

NEWS, VIEWS AND COMMENTS

The Fourth International Network of Twin Registries: Overview from Osaka/Research Reviews: Familial Fraternal Twinning; Twin Study of Masculine Faces; Physical Aggression and Epigenetics; Prenatal Education for Parents of Twins/Current Events: 2016 *Guinness Book of World Records*; Oldest Living Male Twins; Twins Reunited at Sixty-Nine; Panda Twins; Twins.com

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The 4th International Network of Twin Registries (INTR) Consortium Meeting took place in Osaka, Japan, September 28–29, 2015. The venue was the Osaka Medical Center for Medical Innovation and Translational Research. An overview of presentations and other activities is provided. Next, 1930s research on familial fraternal twinning, preference for masculine faces, physical aggression and epigenetics, and a prenatal education program for parents of multiples are described. Current twin-related events include the 2016 *Guinness Book of World Records* (GWR), the oldest living male twins, newly reunited twins, the birth of panda twins and a controversial twin-based website.

The Fourth International Network of Twin Registries: Overview from Osaka

The 4th INTR Consortium Meeting took place in Osaka, Japan, September 28–29, 2015. It was held at the Osaka Medical Center for Medical Innovation and Translational Research. The aim of the attendees was to foster harmonization and data collection among twin researchers around the world. The local organizers were Dr Chika Honda, Dr Mikio Watanabe, and Joonas Kirsi. The meeting's sponsors were the Japan Ministry of Education, Culture, Sports, Science and Technology, the Osaka University International Joint Research Promotion Program and an Osaka University Grant for Inter-University International Symposia.

The three previous meetings were held in Florence, Italy (2012), Seoul, South Korea (2013), and Budapest, Hungary (2014).

The 2015 INTR meeting began with the introduction of Dr Yoshinori Iwatani by Dr Chika Honda. Dr Iwatani,

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**FIGURE 1**

(Colour online) Conference banner for the 4th INTR meeting, Osaka Japan, September 28–29, 2015. Photo credit: Nancy L. Segal.

the current Director of the Twin Registry, delivered the opening address (Session 1). Dr Iwatani emphasized the importance of maintaining twin registries and noted two timely sessions on epigenetics and the microbiome. He also provided a brief history of the city of Osaka, which dates back 1,700 years. Osaka was once known as ‘Naniwa Takatsunomiya’, the first effective capital of Japan that was established between 300–400 A.E. Dr Iwatani’s remarks were followed by an address from Dr Nisho Shojiro, the President of Osaka University. The conference banner is shown in [Figure 1](#).

President Shojiro’s speech was followed by remarks from Drs John Hopper (Australia), Jaakko Kaprio (Finland), and Jeffrey Craig (Australia). Dr Hopper emphasized the need for large number of twins for research. He suggested that potential funding might come from studying dizygotic (DZ) opposite-sex twin pairs, given the widespread interest in gender-related behaviors and development. Dr Kaprio discussed fruitful collaborations among the Nordic countries. He also emphasized the need for sensitivity to cultural differences when compiling screening questions and other protocols for research. Dr Craig stressed the importance of obtaining the most information possible from twin registries regarding biospecimens and biomarkers. He discussed in-

tegrative personal ‘omics’ and how twin research could lead the way in that regard.

The conference included nine additional sessions covering Epigenetics and the Microbiome, New Project Talks, INTR Outreach and Funding, New Project Talks, Updates of Ongoing International Collaborations, Twin Research in Japan (presented by the conference organizers), Emerging and Established Twin Registries, Small Group Discussions on Five Selected Topics (Age at Menarche, Environmental Exposures, the Microbiome, Aging and Birth Cohorts), New Collaboration Development, the Future of International Twin Studies and INTR Evaluation. A Canadian Broadcasting Corporation (CBC) film, *Two of a Kind*, directed and produced by identical twin Leora Eisen, was available for viewing during the lunch break of the second day. Drs Jeffrey Craig and Nancy Segal were interviewed for that film. The conference’s closing ceremony included further remarks from Drs Honda and Iwatani. A group photograph is displayed in [Figure 2](#).

