

# A Pair of Meetings: Twins (UCLA Center for Society and Genetics) and the 13th International Society for Twin Studies Congress (ISTS, Seoul, South Korea) / Twin Research Reviews: Female Sexuality; Maternal Age and Multiple Pregnancy Success / In the News: In Separate Wombs; Big Twinning Rates in Small Towns; School Enrollment Policy Hurts Twins; Establishing Paternity of Twins; Stars Are Born

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## A Pair of Meetings: UCLA and ISTS

### **'Everything You Wanted to Know About Twins': UCLA Center for Society and Genetics, May 18, 2010**

A May 2010 twin panel, hosted by UCLA's Center for Society and Genetics, was moderated by Abigail Pogrebin, former *60 Minutes* producer and the author of *One and The Same*, reviewed in *TRHG*. Pogrebin was introduced by the center's Dr. Norton Wise. Here are Pogrebin's thoughts about the event, in her own words:

'So many experts, so little time. That was my anxiety going into the unprecedented panel discussion on twins. It was actually Dr Nancy Segal who planted the seed for this special event. We were having coffee in New York on one of her trips to the East Coast, and I was telling her about an interview series I moderate at Manhattan's Jewish Community Center called "What Everyone's Talking About". She said, "You should

put together a panel on twins in LA". The proverbial light bulb went off, and faster than I thought possible, six of the top experts in the field of twins (all of whom I'd interviewed for my book, all of whom taught me more than I could ever include) had agreed to talk about twins from every angle in front of an audience of 200-plus. Fortuitously, these specialists are all based in the same neighborhood, and even more fortunately — and generously — UCLA agreed to host.

My goal in the discussion was to weave together several different disciplines, all in the service of understanding twins more expansively — psychologically, developmentally, genetically, epigenetically, and even emotionally. The umbrella question came down to identity: How do we become who we are?'

The panelists included Dr Thomas Mack, Dr Eileen Pearlman, Dr Laura Baker, Dr Eric Vilain, Dr Joan Friedman and myself. I asked each of

them to send me a short summary of their remarks and most of them did.

Dr Thomas Mack, from the Department of Preventive Medicine at the University of Southern California described the value of twins for studying factors affecting disease predisposition. His study of 79 MZ twin pairs discordant for multiple sclerosis (MS) showed that childhood sun exposure was associated with an increased risk of MS. In a related study of 400 MZ and 380 DZ twin pairs, Mack examined MS concordance in twins as a function of zygosity, sex and latitude. Twins from Canada and adjacent US states (at or above 41–42 degrees north) were labeled 'northern'. He found that the heritability of MS was the same for males and females

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(concordance ratios were 2.9 and 2.6, respectively). Latitudinal variation in MZ co-twin concordance rates was influenced by both genetic and environmental factors; MS was diagnosed two years earlier in MZ twins from northern regions.

Mack believes that MZ twins should inform their physicians of their twinship status because illnesses and other health-related conditions in their co-twin may increase their own risk. Interestingly, being born a twin or a non-twin has never been included in the medical history forms that patients routinely complete prior to examinations.

Dr Eileen Pearlman, Director of Twinsight in Santa Monica and co-author of *Raising Twins From Birth Through Adolescence*, stressed that the psychological developmental process differs for twins and non-twins. In addition to learning how to separate and individuate from their parents, twins must take an additional step: Twins have to learn to separate and individuate from each other. The separation/individuation process becomes either more or less intense throughout the different stages of twins' lives. For example, it is more intense during early childhood, adolescence, and young adulthood, when there are changes in twins' lives. Other factors which contribute to psychological developmental differences between twins and non-twins are that twins share the intrauterine environment and hear their co-twin's heart beat in addition to their mother's heartbeat while also interacting with one another. The quality and quantity of time is also different for twins whose parents spend more time with both twins than do

parents of singletons, but spend less time with each twin individually. Twins often become each other's transitional object — for example, an object like a stuffed animal, which is used to soothe and comfort the infant when his caregiver is not available. These differences are important to address when examining the twin relationship.

