

**NEWS, VIEWS AND COMMENTS**

# Brazilian Twin Registry: A Bright Future for Twin Studies/Twin Research: Twin Study of Alcohol Consumption and Mortality; Oxygen Uptake in Adolescent Twins/In the News: Superfecundated Twins In Vietnam; Adolescent Twin Relations; Twin and Triplet Co-Workers; A Special Twin Ultrasound; Monozygotic Twins With Different Skin Color; Identical Twin Returns from Space

Nancy L. Segal

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

The establishment of the Brazilian Twin Registry for the study of genetic, social, and cultural influences on behavior is one of eleven newly funded projects in the Department of Psychology at the University of São Paulo. These 11 interrelated projects form the core of the university's Center for Applied Research on Well-Being and Human Behavior. An overview of the planned twin research and activities to date is presented. Next, two recent twin studies are reviewed, one on the relationship between alcohol consumption and mortality, and the other on factors affecting maximal oxygen uptake. Twins cited in the media include the first identified superfecundated twins in Vietnam, adolescent twin relations, twins and triplets who work together, monozygotic twins with different skin tones and a co-twin control study that addresses the effects of space travel.

---

## Brazilian Twin Registry: A Bright Future for Twin Studies

---

A 2015 grant from the São Paulo Research Foundation (Fundação de Amparo à Pesquisa do Estado de São Paulo) was awarded to Dr Emma Otta, Professor of Psychology at the University of São Paulo, in São Paulo, Brazil. Dr Otta, shown in [Figure 1](#), serves as Project Leader, and her colleague Dr Paulo Sérgio Boggio at Mackenzie University serves as co-leader. Most importantly for twin researchers, this grant will facilitate the establishment of a Brazilian Twin Registry to enable twin studies of genetic, social, and

cultural factors affecting human wellbeing. According to the *QS University Rankings* (QS Topuniversities, 2016) and *U.S. News and World Report* (2016), the University of São Paulo is the top-rated educational institution in Latin America.

---

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) Dr Emma Otta, Professor of Psychology, University of São Paulo. Photo Courtesy: Dr Emma Otta.

The twin studies will include semi-structured, face-to-face interviews with twins for the purpose of exploring their values, attitudes, and interests, and the reasons for co-twin differences in these areas. Studies of temperament, humor styles, and self-esteem are also planned. The videotaping of twins' facial expressions in predefined settings will add immeasurably to research in this area, which has been relatively scant. A detailed list of planned collaborative projects and researchers appears below:

1. Twinning rates in Brazil — Emma Otta, Jaroslava Valentova (Instituto de Psicologia da Universidade de São Paulo [Institute of Psychology, University of São Paulo — IPUSP]) and Marco Varella (postdoc IPUSP)
2. Subjective wellbeing of MZ and DZ twins expressed by self-report and implicit measures (IAT) — Emma Otta (USP) e Renata Gonçalves Ferreira (Universidade Federal do Rio Grande do Norte, UFRN [Federal University of Rio Grande do Norte])
3. Determination of zygosity in Brazilian twins using self-report and DNA testing — Mirella Gualtieri (IPUSP) e Michel Satya Naslavsky (Centro de Pesquisas sobre o Genoma Humano e Células-Tronco, CEGH-CEL [Human Genome and Stem-Cell Research Center])
4. Olfactory awareness — Mirella Gualtieri (IPUSP)
5. Non-verbal communication — Vera Silvia Raad Bussab, Jaroslava Valentova (IPUSP) and Regina Célia Gomes de Sousa (Universidade Federal do Pará, UFPA [Federal University of Para])
6. Friendship and preferred partners' traits — Regina Célia Gomes de Sousa (UFPA), Alda Loureiro Henriques (UFPA) & Jaroslava Valentova (IPUSP)
7. Social behavior: Cooperation and competition — Maria Emilia Yamamoto (UFRN).

