

**NEWS, VIEWS AND COMMENTS**

## The 2016 Satellite Meeting of the International Society of Twin Studies: An Overview/Tribute to Irving I. Gottesman/Research: MZ Twinning After Single Embryo Transfer; Twin Study of Mononucleosis; Cerebral Injury After Twin-To-Twin Transfusion Syndrome Surgery/Human Interest: Sixteen Twin Pairs Born in a Single Hospital; Death of an Identical Twin Playwright; Twin Themes in Advertising; Conjoined Twins Separated in Saudi Arabia; Murder of One Twin By Her Co-Twin Disproved

Nancy L. Segal

*Department of Psychology, California State University, Fullerton, CA, USA*

The 2016 Satellite Meeting of the International Society of Twin Studies took place on June 20 in Brisbane, Australia. The host institution was the QIMR Berghofer Medical Research Institute. An overview of selected presentations and activities is provided. This synopsis is followed by a brief tribute to the recent passing of our esteemed colleague, Dr Irving I. Gottesman. Next, there are summaries of research on monozygotic twinning after single embryo transfer, a twin study of mononucleosis susceptibility, cerebral injury following twin-to-twin transfusion syndrome surgery, and a correction and clarification regarding an article by Segal (2016) on the Brazilian Twin Registry. Human interest articles cover a hospital whose 2015 newborns included 16 pairs of twins born in 1 month, the death of an identical twin playwright, twin themes in advertising, conjoined twins separated in Saudi Arabia, and the dismissed charges of the murder of one twin by her co-twin.

---

## The 2016 Satellite Meeting of the International Society of Twin Studies: An Overview

---

A one-day meeting of the International Society of Twin Studies (ISTS) was held on June 20, 2016 in Brisbane, Australia. The local hosts were Professor Nick Martin and Dr. Sarah Medland from the QIMR Berghofer Medical

---

ADDRESS FOR CORRESPONDENCE: Nancy L. Segal, Department of Psychology, California State University, Fullerton, CA 92834, USA. E-mail: [nsegal@fullerton.edu](mailto:nsegal@fullerton.edu)

**FIGURE 1**

(Colour online) Speakers at the June 20, 2016 satellite meeting of the International Society for Twin Studies, Brisbane, Australia. Photo courtesy: Dr Nancy L. Segal

Research Institute. The conference attracted a wide range of speakers who addressed various behavioral and medical aspects of twins and twin studies. Selected findings from this ISTS meeting will be presented, although all speakers and topics will be credited for their contributions. Some individuals presented their research at the September 2015 International Network of Twin Registries (INTR) in Osaka, Japan, and/or discussed published findings that I summarized in previous *Twin Research and Human Genetics* articles (Segal, 2015, 2016), so theirs will receive briefer mention. A group photo of the conference speakers appears in Figure 1.

The ISTS meeting began with an acknowledgment of country by Gregory Pratt, QIMR Indigenous Research Manager. His contribution was followed by four scientific sessions and a keynote address. Gonneke Willemssen (Netherlands) and Jeffrey Craig (Australia) served as session chairs.

Chika Honda (Japan) and Lucas Ferreira (Australia) updated attendees on outcomes from the 4th meeting of the

International Network of Twin Registries (see Segal, 2015). Ferreira described his doctoral dissertation project, 'Frontiers of Twin Research', a qualitative study that will highlight the relevance of twin research for a broad audience. Juko Ano (Japan) provided an overview of the history of twin research in Japan (see Segal, 2015). Gonneke Willemssen (Netherlands) discussed procedures and issues regarding the provision of feedback to twin participants. She noted that a portal can be created to post personal results for each individual twin. Her talk was followed by a presentation by Perminder Sachdev (Australia) on studies using twins aged 65 and older. This study began in 2005 and includes several waves of data collected via the Australian Twin Registry (ATR). Among the findings are that white lesions in the brain have a strong genetic component. The final paper in the first session was by Dale Nyholt (Australia) on genes linked to twinning (see Segal, 2016).

