

NEWS, VIEWS, AND COMMENTS

Twin Studies of Multiple Myeloma / Research Reviews and News: Critique of Twin Research; Opposite-Sex Twins and Sexual Attraction; Twinning Rates and Assisted Reproductive Technology; Family History of Multiple Implantation / Human Interest: Book Party: *Born Together — Reared Apart*; Morning Sickness and Twins; Sexuality in Conjoined Twins; Kofi Annan: Opposite-Sex Twin; Switched at Birth

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A foundation for studying multiple myeloma, launched by a monozygotic twin, is described. Twin studies of that disease are also examined. A summary of selected research studies and news events follows, with specific reference to a new critique of twin research, sexual attraction in separated opposite-sex twins, twinning rates following assisted reproductive technology and family histories of multiple implantation. Human interest topics cover a gathering of researchers from the Minnesota Study of Twins Reared Apart, morning sickness and twin pregnancy, sexuality in conjoined twins, a famous hidden twin, and a film about switched at birth babies.

Twin Studies of Multiple Myeloma: A Research Foundation and Recent Findings

Multiple myeloma (MM) is a fatal cancer that starts in the plasma cells in bone marrow. It causes the red blood cell count to be low, leading to infections and bleeding (PubMed Health, 2012a). Monozygotic (MZ) female twin Kathy Giusti was diagnosed with the illness in 1996 at the age of 37. A graduate of the Harvard Business School with a background in pharmaceuticals, she founded the Multiple Myeloma Research Foundation (MMRF) in 1998, with the aim of developing new drugs to control the disease; according to a recent article about the foundation, lit-

tle progress in drug treatments for the disease had been made since the 1950s. Giusti then went on to establish the Multiple Myeloma Research Consortium (MMRC) in 2004 (Cavallo, 2012). She and her colleagues have raised nearly

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\$200,000,000 in research funds and have engaged investigators at over 80 laboratories. Given the many different types of cancers, a key goal is to develop drugs that are tailored to each individual patient.

Guisti's twin sister Karen has remained healthy over the years. In 2008, Karen donated stem cells that were transplanted into her sister, who remains in remission. According to British researchers Cutting and Snowden (2006) at the Royal Hallamshire Hospital, the frequency of MM in twins is very low. Several case reports of concordant MZ twin pairs are cited in their commentary, although the cases vary with respect to the similarity of the paraproteins (excess immunoglobulins produced by the clonal proliferation of plasma cells). These variations could reflect epigenetic events or somatic mutation of immunoglobulin genes. These investigators call for comprehensive social and occupational histories of twins, both concordant and discordant for MM. That is because it is suspected that myeloma comes from single cell transformations occurring several decades before their detection, which could be tied to certain environmental substances. Disease differences between MZ co-twins could also be linked to differences in X-linked inactivation in the case of female MZ twins like Kathy and Karen. Cutting and Snowden also suggested that studying future MZ twin cases, both concordant and discordant, by means of molecular genetic techniques, would provide

information on the range of genetic and environmental factors affecting malignant cell growth.

Having an unaffected MZ co-twin can be beneficial to twins affected with MM. A 1999 study compared outcomes in twins who received bone marrow grafts (syngeneic transplants) with those of 125 age-matched patients who received autologous transplants and 125 age-matched patients who received allogenic transplants (Gahrton et al., 1999). The overall survival rate did not differ between the twins and the patients who received autologous transplants. However, a non-significant trend toward better survival was detected among the twins. The twins were MZ, given that syngeneic transplants are between genetically identical individuals; however, the investigators failed to indicate the method by which the pairs' zygosity was established.

Kathy Guisti has been widely recognized for her work (MMRF, 2012). *Time* magazine named her as one of the World's 100 Most Influential People in 2011. She has also been honored by the American Society of Clinical Oncology, the American Association for Cancer Research, and the Healthcare Businesswoman's Association among others. Her sister, Karen, is a corporate attorney who works alongside her. Additional information about the MMRF and MMRC can be found at the links that are referenced in this article.

Research Reviews and News

Critique of Twin Research

A recent book, *Beyond Human Nature: How Culture and Experience Shape the Human Mind* (2012), authored by Jesse J. Prinz, Professor of Philosophy and Director of the Committee for Interdisciplinary Science Studies at the City University of New York, Graduate Center, does considerable disservice to twin studies. As most members of International Society for Twin Studies (ISTS) know, twin studies have been both highly celebrated and unfairly maligned. As a developmental psychologist with a specialization in twin research, I find it unfortunate that the treatment by Prinz (2012) of the topic typifies the latter. Once again, the fallacious argument that MZ twins' behavioral similarities are caused by their similar treatment by others due to their matched physical appearance, with little contribution from their shared genes, is raised repeatedly by him. Numerous twin studies have addressed this possibility and found it wanting: Plomin et al. (1976) showed that the most similar looking twins were rated as least similar behaviorally by their parents; Rowe et al. (1987) showed that MZ twins remain alike in personality even after controlling for physical attractiveness, and Goodman and Stevenson (1989) and Kendler et al. (1993) showed that twins' similarity is consistent with true twin

type, not perceived twin type. As Rowe (1994) asserted, the roots of personality reside in the brain, not in the face.