Every talk was substantive and significant, yet space limitations preclude detailed coverage of each one. Therefore, presentations from only two of the sessions (New Twin Registries and Japanese Twin Studies) will be presented.



FIGURE 2.

(Colour online) Group photo of INTR participants. Photo courtesy: Adam and David Tárnoki.

New Twin Registries

Some of the most exciting talks concerned the establishment of new twin registries. Dr Paulo Ferreira described the Brazilian Twin Registry as part of a global network of registries. Dr Ferreira is currently at the University of Sydney, but is involved in a study of genetic and environmental influences on lower back pain, cleverly called 'Autback'. Young twins are recruited from the university in Belo Horizonte and now total 98 twin pairs (68 MZ and 30 DZ). These twin pairs will form the platform for the Brazilian Twin Registry. Next, Dr Juan Ordoñana from Mexico described collaboration with the Murcia Twin Registry in Spain. Interests concern health and quantitative genetics. Twins are identified in Jalisco state through the linkage of names and birth dates. An estimated 10,000 pairs are available, but so far, 1,500 have been found. Dr Shayesteh Jahanfar from British Columbia, Canada is attempting to set up a twin registry, but has experienced challenges in the form of interest

and funding. She also described twin registries in Iran and Malaysia. In Iran, the registry was supported by the government and was easy to maintain. She then relocated to Malaysia where the individual responsible for the registry left, so further progress was not made.

Identical twins, Adam and David Tárnoki, described recent events surrounding the development of the Hungarian Twin Registry (HTR). Their presentation was an update of their talk delivered at the last International Twin Congress held in Budapest, in November 2014. The HTR includes 862 twin pairs with a mean age of 34 years. Addresses of the twins were made available to the researchers, but only for 6 months, and there were some unexpected legal complications. Their next step will be to distribute postcards requesting twins' participation. Dr Michelle Beaumont discussed features of the Twins UK registry at King's College, London. This registry includes 13,000 pairs, with

approximately 850 actively participating sets. A twin van has been set up to travel to twins for assessment; four individuals can be studied per day within a 50-mile radius. The next speaker was Dr. David Butler, who described the well-known National Academy of Sciences — National Research Council (NAS-NRC) Twin Registry. The registry includes white male twins born between 1917 and 1927, both of whom served in the military. The registry is winding down, but it is possible to apply for access to the data. Numerous health and medical measures are available, and over 370 publications have appeared so far. Inquiries may be sent to twins@nas.edu.

Dr Dedra Buchwald provided an update of the Washington State Twin Registry, founded in 2002. The registry includes a range of physical and mental health measures on twins. The final speaker, Dr Athula Sumathipala from Sri Lanka, discussed his nation's twin registry. It was founded in 1997 and modeled after his own experience at the Maudsley Institute in London, famous for twin studies of schizophrenia. The registry attracts twin volunteers ($N = 14,130$ twins), but is also partly population based ($N = 9,040$ twins). Future traits of interest include depression and metabolic syndrome. Support for this registry has come from the Wellcome Trust.

Japanese Twin Studies

Dr Juko Ando of Keio University traced the history of twin studies in Japan. Dr Ando referred to the 'Golden Age of Twin Studies', a period between 1960 and 1970 when Professor Eiji Inoue authored three major volumes on twins. Twin studies were also largely influenced by German psychology that emphasized unconscious processes. A school that attracted twins for research was established in Tokyo in 1946 and has expanded since then. Also worth noting is that Japan hosted the 7th Congress of the International Society for Twin Studies, in Tokyo, in 1992. Twin research is currently ongoing in many cities in Japan.

