

**NEWS, VIEWS AND COMMENTS**

## Stolen Twin: Fascination and Curiosity/Twin Research Reports: Evolution of Sleep Length; Dental Treatment of Craniopagus Twins; Cryopreserved Double Embryo Transfer; Gender Options in Multiple Pregnancy/Current Events: Appendectomy in One Twin; Autistic Twin Marathon Runners; 3D Facial Recognition; Twin Biathletes

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The story of her allegedly stolen twin brother in Armenia is recounted by a 'singleton twin' living in the United States. The behavioral consequences and societal implications of this loss are considered. This case is followed by twin research reports on the evolution of sleep length, dental treatment of craniopagus conjoined twins, cryopreserved double embryo transfer (DET), and gender options in multiple pregnancy. Current events include the diagnosis of appendectomy in one identical twin, the accomplishments of autistic twin marathon runners, the power of three-dimensional (3D) facial recognition, and the goals of twin biathletes heading to the 2014 Sochi Olympics in Russia.

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### Stolen Twin: Fascination and Curiosity

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In September 2013 I was introduced to Karen Wagner, a 47-year-old preschool teacher from Orange County, California. Karen was intensely interested in learning about twin research and what is known about the importance of twinning. Karen's twin brother was allegedly stolen by hospital staff soon after he was delivered. Her mother was awake and alert during the delivery and clearly recalls the birth of two babies. She was initially told that she had given birth to a single child, but was later told that her second infant had died. Her husband was forbidden to enter the delivery room, so was not a witness to these events. However, Karen's aunt, who was a hospital nurse, noted that a burial for this baby never took place.

According to Karen, the fact that a funeral did not occur was telling. She explained that in the event of an infant's

death, a ceremony would surely have been arranged in the devoutly Christian Republic of Armenia where the family was living at the time.

Karen (née Karine Kemdjian) was born on December 14, 1965. Her mother and father were Nazik and Karo Kemdjian; her mother passed away in 1996. A family photo is displayed in Figure 1. Soviet Armenia (SSR) was then one of the 15 republics comprising the Soviet Union, beginning in 1922. In 1990, the SSR was renamed the Republic of Armenia until its official independence in 1991. A new

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**FIGURE 1**

Portrait of Karen's family taken in 1977 when she was eleven years old. Karen is second from the right in the front row. Photo courtesy: Karen Wagner

constitution was adopted in 1995 (Countries and Their Cultures, 2013). Under the communist regime, citizens could not ask questions, so accurate information (even of a very personal nature such as the birth of a baby) was withheld. Karen emphasized that people outside such regimes have difficulty believing that such things happen, but they do. In one of the switched-at-birth twin cases I reviewed in *Someone Else's Twin* (Segal, 2011), parents in communist Poland were denied access to their twins and non-twin when the infants were hospitalized for treatment of pneumonia. When one twin with a clubfoot was inadvertently exchanged with an unaffected non-twin infant, neither mother questioned the sudden appearance and disappearance of the condition in their child. Had such questioning occurred, the switch might have been discovered immediately. The real twins did not discover each other until they were sixteen and a half.

It is interesting to speculate on the time at which people first learn that they have a twin sibling. Ordinary twins raised together usually answer by saying they 'always knew'. Thus, the precise moment at which they fully understood the significance of twinship cannot be known. In fact, such knowledge is available only to reared-apart twins who are reunited as older children or as adults. It is curious that psychological investigators have researched the timing of chil-

dren's understanding of conservation, gender constancy, and even death, but children's comprehension of sibship and twinship has been ignored. Thinking back over the years, Karen believed that she had always known about her twin because it was a 'constant family story'. However, she indicated that it was not until she was 7 years of age that she fully grasped the concept of twinship. Her sense of being a twin was also reinforced because she had a younger brother who was sometimes taken to be her twin.

Karen and her family emigrated from Armenia to the United States when she was 11 years old. A requirement for doing so was that the family have a blood relative living in the United States. However, she did not arrive in California until she turned 13 because the family remained in Italy for 2 years. Consequently, Karen lost several years of schooling in the process, but was able to matriculate easily into the US school system because of her previously advanced curriculum. Karen eventually attended Los Angeles City College and Orange Coast College, earning two Associate of Arts degrees and several professional certificates.