In a recent study to appear in January's issue of *Personality and Individual Differences* (Segal, 2013), I assessed the personality similarity of pairs of individuals who look very much alike, but are genetically unrelated. I reasoned that if personality depends mostly on treatment by others, then these unrelated pairs should be about as similar as identical twins. Alternatively, if personality has a meaningful genetic component (which virtually all twin studies show), then these unrelated pairs should be very dissimilar. The mean intraclass correlation across the Big Five personality traits was a negligible $r_i = -.05$! This result was replicated in a second analysis $r_i = -.03$ using an alternative personality measure (Segal et al., 2012). In contrast, the mean Big Five correlations from twin studies are .53 (MZA), .48 (MZT), .15 (DZA), and .20 (DZT); see Bouchard (1993). I concluded that identical twins' personality similarity largely reflects their shared genes, and that reactive gene-environment correlation (the concept that identical twins' expressed behaviors evoke similar reactions from those around them) best explains their similar treatment by others.

Opposite-Sex Twins and Sexual Attraction

Twins reveal a great deal about human behavior just by being themselves. The question of sexual attraction between opposite-sex twins reared apart has been addressed in prior issues of *Twin Research and Human Genetics* (Segal, 2008, 2011). A new case recently came to my attention when I attended the *III Congreso des Mentis Brillantes* in Madrid, Spain, in November 2012. The male member of an opposite-sex twin pair informed his spouse that he been adopted and reared apart from his twin sister. His wife conducted an extensive search to find the sister and was successful after one and a half years. However, she eventually learned that her husband was having a sexual relationship with his newly found twin. Behind the shock value of this discovery is information about who we are attracted to, and why. According to the informant, the twins recognized similarities between themselves and were possibly making up for lost time. 'Perhaps his sister was a female version of himself'.

There have been other such cases, mostly between reunited male–female twins who were unaware of their biological relatedness. However, as I discuss in my recent book on the Minnesota Study of Twins Reared Apart (Segal, 2012), we observed flirtatious behaviors between several reunited male–female co-twins who knew that they were twins. The concept of genetic sexual attraction, well known among the adoption community but less appreciated outside it, refers to the strong sexual feelings that may be experienced between reunited relatives (e.g., mothers who relinquished their sons for adoption; Gonyo, 1987).

The bases of such attraction are of interest. For example, partner similarity in the Major Histocompatibility Complex (MHC) alleles has been implicated in sexual attraction, although the picture is unclear. Garver-Apgar et al. (2006) showed that women's sexual responsivity to their partners decreased as the number of common human leukocyte antigen (HLA) alleles (none to three) increased. However, another study found that women favored the scents of males whose HLA genes were similar to their own paternally derived genes, compared with exposure to HLA-associated odors from their families during development (Jacob et al., 2002). These authors suggested that an intermediate level of MHC matching might be an optimal evolutionary strategy for achieving optimal immunocompetence of children.

Close relatives living together tend not to develop sexual feelings toward one another, a phenomenon known as the Westermarck effect. This appears to be adaptive, given that close relatives are likely to carry the same detrimental re-

cessive genes, such that a child resulting from their sexual union would have a 25% chance of inheriting a detrimental trait. Male and female children growing up together in an Israeli kibbutz rarely marry as adults, an observation consistent with the Westermarck effect (Shepher, 1971).

Twinning Rates and Assisted Reproductive Technology

Recent European trends (based on 2004 treatments) were toward increased cycles of assisted reproductive technology (ART) and increased pregnancy rates, but with fewer embryo transfers and fewer multiple pregnancies (Andersen et al., 2008). The data were gathered from 29 European nations, mostly registries. The multiple birth delivery rate in 2004 (as reported in 2008) was 22.7%, compared with 23.1% in 2003 and 24.5% in 2002. These twin and triplet conceptions were from pregnancies associated with in vitro fertilization (IVF) and intra-cytoplasmic sperm injection (ICSI). However, multiple birth deliveries varied considerably across countries — highest in Turkey (39.5%) and lowest in Sweden (6.5%).

An updated analysis of these data that included three additional nations was recently reported (Ferraretti et al., 2012). These data were based on treatments performed during 2008. The total multiple birth rate was 21.7%, indicating a slight decline from the 2008 report. There was an increase in the number of reported ART cycles, but a marginal decline in the number of multiple embryo transfers (i.e., three or more).