School teacher Minako Chiba spoke about research activities at the twins' school in some detail. There are currently 56 twin sets and 2 triplet sets in Grades 7–12. However, a total of 955 twin pairs and triplet sets have been studied over the nearly 70 years (1946–2015) that the school has been operational. Data include blood types, DNA samples, finger and palm prints, height and weight, chest circumference, urine analyses, and parental interviews. Longitudinal data are gathered over six-year periods. Interestingly, twins are placed in different homerooms, but may have some classes together. The twins do not mind if they are confused by people who do not know them well, but they are upset when they are confused by people who do know them.

Dr Syuichi Ooki described a database in Japan that includes families with twins and higher order multiples. She and her colleagues are conducting a nation-wide study of the long-term effects of perinatal conditions on mothers and on twins. Dr Yoshie Yokoyama from Osaka City University reported on the West Japan Twins and Higher Order Multiple Births Registry. Participants were recruited from public health centers in the 1990s, and now include over 8,000 twins and 4,500 higher order multiple births. Studies of maltreatment have found that twins' preterm neurological damage and mothers' poor health are risk factors.

Collaborations have been ongoing with researchers from the University of Helsinki. Drs Mami Tanaka and Masumi Sugawara have pursued longitudinal studies of developmental events in twins and their families as part of the Ochanomizu University Twin Study. The Project began in 1999 in association with the mothers of twins club. Over 2,000 families have enrolled with children between 0 and 15 years of age. A study of depression from late childhood to early adolescence is of interest to these investigators.

Dr Chika Honda summarized research activities involving twins studied at Osaka University (the largest national university in Japan). The Twin Center was started 30 years ago by Dr Kazuo Hayakawa, and at its peak included 12,000 pairs. The center is now comprised of 47 researchers with seven graduate schools at Osaka University taking part. The registry itself is smaller now than in the past and is volunteer based. Prepaid postcard distribution has recently helped locate a number of twins. Many psychological and health-related variables are available, and longitudinal studies using questionnaires are in progress. Imaging studies include PET scan, MRI, and magnetoencephalography. A November 2015 Twin Festival is planned and is certain to attract additional participants.

The consensus of the INTR meeting attendees was that this fourth meeting was very successful. It is also worth noting that University of Melbourne graduate student, Lucas Ferreira, is preparing a comprehensive systematic review of the characteristics and functions of the registries. He will then proceed to offer a model for international collaboration and knowledge translation of twin research.

Interested individuals are invited to visit the conference website for additional information and for viewing of the conference in its entirety. Note that the link will be available for only short time: <http://www.twin.med.osaka-i.ac.jp/INTR2015index.html>.

Research Reviews

Familial Fraternal Twinning

A fascinating paper on familial fraternal twinning by William W. Greulich (1938) is worth examining. Greulich's report documents the birth of six sets of DZ twins to the same couple. Drawing upon research published at that time, he discusses the possible biological circumstances that could explain this unusual occurrence. They include simultaneous rupture of one follicle in each ovary, polyovular follicles (release of two eggs from the same follicle) and polar body twinning (fertilization of the mature ovum and a polar body by separate sperm). In the case under discussion, there was no history of twinning on the mother's side, but a paternal grandfather had had triplets with his second wife. According to Greulich, polar body twinning would allow for a genetic predisposition for twinning to come from the father's side of the family. He reasoned that the sperm of some men may cause the tubal ovum to form two cells, both of which might be fertilized. He also cites evidence consistent with the paternal transmission of twinning.

Greulich's paper dates back to the time when researchers speculated more freely as to the reasons for the phenomena they observed. In addition, family details and twins' photographs were likely to appear along with the science, as they do in this paper, which is well worth reading for its ideas and insights. It also calls attention to polar body twinning that has been documented (Bieber et al., 1981), and described (Souter, Parisi, & Nyholt et al., 2007), but has received limited attention in relatively recent years. I believe one of the best descriptions of the biological mechanisms possibly underlying polar body twinning remains Bulmer's (1970) classic work.