The second session began with my paper (Nancy L. Segal — USA) that presented a world tour of twins switched

at birth. My forthcoming book about the recent double switch of two monozygotic (MZ) male twin pairs in Colombia, South America was discussed. Yesika Montoya who first alerted me to this case is second author. The next speaker was Monica Rankin (Australia) who provided a brief history of ICOMBO. This group was founded at ISTS in 1980, and now includes 16 member organizations and 4 individual members, representing 60,000 families. Rankin called for better statistics on twin stillbirths and methods for supporting families who lose a newborn twin. Next, a talk by Tess Cutler (Australia; presented by Craig) discussed issues involving the importance and outcomes of zygosity determination. Her study found that 19% of MZ twins believed they were DZ, but no DZ twins believed they were MZ. This underlines the importance of scientifically establishing twin type, rather than relying on twins' self-report.

The next to last speaker in the second session was Juan Ordanana (Spain) who discussed identity diffusion in twins. The study used participants from the Murcia Twin Registry, established in 2007. As expected, MZ twins showed greater identity diffusion than DZ twins; interestingly, no differences were noted between DZ same-sex and opposite-sex twin pairs. The final speaker, Meike Vartels (Netherlands), presented findings from a twin study of bullying behavior. An important result was that young twin girls are more likely to be bullied if they are placed in separate classrooms. Apparently, twin separation forfeits the protective advantage that each twin offers the other.

A keynote address, 'Discordant Twin Pairs — National and International Dimensions', was next presented by Jaakko Kaprio (Finland). Kaprio reviewed the principles of the discordant pair design and illustrated advantages and challenges associated with it, using examples from the Finnish Twin Cohort, the Nordic Twin Study of Cancer, and the global CODATwins study. He included the definition of discordance and its dynamics in time, sample size, and power issues. Discordant twin pair analyses are a powerful method for assessing support for or against causal hypotheses between an exposure and an outcome.

The third scientific session began with a paper by Lise Dubois (Canada; visiting scholar in Australia) who discussed findings from the Quebec Newborn Twin Study. The object of this study is to document the association between dietary intake at 9 years and subsequent body mass index (BMI) in adolescent MZ boy and girl twin pairs ( $n = 152$ ). It was found that pre-adolescent boys who ate fewer grain products and fruit, and consumed more high-fat meat and milk, had increased BMIs during adolescence; pre-adolescent girls who consumed more grain products and high-fat meat, and milk had increased BMIs during adolescence. Dubois was followed by John Hopper (Australia), who presented ideas on how twin studies can be

used for population health and wellbeing by virtue of offering a unique and powerful tool for health and medical researchers — to uncover not just causes of variation, but causes per se, both genetic and environmental; also see Segal (2015).

Amabile Dario (Australia; originally from Brazil) discussed the relationship of obesity and back pain, and presented data showing that the former does not appear to be caused by the latter. Activity was also not implicated in lower back pain, and losing weight did not alleviate back pain. Her work was based on a prospective study of Spanish twins. Liang-Dar Hwang (Australia) discussed sweet taste perception and its association with BMI. A relationship was found, but it was stronger for later measures of BMI. In addition, 30–73% of the variance in bitter taste is accounted for by genetic factors. A common genetic factor seems to explain taste for glucose, fructose, and aspartame. The final paper in the third session was by Moritz Herle (United Kingdom), who presented new data to test whether parental beliefs about their twins' zygosity affects findings from an eating questionnaire. He concluded that it does not, consistent with several previous (and early) twin studies on this topic; for example, Scarr (1969).

The fourth and final session began with a paper by Jeffrey Craig (Australia) on the role of epigenetics in early life disease origins. Craig reviewed results from the Peri/Postnatal Epigenetic Twin Study (PETS), a longitudinal cohort of twins followed from mid-gestation to mid-childhood. The most noteworthy findings were epigenetic discordance in multiple tissues from MZ twins at birth, identification of epigenetic states linked with birth weight, and complex dynamics of epigenetic change from birth to 18 months of age. Shuai Li (Australia) discussed genome-wide DNA methylation as a risk factor for cancer. This risk appears to be determined in utero so can be included as a prenatal factor. Both MZ and DZ twins show a high correlation for this measure. Adam Tárnoki (with his collaborator and identical twin brother David—Hungary) spoke about genetic covariance between carotid and femoral intima-media thickening. A strong genetic correlation between common carotid and femoral intima-media thickness was found, based on studies of Hungarian and Italian twins, indicating common genetic influences on these measures. Further studies should be encouraged to find specific genes affecting this association. Atherosclerosis screening could be extended to various sites of vasculature, due to this common genetic underpinning.

