

Editorial

Report of the 19th International Congress on Twin Studies, 26–28 September 2024, Assisi, Italy

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Abstract

The International Society for Twin Studies (ISTS) held its 19th scientific congress in Assisi, Italy, from September 26 to 28, 2024. This prestigious event, which was the seventh joint meeting with the World Congress on Twin Pregnancy, brought together researchers from various fields, including psychology, biology and medicine. Representatives from ICOMBO (the International Consortium of Multiple Birth Organisations), which supports multiple-birth families worldwide, were also in attendance. Many twin researchers consider this event to be the highlight of their professional year, as it brings together experts and parents alike to discuss the latest advancements in twin studies.

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Conference Summary

The 2024 congress focused on exploring the factors that shape human development through twin research. A major theme was the interplay between genetics and environment in influencing health outcomes. The wide-ranging topics covered included health risks, the influence of environmental factors, and the use of innovative research tools to advance scientific understanding.

One of the most interesting findings presented was the role of life events, like stress, in altering DNA activity. Research showed that these epigenetic changes could increase the risk of diseases such as cancer and anxiety. This demonstrates how external factors can leave a lasting imprint on our genetic material, potentially affecting not just the individual but also future generations.

Another area of focus was the gut microbiome, where long-term studies explored how early life factors, such as diet and breastfeeding, influence children's mental health and development. Researchers presented data showing that gut health in early life could have lasting effects on brain development, opening the door for new interventions that promote mental wellbeing through dietary adjustments.

The Danish Twin Registry provided valuable insights into the genetics of COVID-19. During the first and second waves of the pandemic, no significant genetic effect on COVID-related hospitalizations was found. However, during the third wave, when vaccines were available, researchers observed a slight genetic influence. Interestingly, the study revealed that the risk of hospitalization for COVID-19 was no higher in an identical twin than in their (primarily female) spouse. This finding highlighted the complex nature of genetic and environmental influences on disease susceptibility.

Breast cancer research was another key topic. One study highlighted how stressful life events and early menarche (the onset of menstruation) were linked to an increased risk of breast cancer in identical twins. The affected twin had a higher risk compared to her co-twin, underscoring the importance of life experiences in shaping health outcomes, even in genetically identical individuals.

In addition to these health-focused studies, the congress also showcased innovative research tools. New methods for analyzing administrative data are enabling scientists to build larger twin cohorts, which will lead to more accurate and reliable studies. Advancements in imaging technologies offered fresh insights into how pregnancy affects blood vessels, and artificial intelligence (AI) is making it easier to distinguish between identical twins. These innovations have potential applications in forensic science and medical research, where identifying twins accurately can be crucial.

The Bulmer section of the conference was dedicated to twin biology research. One study found a difference in a particular RNA transcript involved in the formation of fraternal twins, suggesting that multiple ovulation is a key factor. This trait, researchers noted, is inherited through the mother, with no influence from paternal genetics. Another fascinating discovery linked identical twinning to a rare condition known as amyoplasia, which was found to have a tenfold increase in incidence among identical twins. These findings contribute to our understanding of the biological mechanisms underlying twin formation.

Personalized medicine was a major theme throughout the conference. Several presentations examined how genetic and environmental factors interact to influence conditions like obesity and diabetes. By understanding these interactions, researchers hope to develop more effective treatments tailored to an individual's genetic profile. Brain imaging studies added further depth by showing how both genetic factors and environmental influences shape brain structure and development. These insights

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are paving the way for new approaches to mental health treatment, offering the possibility of more personalised interventions in the future.

Opening Lecture: Nancy Segal's Presentation

The conference opened with a keynote presentation from Professor Nancy L. Segal, a leading expert in twin studies. Her talk, titled 'Twins and Twin Studies: The Science and the Fascination', captivated the audience as she explored the unique insights twins offer into human development. Segal explained that identical twins, who share 100% of their genes, and fraternal twins, who share about 50%, provide a natural experiment for studying the roles of genetics and the environment.

Segal highlighted some extraordinary twin cases, including mirror-image twins (who display reversed physical traits), identical twins with dramatically different outcomes, and biracial twins, where each twin had a different father. She also discussed twins raised apart, which have been instrumental in demonstrating the impact of environment on development, even when genetics are shared.