Twin Study of Masculine Faces

An increasing number of researchers are using twin methodologies to assess evolutionary-based hypotheses and questions. In the past, women's preferences for masculine faces have been explained with reference to context-dependent effects. However, some uncertainty has arisen regarding such explanations. Brendan P. Zietsch from the University of Queensland and colleagues (Zietsch et al., 2015) conducted a twin study in which MZ and DZ female twins completed a forced-choice experiment asking them to select one of two male images that they preferred. One image showed males with masculinized features, while the other showed males with feminized features. After considering various contextual factors such as disgust for pathogens and self-perceived attractiveness, it was concluded that

genetic differences accounted for the greatest amount of variation in masculine facial preferences (38%), relative to the combined effects of context-specific factors (<1%).

Prenatal Education for Parents of Twins

A survey of websites for hospitals local to the University of Connecticut, in Storrs, showed that a prenatal education course for mothers expecting multiple birth babies was unavailable (Kuhnly et al., 2015). Consequently, the combined efforts of three researchers culminated in a unique nine-hour course. The program was organized as a three-part series including three three-hour sessions per week for three-consecutive weeks. The decision was made to make the course available every three months.

This prenatal education program is detailed and comprehensive. The first week covers labor and birth, cesarean sections, and postpartum care. The second week covers infant care and also provides a tour of the maternity facilities. The third week includes a tour of the neonatal intensive care unit (NICU), information on feeding, and the personal perspective of a multiple birth parent. Expectant mothers especially appreciated knowing that a staff member was herself the parent of multiples. The program is still evolving to meet the growing needs and challenges associated with multiple pregnancy and beyond.

Physical Aggression and Epigenetics

A review of research on the developmental origins of physical aggression, with reference to twins and epigenetics (Tremblay, 2015), is a timely contribution to the literature. Longitudinal studies of twins and non-twins have shown that physical aggression is more frequent during the early childhood years than at other times during the lifespan. However, there is greater scientific focus on aggressive behaviors expressed during adolescence and adulthood.

Epigenetic considerations are that women who smoke, consume alcohol, are exposed to abuse and/or have behavioral problems are more likely to have children whose brain development is altered due to prenatal gene modifications. These children may be more likely to experience difficulties controlling their emotions. Tremblay suggested that the 'ultimate experimental design' would be the random allocation of MZ twins to different environmental situations for monitoring their gene expression, behavioral traits, and brain development. The reasoning is that insights into the origins and prevention of physical aggression would be likely, given

the genetic control. Of course, such a plan could not be implemented due to the unethical implications of placing one twin in a socially disadvantageous situation. However, twins raised apart offer such research advantages, but do

not do so because of purposeful separation. The intentional subjection of twins to different conditions with the potential for differences in physical aggression cannot be condoned.

Current Events

2016 Guinness Book of World Records (GWR)

The 2016 GWR includes special two-page coverage of new world records set by twins. I was privileged to serve as a consultant for this upcoming edition, which involved confirming some previously held records, but mostly discovering new ones. I am grateful to readers of *TRHG* and others who responded to my request for new facts and figures.

An interesting note is that identical twins Norris and Ross McWhirter, from England, launched the GWR in 1955. They were the first authors to sell over 25,000,000 copies of a single title. Sadly, Ross was killed by the provisional Irish Republican Army in November 1975 as a result of his political activities. His twin brother Norris authored a wonderful book about him, simply titled, *Ross* (McWhirter, 1976). I quote from his introductory section:

The products of single births and indeed many twins do not and cannot understand the intimacy of some identical twinhoods. This one had lasted literally from the moment of birth to this moment of death. As I was being driven back through the roadblock in a policeman's sports car with my head under a blanket, I felt that I was about to be reborn — not as half a person but as a double person.