The growing list of collaborators reflects the participation of several Brazilian universities, including the Federal

University of Rio Grande do Norte, the Federal University of Pará and Mackenzie University, as well as the University of São Paulo. International collaborations include faculty members at The University of Sydney in Australia. The project currently includes 17 team members and the number is growing. Additional information is available (in English) at: [http://www.natura.com.br/sites/default/files/static/relatorioanual\\_en/8\\_1\\_inovacao\\_4.html](http://www.natura.com.br/sites/default/files/static/relatorioanual_en/8_1_inovacao_4.html).

I was privileged to serve as a research consultant for this project in February 2016. I spent one week at the Federal University of Rio Grande do Norte, hosted by Professor Emilia Yamamoto, and one week at the University of São Paulo, hosted by Professor Emma Otta. Under discussion were the changing twinning rates in the city of São Paulo and in the nation of Brazil, methods for zygosity testing of twins who would join the registry, and strategies for twin pair recruitment. Some procedures and questionnaires will be adapted from those used at CSU Fullerton's Twin Studies Center. A faculty member and student from the Federal University of Pará were visiting during my stay for discussion of twin studies involving sexual orientation.

Subsequent to my return to the United States, a clinical component dedicated to adult twins has been under consideration. In addition, a special twins festival to assist in the identification of twins was set for April 16. It was organized by Dr. Paulo Ferreira (currently at The University of Sydney), and took place in Belo Horizonte at the Federal University of Minas Gerais. A similar, very successful event took place several years ago in Brazil, organized by identical twin physicians, Alexandre and Ricardo Ghelman, who created the *Sindicato dos Gêmeos (Twins Union)*; a video of the group event (in Portuguese) is available on YouTube at <https://www.youtube.com/watch?v=dm4uZ4d6vmw>. The Ghelman twins will be closely involved with the twin research program.

A particular project of interest concerns the collection of Brazilian twins' life histories for the dual purposes of scientific study and human interest. The idea is to reproduce the stories of MZ and DZ twins reared apart and together, to be accompanied by commentaries from psychologists who are members of the research team. The stories will be evaluated for ideas and themes that can be examined more systematically using larger twin samples. Input from the website *Neighbors in the Uterus* (<http://vizinhosdeutero.blogspot.com.br/>) will help in this regard. I would urge readers of *Twin Research and Human Genetics* to visit this site, which is available in several different languages. It includes fascinating stories about twins reared apart, parents of twins, Brazilian celebrity twins, and adopted twins. It also includes a section for missing twins — one family posted a heartbreaking note about one of their male twin toddlers who vanished suddenly last August and has never been found.

## Extracurricular Activities

Brazil offers many cultural and recreational opportunities that I enjoyed, but I will only describe the two that are twin-related:

1. I visited São Paulo's stunning Ibirapuera Park that houses a museum, music hall, restaurant, and observatory, in addition to recreational areas and jogging paths. One of the twin project members, graduate student Tania Kiehl Lucci, drew my attention to the unusual graffiti that covered some of the park's buildings. This beautiful work was created by 42-year-old identical twin artists, Gustavo and Otavio Pandolfo, who go by the name 'Osgemeos' or 'The Twins'. As children, these twin brothers played and communicated via an artistic language all their own. They are recognized nationally and internationally, with exhibitions of their work having appeared in the United States, Cuba, Chile, Italy, Spain, and Japan. Their website (<http://www.osgemeos.com.br>) includes many of their artistic works and additional biographical information about them.

2. identical twin, Dr Ricardo Ghelman (see above), introduced me to his friend, Paulo Caruso, a very well-known Brazilian cartoonist, illustrator, caricaturist, and musician living in São Paulo. Caruso's identical twin brother, Chico, is also a caricaturist, living in Rio de Janeiro. The twins do not collaborate in their artwork, but they do play music together. I received a signed copy of Caruso's (2014) book, *Desenando Longe Cadernos de Viagem Eua Copa 94 (Travel Away Drawing Notebook 1994 World Cup)*, a collection of sketches completed in different United States cities during the 1994 world cup. Caruso agreed to compose caricatures of my fraternal twin sister (from a photograph) and me (in person) on the inside cover. His work reminds us that additional twin research on artistic ability and creativity would be welcome.