One of the more recent developments Segal shared was the discovery of subtle genetic differences between identical twins. While they share nearly all of their DNA, tiny mutations can occur that make them genetically distinct in specific ways. Moreover, identical twins carry epigenetic markers — changes in gene expression influenced by external factors — that persist throughout life. This makes twin studies particularly valuable for understanding how genes and environment interact over time.

Segal's presentation not only offered a scientific perspective on twin research but also explored the public's fascination with twins. Whether it is the mystery of identical twins or the surprising differences between fraternal twins, the public remains deeply intrigued by these 'natural experiments' in human genetics. Segal's research continues to shed light on how twin studies can help us better understand everything from personality development to the origins of disease.

Invited Lecture: Matthew J. Landry's Presentation

Matthew J. Landry delivered an engaging invited lecture titled 'You Are What You Eat: A Twin Experiment'. His research focused on nearly 30 pairs of identical twins in the United States, exploring how different diets affect health outcomes. The study followed the twins for eight weeks, with one twin in each pair following a vegan diet, while the other continued with their regular eating habits.

The results were striking. After just four weeks, the vegan twins showed a significant decrease in LDL cholesterol levels, which are associated with a reduced risk of heart disease. By the end of the eight-week study, these twins had also experienced decreases in insulin levels and body weight. The study even found that the short-term vegan diet had an epigenetic effect, with the epigenetic clocks of the vegan twins showing an age advantage of six seconds compared to their nonvegan counterparts.

Landry's research highlights the potential of dietary interventions to produce rapid and measurable changes in health markers. More importantly, it demonstrates how lifestyle factors, like diet, can influence not just immediate health outcomes but also long-term genetic expression. This type of research is essential as we look for ways to personalise dietary recommendations based on an individual's genetic makeup.

Jenny van Dongen in the Bulmer Session

Jenny van Dongen from Vrije Universiteit Amsterdam presented her research during the Bulmer session, focusing on the epigenetic patterns linked to identical twinning. Van Dongen's study built on previous findings that identified specific epigenetic markers associated with twinning. Her research compared naturally conceived twins with those born via in vitro fertilisation (IVF) and found distinct differences in their epigenetic profiles. Interestingly, identical triplets displayed even stronger epigenetic patterns, further supporting the idea that twinning leaves specific genetic and epigenetic markers.

One of the more intriguing aspects of van Dongen's presentation was the potential for developing a test to identify lone survivors of identical twinning events, where one twin was lost early in pregnancy. This research not only advances our understanding of how twinning occurs but also opens up possibilities for new diagnostic tools that could detect epigenetic signatures of early twin loss.

The Film Session

A unique feature of the ISTS congress was a session dedicated to twin-based documentary films, chaired by Dr Nancy Segal. Two new films, *The Accidental Twins* and *Peter & Erik*, were showcased, both of which explored the psychological and emotional impacts of twins who were separated or switched at birth.

The Accidental Twins, directed by Colombian filmmaker Alessandro Angulo Brandestini, tells the story of two sets of identical twin boys who were accidentally switched at birth in Colombia. The mix-up went undiscovered for 25 years, leading to significant identity struggles when the truth was revealed. The film examines how the twins' lives diverged based on the environments in which they were raised, despite their genetic similarities.

Jorge and William, one of the pairs of switched twins, were raised in Bogotá, while Wilbur and Carlos grew up in Velez, a small town 100 miles away. The twins' lives took very different paths, shaped by the resources and opportunities available in their respective environments. William, for instance, only attended school until the fifth grade and struggled to access further education, while Jorge earned a college degree and became an engineer.

The discovery of the switch was traumatic, especially for Carlos and William, whose sense of identity was deeply affected. The film follows the twins as they navigate their new reality and come to terms with the lives they might have lived. *The Accidental Twins* offers a poignant exploration of the nature versus nurture debate, showing how genetics and environment intertwine to shape who we are. More about this story is available in the book *Accidental Brothers*, by Nancy Segal, published in English and Spanish.

The second film, *Peter & Erik*, directed by Dutch journalist Myrthe Buitenhaus, tells the story of identical twins in the Netherlands who were adopted into separate families as infants, against their biological mother's wishes. The twins, who were unaware of each other until they were 17, embarked on a journey to uncover the reasons for their separation, which they suspect may be linked to controversial twin-separation studies conducted in the 1960s.

Peter & Erik delves into the emotional and psychological impacts of being separated from a twin, as well as the ethical questions.