Nick Martin (Australia) presented a twin and genome-wide association analysis of nicotine metabolic ration, as a biomarker of smoking behavior. This talk was designed to show how fruitful collaborations can grow out of ISTS. QIMR is collaborating with the Finnish twin registry to find the genes controlling nicotine metabolism. Fast metabolizers smoke more and find it harder to stop, so if the rele-

vant genes can be identified, this might enable the design of drugs to slow metabolism and enable individuals to give up smoking.

In addition to these papers, a poster session including 14 excellent contributions was held. Please plan to attend the larger meeting of ISTS in Madrid, November 2017.

## Tribute to Irving I. Gottesman

---

It is with profound sadness that I write this tribute to our marvelous friend and colleague, Irving I. Gottesman. Irv passed away on Wednesday, June 29, 2016, at his home in Edina, Minnesota. We all knew him as a pioneer in twin studies of psychopathology and personality, a gentle but forceful critic when the challenge arose, and a friend and mentor to the scores of students he guided over the years. He will be missed by many.

My News Views and Comments column in the next issue of *TRHG* will include a longer, more detailed remembrance of Irv, his life, and the people he touched. I will appreciate brief comments, reflections and anecdotes from twin research colleagues that will help me shape this piece — so that it will meet Irv's high standards. I plan to organize a special symposium in

his honor at the 2017 ISTS meeting in Madrid. I would also like to encourage all members to make a donation to the Federation of Associations in Behavioral & Brain Sciences (FABBS), to have Irv's name placed on their prestigious Wall of Honor. Our goal is to raise the required \$2,000, so please make a contribution by visiting the link (<http://www.fabbs.org/fabbs-foundation/honoring-our-scientists/make-a-donation/>), and be sure to include his name (Irving I. Gottesman) with the donation; donations have already started to come in.

I want to thank Dr Bruce Overmeier, a faculty member in the Department of Psychology at the University of Minnesota, for launching this process that I will continue.

## Research

---

### MZ Twinning After Single Embryo Transfer

The increased frequency of MZ twinning following treatment with assisted reproductive technology (ART) has been known for some time. A study by Kanter et al. (2015), at Emory University's School of Medicine and Centers for Disease Control and Prevention in Atlanta, Georgia, has brought new information to this association. MZ twinning as a function of day of single embryo transfer was tracked among 641 mothers who delivered MZ twins between 2003 and 2012. MZ twinning was more frequent among mothers who underwent 5–6 day transfers, compared with 2–3 day transfers. Previous pregnancies increased the MZ twinning rates among this group, as well. However, assisted hatching (creating a small opening in a 3-day-old embryo's outer shell, or zona pellucida, prior to implantation) was linked with an increased risk of MZ twinning, compared with singletons, for 2–3 day transfers; intracytoplasmic sperm injection decreased the risk. Some studies, but not all, have indicated that the manipulation of the zona pellucida increases the risk for MZ

twinning, although the mechanism by which this occurs is unknown.

### Twin Study of Mononucleosis

Infection by the Epstein-Barr herpes virus typically occurs from close oral contact in a crowded childhood setting. Adolescents and adults may display a form of this infection known as infectious mononucleosis (IM). Genetic influences on IM susceptibility are of interest. Hwang et al. (2012) examined genetic effects on contracting IM using twins from the California Twin Program at the University of Southern California.

A questionnaire was sent to 115,733 individual twins and returned by 51,609. Data were analyzed for 6,926 twin pairs, born between 1957 and 1982, in which both co-twins responded. One member of 611 twin pairs and both members of 58 twin pairs reported a history of IM. Pairwise concordance values were 12.1% (MZ twins) and 6.1% (DZ twins), indicative of genetic effects. This is important health-related information for twins and their



families. However, proband concordance values are preferred because pairwise values tend to underestimate genetic influence. In addition, probandwise values can be compared across studies despite differences in ascertainment, and can accurately estimate the population rate since data are considered at the level of the individual, not the pair (McGue, 1992).