Dr Joan Friedman, a Los Angeles psychotherapist, noted that little attention has focused on adult twin pairs who might experience developmental challenges resulting from growing up as half of a dyad. Her research has highlighted the finding that older twins are often reticent about seeking help. They feel a sense of guilt, shame, and inadequacy if their relationship does not reflect the stereotypic norm of best friends and soul mates. Along these same lines, there is a need for well-trained mental health practitioners and educators who can understand and manage emotional concerns specific to the multiple birth population. Friedman's upcoming book will discuss these issues in greater detail, providing insight and practical solutions to the difficulties and discrepancies affecting twin relationships.

I reviewed research from studies of twins reared together and apart showing that there is genetic influence on most measured traits. I also discussed research on twin relationships, virtual twins and twin loss. Most studies show that MZ twins share closer social relationships than DZ twins, regardless of their rearing status. This is a finding that teachers and educators need to consider when deciding the placement of twin children at school; see the news story below. I am in the process of studying social relations within

virtual twin pairs (VTs or same-age unrelated children reared together since birth), and I expect they will show reduced closeness relative to MZ and DZ twins. One of my recent studies showed that VTs were less successful on a joint problem-solving task than MZ and DZ twins, with MZ twins being the most successful (Segal et al., 2008).

Twin loss continues to be an important topic, given that it is highly overlooked by bereavement specialists. I now have nearly 700 twins enrolled in the ongoing Fullerton Twin Loss Project. The finding of increased grief intensity among surviving MZ than DZ twins is robust. A recent twin study of suicidal predisposition, based on a subset of these twins, indicated a genetic component (Segal, 2009).

Dr Laura Baker, from the Department of Psychology at the University of Southern California and USC Twin Project addressed questions concerning twin relationships in young twins and how parents may handle them. Referring to her studies of aggression, she pointed out that twins who tend to be aggressive may not get along because of these genetically influenced behavioral traits. Dr Eric Vilain, from the Departments of Urology and Human Genetics at the University of California, Los Angeles, discussed his research on twins and sexuality. We all answered questions from the audience, many about the rearing of twins and how to handle within-pair conflicts.

The UCLA event may be viewed in full on [www.youtube.com/](http://www.youtube.com/) ('Everything You Wanted to Know About Twins'). The program is 88 minutes long.

## 13th Triennial Meeting of the International Society for Twin Studies, Seoul, South Korea, June 4–7, 2010

The 13th meeting of the International Society for Twin Studies was hosted by Dr. Yoon-Mi Hur in Seoul, South Korea, in June 2010. The venue was the Hyatt Regency Hotel, located near the area of Itaewon. The meeting was

very well attended and included 10 symposia, 12 paper sessions, 5 plenary talks, a presidential address and 80 poster presentations.

There were many excellent presentations so only a sampling of highlights

from the perspective of this author is possible. This was the year of epigenetics, the study of chemical reactions that cause parts of the genome to become expressed or silent. A sympo-

sium, 'Epigenetic Studies in Perinatal Cohorts,' included four contributions from Australian investigators. Jeffrey Craig detected methylation discordance in all twin pairs, with DZ twins showing greater variation than MZ twins. This finding demonstrated that both the intrauterine environment and genetic factors affect the neonatal epigenome. Richard Saffrey described the collection of birth specimens including blood, buccal smears and placenta from infant twins in approximately 250 pairs. These materials will enable further comprehensive investigation of factors affecting the neonatal epigenome. Eric Joo speculated that microenvironmental features of the intrauterine environment will be reflected in epigenetic marks and gene expression. B. Novakovic discussed evidence that preconception maternal alcohol consumption may affect the epigenetic profile.

The symposium 'Twin Studies in China' was a fascinating look at the research and registries that have been developed in recent years. Given my recent work with young Chinese twins separated at birth, I was particularly interested in this series of papers. Liming Li reported that over 8,000 twin pairs have been enrolled in the Chinese National Twin Registry. The twins come from four cities in China and will be used to study a variety of medical and psychological traits. A paper by Mingguang He described the Guangzhou Eye Study that began in 2005 and includes over 9,000 twin pairs. Twins are followed longitudinally to assess changes in ophthalmological health. Ting Wu discussed blood pressure and obesity studies using twins from the national registry. Genetic correlations between systolic blood pressure and body mass index were reported. Weili Yan described a twin study of low and non-response to hepatitis B vaccination (HPV) in infants. Factors affecting this response will help to develop techniques for improving the efficacy of HPV vaccination in low and non-responders. A paper by Tao Li offered an overview of the Southwestern Twin Registry. IQ and personality traits have been studied in twins 6–16 years of age. The heritability of IQ was shown to increase with age, a finding that has been

demonstrated in other twin and adoption studies.