It is gratifying to see interest in twin studies spreading throughout the world. The great potential twin studies offer to so many fields is clearly well recognized. *Twin Research and Human Genetics'* next special issue on twin registries is likely to be even larger than the last one — and Brazil will be well represented.

# Twin Research

---

## Twin Study of Alcohol Consumption and Mortality

The detrimental effects of alcohol consumption on health are well known, but a new twin study looking at levels of drinking with reference to mortality is informative. Finnish researchers (Sipilä et al., 2015) distributed questionnaires to 15,607 twins to obtain measures of monthly alcohol consumption, heavy drinking occasions, and alcohol-induced blackouts. Completed forms were received from 14,787 twins between the ages of 24 and 60 years. Heavy drinking occasions (HDO) was defined as consuming more than five beers, a bottle of wine or a half bottle of spirits, at least one time per month, and on a single occasion, corresponding to more than five standard drinks or more than 60 grams of pure alcohol on one occasion. The responses were collapsed into three HDO categories: HDO, neither in 1975 or 1981; non-persistent HDO, either in 1975 or 1981; and persistent HDO, both in 1975 and 1981).

The data generated several main conclusions: (1) examining the twins as individuals confirmed an association between the three levels of heavy drinking and mortality, also found among non-twins. (2) earlier mortality was associated with heavy drinking episodes, at both the individual twin and within-pair levels. Thus, family factors could not

explain the associations between heavy drinking and earlier mortality. (3) a relationship between mortality and monthly alcohol consumption was found among MZ twins discordant for drinking. The overall conclusion from this study was that there exists a *causal connection* between high levels of drinking and early death.

## Oxygen Uptake in Adolescent Twins

The bases of athletic abilities are of great interest, especially in light of the summer 2016 Rio de Janeiro Olympic Games. A twin study and meta-analysis of the heritability of maximal oxygen uptake was completed by Schutte et al. (2016), from the Netherlands. Maximal oxygen uptake is the highest rate of oxygen consumed during a maximal intensity exercise. It is considered to be a valid index of aerobic fitness and endurance.

The study included 221 adolescent twin pairs (112 MZ and 109 DZ), 33 of their non-twin siblings and 2 non-sibling pairs. All participants completed a lifestyle interview regarding the nature and frequency of their sports participation, underwent a test of oxygen uptake while exercising, and were monitored by an electrocardiogram during exercise. The heritabilities were 0.60 (measured maximal oxygen uptake) and 0.55 (predicted maximal oxygen uptake, based on

a treadmill test). A meta-analysis of eight studies, including this one, showed that over half the variance in maximal

oxygen uptake during adolescence is associated with genetic factors.

## In the News

---

### Superfecundated Twins in Vietnam

The first pair of identified Vietnamese heteropaternal superfecundated twins (twins with different fathers) was identified in Hanoi, the capital city of Vietnam (BBC, 2016). A DNA test, performed because their family was aware of marked physical differences between the twins — one twin had curly hair, while the other twin had straight hair — revealed that the 2-year-old twins were fathered by different males. According to Professor Le Dinh Luong, President of the Vietnam Genetic Association, these twins are one of less than ten known cases.

When a female releases an egg there is a 12- to 28-hour window of opportunity for fertilization to occur. Furthermore, sperm viability lasts 7–10 days, so fertilization by two different males is entirely possible (Luu & Tran, 2016). Of course, superfecundated twins can share their fathers, and physical differences between DZ twins (including difference in hair texture) are expected, because DZ twins share only 50% of their genes, on average, by descent. Additional information explaining why the family sought a DNA test for the twins was not provided.