### **Cerebral Injury After Twin-to-Twin Transfusion Syndrome Surgery**

It is well known that monozygotic twins are at risk for twin-to-twin transfusion syndrome (TTTS). Prenatal surgical intervention to improve this situation has been avail-

able for some time. A study by Spruijt et al. (2012) compared the incidence and risk factors for cerebral lesions in monozygotic twins treated for TTTS with fetoscopic laser surgery, compared with dizygotic twins, matched for gestational age at birth. The study took place at the Leiden University Medical Center in Leiden, the Netherlands. The incidence of cerebral lesions was similar in the two groups — 8.6% and 6.6% among the 267 monozygotic twins and 267 dizygotic twins, respectively. It was determined that only gestational age was independently linked with increased risk for severe cerebral lesions. 12 of these 23 monozygotic twins, or 52.2%, showed severe lesions that were antenatal in origin, compared with 3 of 18 dizygotic twins, or 16.7%.

## Human Interest

---

### **Sixteen Twin Pairs Born in a Single Hospital During a Single Month**

Advocate Christ Medical Center in suburban Chicago witnessed the birth of 16 sets of twins in April 2015 (NBC, 2016). Eight of the pairs were born during the first week of that month, with the other eight delivered over the next few weeks. Twenty-nine of the 32 newborns, or 90.6%, spent time in the neonatal intensive care unit. Neither the twin type of the pairs, nor the proportion of pairs conceived naturally or by ART were reported.

The hospital staff cited their superior facilities as responsible for the rise in multiple births, attracting prospective mothers to their hospital. It is, however, likely that older maternal age and ART were also significant explanatory factors. The hospital noted that 30 new sets of twins were delivered in 2016, 5 in January, 10 in February, and 15 in March.

### **Death of an Identical Twin Playwright**

Identical twin playwright, Peter Shaffer, passed away on Monday, June 6, 2016 in County Cork, Ireland, at age 90. Shaffer's identical twin brother, Anthony, also a well-known playwright, passed away in 2001 in his mid-70s (Weber & Berkvist, 2016).

Among Peter Shaffer's best-known works are *Equus* (based on the true story of a stable boy who blinded horses) and *Amadeus* (a depiction of the rivalry between the composers Wolfgang Amadeus Mozart and Antonio Salieri). Both plays won Tony awards while on Broadway, and *Amadeus* was turned into a successful full-length film in 1984. Shaffer's twin brother who authored *Sleuth* was also recognized with a Tony award. The twins were apparently

on good terms with one another — in 1950, they published the first of several mystery novels under the pseudonym Peter Anthony. Interestingly, it has been noted that some of Peter Shaffer's plays focused on pairs of competitors, a possible theme in his own twinship.

### **Twin Themes in Advertising**

In June 2016, I received an unexpected package of twin-related materials from University of Minnesota Professor Thomas J. Bouchard, Jr. Bouchard was trimming down his files and forwarded a number of photographs and articles to me, many of great interest and meaning. Some were dated 1979–2009, overlapping in part with the years 1979–1999 that the Minnesota Study of Twins Reared Apart (MISTRA) was in progress. A page from a 1997 issue of the women's magazine, *Mademoiselle*, carried an advertisement titled 'Separated at Birth: The Life Story of Twin Shirts' (Separated at birth, 1997). A pair of identical purple shirts is depicted, with a caption to the effect that washing one in gentle Ivory Snow and the other in a different leading detergent yields demonstrable differences in the appearance and life of each garment. 'When you're treated with the utmost of care and respect it obviously shows' (p. 106). This piece is a nice example of accidental co-twin control — and/or gene × environment interaction. I strongly suspect that its content was inspired by the MISTRA.

### **Conjoined Twins Separated in Saudi Arabia**

Saudi Arabia has a reputation for successfully performing surgical separations on conjoined twins. (A number of years ago I was invited to visit Saudi Arabia's twin clinic, but was

unable to go.) According to Dr. Abdullah Al-Rabeeah, the Canadian-trained surgeon who leads this program, over 40 operations have been performed on twin pairs from poor families from 20 poor countries, across three different continents. The venue is the King Adullah Specialist Children's Hospital in Riyadh, and the program is supported by royal largesse, Islamic charity and 'shrewd public diplomacy' (Hubbard, 2016). This work has not been widely documented in scientific journals, but Dr. Rabeeah indicated that 70 out of 74, or 94.6% of the patients had survived. Dr. James O'Neill from Vanderbilt University's Medical Center commented saying that he was not very familiar with the program, but looked into it, concluding that 'on a surface level, it sounds quite valid'.