A Bulmer session was held on Sunday June 6, late in the day. Virtually every twin researcher is familiar with M.G. Bulmer's marvelous 1970 book, *The Biology of Twinning in Man*. The superb papers in this session by Catherine Derom, Jodie Painter, Gonneke Willemsen, Niels Lambalk and E.A.M Kuiper examined various topics on the genetic aspects of twinning. A late entry in this session, 'The Genetics of MZ Twins', was not listed in the official program. The paper was delivered by Bruno Reversade from the National University of Singapore. Reversade began by saying that MZ twinning is genetic, not stochastic. Based on his studies of a Jordanian village that has a high monozygotic twinning rate, he claims to have found a gene common to some of the families. The gene is associated with the blastocyst, is specific to the inner cell mass of the human embryo and is critical in development. Reversade believes that if this gene is 'overexpressed' the result is MZ twins. He believes that this gene might explain the high frequency of MZ twinning in a subset of families only, with random processes explaining MZ twinning in general.

Additional families are needed to confirm Reversade's findings and he is pursuing studies along those lines. It seems extraordinary that after so many years of twin research the answer to the question of what causes MZ twinning remains elusive.

Matt McGue's presidential address was a wonderfully informative overview of where twin research began and where it has gone. Galton, of course, was the father of the twin method in the late 1800s. However, twin research was largely ignored because of the widespread behaviorist views of the 1920s and in the decades that followed. Eugenic movements in the United States and elsewhere during that time also undermined behavioral genetic research in the United States. I would add that horrific twin studies conducted by Mengele at Auschwitz also did considerable damage to the status of twin studies. In the 1960s there was a growing disenchantment with environmentalist explanations, as

well as accumulating evidence of behavioral heritability. Our colleagues such as Irving Gottesman and Steven Vandenberg did a great deal toward reviving behavioral genetics in general, and twin research in particular. There were critics of the twin method, but they made us more careful about our data collection and interpretation. McGue also cited the wonderful twin research done by Dorothy Burlingham in the 1940s and 1950s.

According to McGue, twins are 'an antidote to the blank slate'. They saved psychology from purely environmentalist views. He concluded by saying that twins did more for psychology than psychology did for them. I think he meant that twins deepened our understanding of behavior by adding a genetic perspective and that greater efforts toward understanding the unique developmental aspects of twinning are needed.

Another highlight of the ISTS Congress was recognizing colleagues and students who have made outstanding contributions to twin research. Kaare Christensen from the University of Odense, in Denmark, was honored with the James Shields Award for Lifetime Achievement in Twin Research. Christensen has done outstanding twins studies of aging, X-chromosomal inactivation, twin loss and many other topics. James Shields is famous for his reared apart twin studies conducted in Great Britain and published in 1962. His colleague, Irving Gottesman, created the award in Shields's honor.

The Galton Award recognizes the best presentation delivered by a student. This year there were several winners — Christian Kandler and Adina Feldman, with special mention going to Arianne Lim. The Gedda Award honors the best poster presented by a student. The winner was Jonas Mengel, with runner-ups Karin Verweij and Jacquelyn Myers.

A highlight of this year's banquet was a charming musical presentation performed by identical female Korean twins. It was an opportunity to observe and enjoy the matched talents that are so typical of MZ twins. Many thanks are due to Dr. Yoon-Mi Hur and her staff for hosting such an excellent conference.

# Twin Research Reviews

## Female Sexuality

The G-Spot, first described by Dr Ernst Grafenberg in 1950, refers to a sensitive area on the anterior wall of the human vagina. There has never been any anatomical proof of a G-Spot, but most women believe that it exists. A British twin study by Burri et al. (2010) examined genetic and environmental influences on self-reported G-Spots.

Sexual life history and personality inventories were mailed to 4,625 unselected female twins. Complete data were available for 1,840 of the 1,875 women who returned the forms. Over half the respondents (56%) indicated having a G-Spot and those who did were younger than those who indicated that they did not. Women indicating the presence of a G-Spot also scored higher on the personality dimensions of extraversion and openness to experience.