Oldest Living Male Twins

The 2016 *GWR* went to press prior to the inclusion of a new twin-based statistic: the oldest living male twins. This distinction belongs to 102-year-old Pierre and Paul Lange-rock of Belgium. The twins were born on July 8, 1913. This information was made available to me by Carim Valerio, who works for *GWR*. Interestingly, she wrote, 'They are relatively young by *GWR* standards.' In fact, the oldest male twins ever to have lived were Glen and Dale Moyer of the United States, born in 1895, who both lived to be 105 years of age (*Guinness Book of World Records*, 2015).

Twins Reunited at Sixty-Nine

Twins, George Skrzynecky and Lucian Poznanski, were born on June 1, 1946, in Kassel, Germany. Their Polish mother, Elizabeth Janowska, gave birth to them after she was sent to a forced labor camp (O'Neill, 2015). When she became ill and unable to care for them, the twins were sent to Poland by the Red Cross and adopted by different families.

They were unaware of each other's existence for many years. Lucian only learned that he was adopted after being drafted into the army, while George learned that he had a twin at age 17. George tried to find his brother in 1960, but was unsuccessful. George eventually relocated to California to begin a new life, while Lucian remained in Poland.

The twins who appear to be fraternal, were recently reunited in Warsaw following a search through the Red Cross. It happened after Lucian learned as recently as 2014 that he had a twin brother. Their moving reunion was captured on film and has been circulated widely via numerous websites. The twins also learned that their mother had tried to find them, but was told she could not reclaim them. They were also told that their father was an American soldier who had returned home prior to their birth.

The brothers' reunion in Poland was very emotional and very moving. A website for viewing this event is provided in the reference list to this article. Lucian is planning a visit to his twin brother's home in California in the near future.

Panda Twins

A panda bear, Mei Xiang, housed at the Smithsonian National Zoo, in Washington, D.C., was expecting. However, the surprise for the zoo staff was the delivery of twins (Parsons, 2015; Geggel, 2015). The two babies were born five hours apart on August 22. Like other cubs, the twins were pink, had wispy fur and were blind. In an attempt to assist their survival, one newborn was removed from Mei Xiang for hand feeding, given antibodies from his mother and placed in an incubator. The twins were exchanged every three to four hours, but Mei Xiang was not always interested in having their positions altered.

The twins' father was not immediately known, but DNA analysis eventually determined that it was Tian Tian. DNA tests were required in this case because the semen of several male pandas had been used to inseminate Mei Xiang.

Tests showed that the twins were fraternal males. Unfortunately, the smaller of the two twins passed away at five days of age. This twin had been spending more time in the incubator than with his mother and had been losing weight. In order to foster his growth, he had been given water mixed with human and puppy formula, as well as antibiotics. However, he grew progressively weaker and was not gaining weight. He passed away on August 26.

Giant pandas deliver twins in about 50% of the pregnancies. The birth of these fraternal male twins was only the third multiple birth panda delivery in the United States. The other two panda mothers had delivered twins who survived, but with a great deal of support.

Most recently, on October 13, twin pandas were born in Canada at the Toronto Zoo (Phys.org, 2015). Their mother has shown excellent care-taking behaviors, but the infants remain vulnerable and will be kept under observation.

Twins.com

This twin-based website is run by twins, Durland, and Darwin Miller (Lindbergh, 2015). The twins selected their url (twins.com) very early, in March 1995, and claimed it for free. Since then it has been a coveted address, but the twins will not relinquish it. This address has been sought after by Major League Baseball (MLB) for the site of the Minnesota Twins baseball team. Even MLB had some difficulty securing a web address because mlb.com was first taken by the company Morgan, Lewis & Bockius, LLP, a Philadelphia-based law firm. MLB eventually created majorleaguebaseball.com in 1998, but it takes longer to type.

The details of this situation are fascinating, but too complex to report in detail. They are worth reading at the url attached to the author's name. The Miller twins continue to refuse requests to yield the address twins.com, claiming that they have identified with it for many years. (The twins look very much alike in the photograph accompanying the article, but their zygosity is uncertain due to some physical differences.) A visit to their website yields little substantial information, informing viewers that it is under construction.

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