A recent operation conducted at this facility involved conjoined female twins, Fatima and Mishal, from Pakistan, connected at the belly and sharing a liver, but having individual hearts and limbs. The operation, performed by a team of 20 doctors, nurses, and technicians, was successful. The twins were approximately 1 year old at the time. The 2016 *New York Times* article that reported the story included a series of fascinating and informative photographs.

### Murder of One Twin by Her Co-Twin Disproved

Identical twin and yoga instructor Alexandria Duval was accused of murdering her identical twin sister, Anastasia, when their car fell off a sea cliff in the Hawaiian island of Maui (Ortiz, 2016). The incident occurred on May 29. Witnesses reported that the twins had been arguing prior to the fall, and authorities determined that brakes had not been applied; in fact, the car had accelerated as it approached the cliff. Anastasia was pronounced dead at the scene, whereas Alexandria (who was driving) survived, despite her critical injuries.

The twins, originally from Florida, had changed their names from Alison and Ann Dadow, although the reason is unclear. They had planned to open a yoga studio in Hawaii after several failed attempts in other states. Both twins had criminal records, including public intoxication. Ultimately, charges were dropped against Alexandria for lack of evidence.

### References

- Hubbard, B. (2016, April 6). Conjoined twins, a trip to Saudi Arabia and a risky operation. *The New York Times*. Retrieved from [http://www.nytimes.com/2016/04/07/world/middleeast/conjoined-twins-a-trip-to-saudi-arabia-and-a-risky-operation.html?\\_r=0](http://www.nytimes.com/2016/04/07/world/middleeast/conjoined-twins-a-trip-to-saudi-arabia-and-a-risky-operation.html?_r=0)
- Hwang, A. E., Hamilton, A. S., Cockburn, M. G., Ambinder, R., Zadnick, J., Brown, E. E., ... Cozen, W. (2012). Evidence of genetic susceptibility to infectious mononucleosis: A twin study. *Epidemiology and Infection*, *140*, 2089–2095.
- Kanter, J. R., Boulet, S. L., Kawwass, J. F., Jamieson, D. J., & Kissin, D. M. (2015). Trends and correlates of monozygotic twinning after single embryo transfer. *Obstetrics and Gynecology*, *125*, 111–117.
- McGue, M. (1992). When assessing twin concordance, use the probandwise not the pairwise rate. *Schizophrenia Bulletin*, *18*, 171–176.
- NBC. (2016, April 8). 16 sets of twins born at suburban Chicago Hospital. Retrieved from <http://www.nbcchicago.com/news/local/16-Sets-of-Twins-Born-in-Last-Month-at-Advocate-Christ-Hospital-375050731.html>
- Ortiz, E. (2016, June 7). Yoga instructor accused of murdering twin by driving her off Maui cliff. *NBC News*. Retrieved from <http://www.nbcnews.com/news/us-news/yoga-instructor-accused-murdering-twin-driving-her-maui-cliff-n587261>
- Scarr, S. (1969). Environmental bias in twin studies. In M. Manosevitz, G. Lindzey, & D. D. Thiessen (Eds.), *Behavioral genetics: Method and research* (pp. 597–605). New York, NY: Appleton-Century-Crofts.
- Segal, N. L. (2015). The fourth international network of twin registries: Overview from Osaka. *Twin Research and Human Genetics*, *18*, 812–818.
- Segal, N. L. (2016). Brazilian twin registry: A bright future for twin studies. *Twin Research and Human Genetics*, *19*, 292–296.
- Separated at birth: the life story of two shirts. (1997, June). *Mademoiselle Magazine*, p. 106.
- Spruijt, M., Steggerda, S., Rath, M., van Zwet, E., Oepkes, D., Walther, F., & Lopriore, E. (2012). Cerebral injury in twin-twin transfusion syndrome treated with fetoscopic laser surgery. *Obstetrics and Gynecology*, *120*, 15–20.
- Weber, B. V., & Berkvist, R. (2016, June 7). Peter Shaffer, who dissected male psyche in *Equus* and *Amadeus*, dies at 90. *New York Times*, p. B9.