The investigators failed to find genetic influence on self-reported G-Spots. The polychoric correlations were .11 (MZ twins) and .12 (DZ twins). The only model that fit the data suggested that non-shared environment and random error explained approximately 89% of the variance. Burri et al. concluded that the most likely explanation for the lack of genetic influence was the absence of physical or physiological evidence that the G-Spot exists.

## Maternal Age and Multiple Pregnancy Success

A recent study published in the journal *Human Reproduction* (Delbare et al., 2008) showed that the perinatal outcomes of twin pregnancies are more favorable in women over age 35, compared with women between the ages of 25 and 29. These findings seem at odds with the greater reproductive difficulties reported for older mothers; see, for example, Simchen et al. (2009), reviewed in TRHG by Segal (2009). I was intrigued by the response to this report by biologist Samueli Heele from the University of Turku, in Turku, Finland (Heele, 2010).

Heele set forth the terminal investment hypothesis, the idea that women should invest more resources in their final reproductive effort because there is little to lose and much to gain by doing so with respect to their biological fitness. In support of this hypothesis, he cited the (1) increase in DZ twinning among older mothers, (2) possible selective mechanisms associated with polyovulation (and DZ twinning) that would allow mothers to increase their reproductive effort and fitness via twinning and (3) women's tendencies to stop reproducing after delivering twins.

Heele asserted that if natural selection favors such a reproductive strategy then investment in multiple birth children should increase among older

mothers. He claimed that available evidence supports this, such as the greater survival of multiples, and the heavier birth weight of triplets born to older women. Heele also indicated that twins are not disadvantaged with reference to reproduction or survival, relative to non-twins. However, Heele needs to reconcile his last piece of evidence with research reported by Luuma et al. (2007) and reviewed in TRHG by Segal (2007).

Luuma et al. found that: (1) Adult female twins from opposite-sex pairs have a 25% lower rate of having children than do adult female twins with female co-twins, (2) females who had a male co-twin had a reduced probability of marrying, compared to females with a female co-twin, and (3) mothers of male-female twins had fewer grandchildren than mothers of same-sex twins, and consequently reduced evolutionary fitness. The female co-twins' biological disadvantage was attributed to prenatal exposure to testosterone, which may have had a masculinizing effect. Of course, Luuma's comparisons involved opposite-sex and same-sex twins, rather than twins and non-twins, but they bear upon Heele's thesis.

Heele's terminal investment hypothesis is intriguing. Additional relevant data will, hopefully, allow further tests of his ideas.

## In the News

### In Separate Wombs

Uterus didelphys refers to the presence of two fully separate uteri in the same woman. This rare condition results from the non-fusion of the Mullerian ducts (Syed et al., 2009). Thirty-four-year-old Angie Cromar from Utah recently conceived two infants approximately 1 week apart, one in each uterus (AOL News, 2009). Her physician noted that less than one hundred such cases have been reported worldwide. The article's author indicated that the two infants would not be twins. I agree with this author, but I

believe that a closer look at what defines twins can help scientists decide how to appropriately classify these children.

Twinship is uniquely identified by concurrent conception, a shared intrauterine environment, shared parents and shared time of birth. (I developed these criteria when the 1996 birth of Dolly the cloned lamb brought attention to possible human reproductive cloning and the relationship status of clones and donors; see Segal, 1997, 2006). However, there are important exceptions to these criteria.

For example, superfetated twins can be conceived weeks apart and unusual prenatal conditions can cause one twin to be born weeks, or even months, before his or her co-twin (see Segal, 2000). These are all naturally occurring events that are variations on the usual twinning processes, so they do not negate the twin status of the infants in questions.

In my view, the Utah case meets all the criteria for twinship with the exception of the shared intrauterine environment. The uteri in uterus didelphys are completely separate, so

the fetuses would not be exposed to the possibly adverse effects of a shared prenatal environment.

### Big Twinning Rates in Small Villages

Rudnik is a small village located in the southeastern part of Bulgaria. The population of Rudnik is approximately 5,000 people. Official records indicate that 56 pairs of twins were born in Rudnik since 1944, and that the twinning rate in 2009 was 6.7% (4 twin births out of 60), much higher than Bulgaria's national average of 1.5%. The citizens of Rudnik insist that the twins are conceived naturally and they have commemorated their high twinning rate with a special twin festival that has been ongoing for the last 5 years.