### Adolescent Twin Relations

A mother of twins posed a question in the syndicated Dear Abby column that is relevant to many parents raising identical adolescent twins (Dear Abby, 2016). Her 18-year-old male twins do not date and do not invite friends to their home. They appear to be content to be together all the time and refer to their classmates in derogatory terms. The twins' mother wondered if she should worry or simply wait until the twins attend college to see how their social lives progress.

Dear Abby believed that the twins' attitudes and behaviors were a cause for concern. She encouraged the parents to insist that the twins enroll in different colleges, albeit after seeking guidance from a qualified psychologist. I believe that twins should enjoy their close relationship with each other, but agree that interactions with individuals outside the twinship are important for individual intellectual and social growth. Unfortunately, it is difficult to find psychologists who are sensitive to twins' special developmental issues, although I am aware of two excellent psychotherapists in the Los Angeles area who are also identical twins. Choosing different schools may be too difficult for the twins at this time, but living in different dormitories may

help them achieve a good balance between closeness and separation.

### Twin and Triplet Co-Workers

Four sets of twins (two male and two female) and one set of female triplets who each developed and operate a joint business were profiled in a recent issue of *Orange Coast Magazine* (OCM; Mayfield, 2015). (OCM covers local news and social events in Orange County, California.) The members of the twin and triplet sets all appear to be identical, as judged by their photographs. Their businesses include creative design (Hoodszpah Design Company — the name, which derives from the Yiddish word *chutzpah*, was intended to give an impression of boldness), cake baking (Twinfully Sweet), musical performance (The Mattson 2), chiropractic medicine (Twins Chiropractic), and advice giving (Triplet Living). Not all twins become business partners, but these examples and others illustrate the genetic underpinnings of occupational choice, work values and job satisfaction (Ilies et al., 2006; also see Segal, 2012).

### A Special Twin Ultrasound

A couple expecting male–female twins (whom they named Mason and Madilyn) were devastated to learn (prior to the birth) that their son had a hole in his heart and an abnormal brain (Huffington Post, 2016). He was not expected to survive the pregnancy and delivery, but if he did, his life expectancy was judged to be minimal. The twins' parents gained some comfort from an ultrasound showing Mason's hand wrapped around Madilyn's finger. Prenatal interaction between twins has been beautifully documented in films made while twins are in the womb (Piontelli, 2002); twin fetuses have been shown to touch, kick, swipe, and sometimes hold hands.

### Monozygotic Twins With Different Skin Color

The first pair of identical twins who differ in skin tone, born in early 2015, was announced in 2016 (Brennan, 2016). The twin sisters, Amelia and Jasmine, were born to a mixed-race couple, Libby Appleby, who is Caucasian, and her partner, Tafadzwa Madzimbamuto, who is black. When the zygosity of the twins (MZ) was diagnosed prenatally by their physician, the couple assumed that they would have difficulty

telling their twins apart, but the twins' different appearance has made that task easy. In fact, strangers assume that the twins are step-sisters.

Dr Claire Steves from King's College noted that the twins' contrasting skin tones could reflect a somatic mutation in one of the multiple genes that control skin color. An alternative explanation is that epigenetic markers may differentially influence how the twins' genes are expressed; evidence that skin color may partly depend on epigenetic effects is available.

There have been documented cases of mixed-race parents whose dizygotic twins inherit different physical characteristics from each parent (Segal, 2000). However, according to results from an analysis of a placental sample, Amelia and Jasmine are identical twins whose different appearance poses an intriguing challenge for twin researchers to resolve. In fact, I find it difficult to believe that these twins are identical — aside from their skin tone difference, the twins also differ in facial structure, hair texture, and eye color. It is also unclear if their DNA was tested — reference to the placental analysis that was performed was quite vague. Until additional information is known about these twins, I prefer to withhold judgment as to their zygosity.