Family History of Multiple Implantation

The genetic transmission of factors conducive to multiple birth pregnancies continues to intrigue investigators. Researchers in the Netherlands reasoned that if multiple implantation is not hereditary then women who undergo IVF or ICSI should show the same rate of single and multiple twin conceptions in their families (Lambers et al., 2008). The questionnaire findings, based on 940 women, showed comparable percentages of singletons and twins in the participants' families regardless of whether they were carrying singletons (27.2% and 15.5%, respectively) or twins (29.5% and 17.8%, respectively). The percentages did not differ between women carrying single or multiple pregnancies when the analysis was restricted to twins among their first-degree relatives. It was concluded that multiple implantation does not have a genetic basis.

Human Interest

Book Party for *Born Together — Reared Apart: The Landmark Minnesota Twin Study*

On October 5, 2012, colleagues and contributors associated with the Minnesota Study of Twins Reared Apart (1979–1999), directed by Prof. Thomas J. Bouchard, Jr., celebrated the publication of *Born Together — Reared Apart*. The gathering took place at the University of Minnesota's Faculty Club. The event included an introduction by Matt McGue, followed by remarks from the book's author Nancy Segal, as well as Irving Gottesman and Tom Bouchard. A powerpoint presentation showing the investigators and reunited twins ran continuously in the background. Photographs from the event can be found at Nancy Segal's Web site: <http://drnancysegaltwins.org/born-together-reared-apart-gallery>.

Videotaped remarks (by McGue, Segal, Gottesman, and Bouchard) and written comments from attendees are available at <http://drnancysegaltwins.org/new-documents>.

Morning Sickness and Twins

Hyperemesis gravidarum (HG) is a severe form of morning sickness that may signal either a multiple birth or a hydatidiform mole. A hydatidiform mole, which occurs infrequently, is a growth that develops inside the uterus at the start of pregnancy (PubMed Health, 2012b). HG has received considerable attention recently because of its diagnosis in the Duchess of Cambridge. The possibility that she is carrying twins has triggered considerable speculation as to which twin would ascend to the throne; based on revised royal protocol, it would be the firstborn twin regardless of gender. Interestingly, a physician performing a C-section would be somewhat responsible for choosing the future king or queen (Voorhees, 2012).

A Swedish Twin Registry study, based on 3,068 pregnancies (1973–1981), found that HG was present in slightly over 3/1,000 pregnancies, although the frequency varied across hospitals (Källén, 1987). HG occurred more commonly among younger first-time mothers carrying females than males, and more commonly among mothers carrying twins than non-twins. The data set included 57 complete twin pairs (24 same-sex male pairs, 22 same-sex female pairs, and 11 opposite-sex pairs) and two twins whose co-twins did not survive. It was determined that there was a 2.2-fold increased risk of twins in the HG group.

The Duchess of Cambridge may or may not be pregnant with twins. There is great excitement over that prospect, but because HG may be associated with other conditions, early celebration may lead to disappointment.

Sexuality in Conjoined Twins

Alice Dreger, Professor of Clinical Medical Humanities and Bioethics at Northwestern University in Evanston, has studied conjoined twinning for many years. In a recent article, she addressed the public's fascination with the sexual lives of conjoined twins (Dreger, 2012). People wonder, for example, if twins with shared genitals experience the same sexual feelings if one twin is sexually engaged. Dreger responds that we do not really know — conjoined twins, like anyone else, keep their sexual lives private — but the possibility is there. She also suggests that physicians may decide to surgically separate conjoined twins partly because of two opposing fears: the fear that conjoined twins will never experience sex and the possibility that they will.

Dreger should be commended for emphasizing the humanity of conjoined twins. She also mentions the well-known twins, Chang and Eng Bunker, who had 22 children between them, having married sisters. Interestingly, the sisters' father objected to the marriage, not because the twins were conjoined, but because they were Asian. This article and her book, *One of Us*, are well worth reading.

Kofi Annan: Opposite-Sex Twin

Prominent individuals are sometimes hidden twins. Kofi Annan, former Secretary-General of the United Nations, is such a person. Unfortunately, his twin sister passed away in 1991 from malaria — Annan's first encounter with death. The twins, originally from Ghana, attended different boarding schools and moved to different continents after graduating. Nevertheless, they exchanged letters frequently, often on the same day. In a recent radio interview, Annan described a close relationship with his sister. Upon learning of her illness he traveled to New York City where she was hospitalized, but never recovered (BBC, 2012).

Switched at Birth

Identical twins switched at birth offer opportunities to observe genetic expression and self-identity in different environments. A 2012 movie by Lorraine Levy, *The Other Son*, does not involve twins, but will still be of great interest to twin researchers. The plot involves the accidental switching of two male infants born on the same day and in the same hospital, one to an Israeli family and the other to an Arab family. The discovery was made when the Jewish son received results from his blood test (A+) as part of a physical examination prior to military service. It turned out that he could not have been conceived by his parents, both of whom had blood type A-. A little research by one of the physicians located the other family raising their son. The evolving relationships between the two adolescent sons,

between each son and his biological family, and between the two mothers and fathers are fascinating to witness. I highly recommend this film.

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