Explanations for Rudnik's twin explosion vary from the scientific to the unusual. A genetics professor from the capital of Sofia claimed that Rudnik's twinning reflects hereditary factors, while a gynecologist believes that elements in the water and soil promote multiple ovulation. There was little reference to the type of twins produced in Rudnik with the exception of one young set described as identical. Regardless of its cause, Rudnik's multiple birth rate is of great interest to investigators interested in the origins of twinning.

Rudnik is not the only village whose twinning rate is elevated. The high rate of twinning in the village of Kodinji in India's northern province of Kerala, was brought to my attention by Khan Sahab and K. P. Skandhan, from the Department of Physiology, at the Sree Narayana Institute of Medical Sciences, Chalakka, Ernakulum, in India. Records show that twins comprise 5% of Kodinji's population, higher than the national average of 8%. The Twins and Kins Association (TAKA) reported that, in 2009, there were 230 pairs of twins and five women pregnant with twins at that time. Sahab and Skandhan reviewed various reasons for increased twinning that have been considered elsewhere — for example, coffee consumption, dietary factors and environmental pollution — but they were unable to offer a definitive explanation. As was true of Rudnik, the factors responsible for Kodinji's high twinning rate pose

an important problem for interested investigators.

### School Enrollment Policies Can Hurt Twins

Magnet schools are public schools specializing in certain curricula. The term magnet refers to the fact that these schools draw students from across the boundaries that define the various school districts.

Chicago area students interested in attending magnet schools enter a lottery and, based on the number they draw, may or may not be admitted to the school of their choice. The magnet school policy, revised for the 2010 school year, proved favorable to non-twin siblings, but unintentionally damaging to twins (Yates, 2010). The new regulations allow for the acceptance of a child whose sibling is already enrolled in a given magnet school, regardless of his or her lottery pick. Unfortunately, the policy does not apply to twins, as shown by the difficult situation faced by 4-year-old twins, Mia and Luna. Luna's number gave her admittance to either of two magnet schools, whereas Mia's number kept her out of both. School officials claimed that the policy was not intended to hurt twins, but they are unwilling to make changes or exceptions until 2011.

The twins did well together in preschool, but they may be separated if Mia does not move up on the waiting list. A resolution to enable parental input into twins' school placement decisions has been enacted in Illinois, but according to the official website ([www.twinslaw.com](http://www.twinslaw.com)), the resolution has not been effective and a law is being urged. Mia and Luna's situation exemplifies the inadequacy of the resolution.

School officials need to become acquainted with the developmental and educational literature on twins. A number of studies on twins' school placement outcomes should be required reading for all educators; see an excellent article by DiLalla and Mullineaux (2008). My experience is that many parents are eager to keep young twins together in school because of the educational and emotional support that they provide for one another.

### Establishing Twins' Paternity and Citizenship

A case involving the paternity and citizenship of male twins, Itai and Liron, born to a homosexual male and surrogate female in Mumbai, India attracted worldwide attention in May 2010 (Indiaexpress, 2010). Dan Goldberg, the twins' father, was denied a paternity test by a family court judge in Jerusalem, preventing him from returning to Israel with his twin sons. The judge claimed that he was not authorized to rule in a case involving children born outside Israel. Protests in Israel from the left wing and gay communities led Prime Minister Benjamin Netanyahu to bring the case before the Knesset, the Israeli parliament. The Jerusalem District Court then ruled that the family court judge could decide the case. The judge allowed Goldberg to take a DNA test to establish his paternity. Once his paternity was confirmed, Goldberg and his partner, Aron Angel, brought their twin sons home to Jerusalem.

### Stars Are Born

Astronomers have determined that most stars are born by processes paralleling those of monozygotic twins (Beradelli, 2010). MZ twins result when a single zygote divides between the first and fourteenth post-conceptual day. It now appears that many binary stars hatch from a single cloud of dust. Binary stars are star systems comprised of two stars orbiting a common center mass (Wikipedia, 2010). They result when protostellar clouds assume elongated rather than spherical shapes, making them more likely to divide. Seventeen out of twenty protostellar clouds observed by the astronomers were irregular and elongated in shape, a likely explanation for why most Milky Way stars are binary.

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