis. However, he showed a 45,X/45,XY

karyotype in his peripheral blood cells at all follow-up visits. Nevertheless, he developed as a normal male, reaching an adult height of 182 cm. He showed normal testicular endocrine function, but significant reduction in sperm count and consequent fertility difficulties. These characteristics place him into a rare group of 45,X/46,XY males, given that most such individuals are short, and show testicular failure and azoospermia (failure to show measurable levels of sperm in semen).

The other twin showed ambiguous genitalia at birth, as well as a 45,X/45,XY chromosomal constitution in the left testis, right streak, vas deferens and clitoral skin. Surgical reconstruction was performed to bring the genital organs in line with the female sex. During the procedure, a midline uterus and right fallopian tube with an associated streak gonad were identified. This twin received low dose estrogen, and showed full breast development at age 14. Her final height at this time was 156 cm, placing her at the 25th centile for girls of her age. Regular menses began, but ceased by age 21 because she failed to follow the prescribed hormone treatment.

Tho et al. (2007) speculated that, following the twinning event, a mitotic error occurred in one of the embryos (female twin), generating the mosaic karyotype. They further reasoned that the male twin received 45,X cells from his co-twin prenatally, due to shared placental circulation; this may have interfered with the normal process of spermatogenesis.

Human Interest

The Cave of Romulus and Remus

According to legend, Rome's famous founders were a pair of twins, Romulus and Remus. The twins, sons of Mars, were abandoned in a cradle by the Tiber river where they were discovered and nursed by a she-wolf. After founding the city of Rome in 753BC, they fought over which twin should rule. Romulus ended up

killing Remus to become the first king of Rome.

This familiar story has become news in light of a recent archeological find: the cave where the wolf is said to have nursed the twins (Reuters, 2007). The underground area, located near the ruins of Emperor Augustus's palace on the Palatine hill, is decorated with seashells, marble mosaics and pumice stones. The investigators are convinced

that it is the Lupercal (derived from the Latin word for wolf) where Romulus and Remus were cared for. Greater investigation of this cave is scheduled to begin, but may be delayed due to the surrounding debris.

Twin Politicians in Poland

In July 2006, Poland became the first country to be led by a pair of identical twins, President Lech Kaczynski and

Prime Minister Jaroslaw Kaczynski (Associated Press, 2007). That ended in October 2007 when an opposition party calling for withdrawal of Polish troops from Iraq ousted the Prime Minister. His twin brother will remain as President until the end of his term in 2010.

This turn of events raises the interesting question of assessing twin concordance for behaviors such as political roles and abilities. Depending on definitions and trait-specificity, the twins can be classified as either concordant or discordant, like the Polish twins. Clearly, the time at which twins provide life history and other self-report data can significantly impact their degree of measured similarity.

Parents of Twins in Hong Kong

In January 2008, I visited Hong Kong for the first time. I was fortunate to meet the members of the Hong Kong Mothers of Multiples (MOMs) Organization, and to address the group of approximately 40 mothers and fathers. This organization maintains an active program of luncheon talks, under age 3 playgroups, morning coffees and other social events. The question and answer session reminded me that parents of twins everywhere are intensely interested in learning everything they can about raising and educating their twin children. Common concerns were placing twins at school (in same or separate classrooms), resolving co-twins' arguments,

and caring for singleton children who may not inspire the same level of interest and excitement among nonfamily members as their twin siblings. The MOMs website can be visited at www.moms-hongkong.com.

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