## Identical Twin Returns from Space

Identical twin Scott Kelly returned to earth on March 2, 2016 after spending 340 days at the International Space Station or ISS (Hammond, 2016; Than, 2016). He and his earthbound twin brother Mark Kelly are volunteer participants in an unusual co-twin control study in which scientists will compare the twins' physiology (e.g., changes in heart, muscles, and bones), behavioral health (e.g., perception and reasoning), microbiology/microbiome (effects of diet and stress on gut organisms), and molecular factors/'omics' studies (e.g., how genes are affected by space travel; how radiation and microgravity affect proteins and metabolites). Mark Kelly, who remained on earth while his twin brother was at the ISS, has spent a total of 54 days in space during four separate missions.

## References

BBC News. (2016, March 9). Vietnam twins found to have different fathers in rare case. Retrieved from <http://www.bbc.com/news/world-asia-35761281>.

Brennan, S. (2016, February 24). The mixed race twins with DIFFERENT colour skin and eyes: Amelia and Jasmine become UK's first sisters to be genetically identical but don't look the same. *Daily Mail*. Retrieved from

<http://www.dailymail.co.uk/femail/article-3461832/First-identical-twins-different-skin-colour-born-UK.html>.

Caruso, P. (2014). *Desenando longe cadernos de viagem eua copa 94 (travel away drawing notebook 1994 world cup)*. São Paulo, Brazil: Imprensa Oficial.

Dear Abby. (10 March, 2016). Twins Headed to College Should Follow Different Paths. *Orange County Register*, p. 10.

Hammond, S. (2016). Kelly twins: What does a year in space do to body, mind? *Arizona Public Media*. Retrieved from <https://news.azpm.org/p/science-news/2016/3/1/82988-what-does-a-year-in-space-do-to-body-mind/>.

Huffington Post. (2016). Stunning ultrasound photo shows unborn baby clutching twins. Retrieved from [http://www.huffingtonpost.com/entry/stunning-ultrasound-photo-shows-unborn-baby-clutching-twin\\_us\\_56c4b83ae4b0c3c550535def](http://www.huffingtonpost.com/entry/stunning-ultrasound-photo-shows-unborn-baby-clutching-twin_us_56c4b83ae4b0c3c550535def).

Ilies, R., Arvey, R. D., & Bouchard, T. J. (2006). Darwinism, behavioral genetics, and organizational behavior: A review and agenda for future research. *Journal of Organizational Behavior*, 27, 121–141.

Luu, C. C., & Tran, P. D. (2016, March 8). Twins with different fathers found in Vietnam. *CNN*. Retrieved from <http://edition.cnn.com/2016/03/07/health/twins-with-different-fathers-vietnam/index.html>.

Mayfield, R. L. (September, 2015 15). Double takes: Twins + triplets working together. *Orange Coast Magazine*. Retrieved from <http://www.orangecoast.com/features/double-takes>.

Piontelli, A. (2002). *Twins: From fetus to child*. London: Routledge.

QS Topuniversities. (2016). Retrieved from <http://www.topuniversities.com/university-rankings-articles/qs-best-student-cities/sao-paulo>.

Schutte, N. M., Nederend, I., Hudziak, J. J., Bartels, M., & de Geus, E. J. (2016). Twin-sibling study and meta-analysis on the heritability of maximal oxygen consumption. *Physiological Genomics*, 48, 210–219.

Segal, N. L. (2000). *Entwined lives: Twins and what they tell us about human behavior*. New York: Plume.

Segal, N. L. (2012). *Born together-reared apart: The landmark Minnesota twin study*. Cambridge, MA: Harvard University Press.

Sipilä, P., Rose, R. J., & Kaprio, J. (2015). Drinking and mortality: Long-term follow-up of drinking-discordant twin pairs. *Addiction*, 111, 245–254.

Than, K. (2016). A brief history of twin studies. *Smithsonian.com*. Retrieved from <http://www.smithsonianmag.com/ist/?next=/science-nature/brief-history-twin-studies-180958281/>.

U.S. News and World Report. (2016). Best global universities in Latin America. Retrieved from <http://www.usnews.com/education/best-global-universities/latin-america>.