Karen thinks about her twin brother often, especially since she is the godmother of dizygotic (DZ) twin girls and is surrounded by four sets of young twins at the school where she teaches. She finds twins 'fascinating and amazing'

in appearance, and in their interactions with one another. She is not bitter or resentful about losing her twin, but instead is extremely grateful for the benefits of living in the United States. Unable to have children of her own, Karen thought about adopting twins. She tried to adopt when her husband became a Big Brother to a male–female non-twin sibling set — she did not want them to be separated — but that did not work out. Karen also tried adopting children from Armenia following the 1988 earthquake that left many children without parents, as well as from China, but various financial and procedural complexities prevented this from happening.

Karen's husband recently found the father whom he had never met. Both he and Karen have been impressed by father-son similarities in gestures, occupational pursuits, and other behaviors. At the present time, Karen remains curious about her twin brother, a feeling no doubt reinforced by her husband's reunion experience. She wonders where her brother might be, assuming realistically that he has no knowledge of his multiple birth status. The Internet has helped many twins and non-twins reconnect with biological family members — some people unaware of being

a twin suddenly discovered that they had one (Futerman, 2013). Unfortunately, Karen has no information with which to work other than a birth date. The chances are slim that she will locate her twin brother, but perhaps this article will help find him.

Karen's story poses critical implications for health services and the importance of family. As I demonstrated in *Someone Else's Twin* (Segal, 2011), more rigorous protocols need to be instituted in hospitals and nurseries to ensure that mothers receive the right babies, and that unauthorized individuals are prevented access to infants. Progress has been made along these lines, and along the lines of patient empowerment, but much remains to be done. For example, it was estimated that in 2010, approximately 20,000 baby switches occur each year in US hospitals (DNA Diagnostics Center, 2007). Most errors are believed to be corrected, but it is likely that some mistakes go undetected. Second, appreciation and respect for parents and their infants need to be heightened in many societies. Every mother deserves to go home with the baby (or babies) she delivered. Individuals selling newborns for profit need to be severely punished. There is simply no excuse for their actions.

## Twin Research Reports

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### Evolution of Sleep Length

There is considerable individual variation in sleep length. Prior research has reported genetic influence on hours of sleep per night using one time point. However, Finnish researchers have recently reported the first longitudinal twin study of self-reported sleep length gathered at three points in time (Hublin et al., 2013). The adult twins were identified via the Older Finnish Cohort that includes same-sex twins born before 1958, with both co-twins alive in 1975. A total of 11,041 twin pairs completed the sleep survey at all three time points (1975, 1981, and 1990). Participants responded to the question: 'How many hours do you usually sleep per 24 hr?' embedded in a longer questionnaire. Response alternatives were organized into three groups: short (<7 hr), average (7–8 hr) and long (>8 hr). Prior to analysis, the pairs were categorized by age and sex within each measurement time (18–32, 33–34, and 45–54 years).

Relatively low but stable genetic influence was detected at all three time points, ranging between 0.30 and 0.32. Genetic correlations among these estimates were high, ranging between 0.76 and 0.93). In contrast, environmental effects (nearly exclusively non-shared) at all three time points were relatively high, at approximately 0.70. However, the correlations among these measures were low, ranging between 0.18 and 0.33. The investigators concluded that the evidence of sizeable environmental influences on sleep length suggests that effective remedies for some sleep

problems (e.g., insomnia or brief periods of sleep) are likely.

### Dental Treatment of Craniopagus Twins

Craniopagus twins are conjoined twins attached at the head. Two pediatric dental teams described their recent treatment of 4-year-old craniopagus female twins in Canada (Campbell, 2013). Only 2–6% of conjoined twins are connected in this way. The twins in question were conjoined in the temporoparietal region of the skull in a way that their faces looked away from one another. The report describes the unique challenges and innovative procedures associated with the twins' dental care.

Both twins showed complete dentition, but had many decayed teeth. They also followed poor oral hygiene habits. Both twins were also affected with slight gingivitis (inflammation of the gums). The twin with the longer face and narrower maxillary arch form showed more pronounced gingivitis than her co-twin (the maxilla is the bone of the upper jaw). This suite of traits is consistent with breathing through the mouth, associated with restricted airway volume. Finally, the twins showed mirror-imaging of surface caries in some teeth with respect to distribution and severity.

The twins' dental treatment required general anesthesia, two sets of intravenous and monitoring equipment,

and two dental carts. Two surgical teams were assembled to treat the twins simultaneously so as to minimize the time each child would spend in surgery. A larger than normal room was reserved to accommodate the physical requirements and logistics of the operation. The orientation of the twins' faces posed some challenge to the two pediatric dentists who were both right-handed. However, the treatment proved successful and the twins were asymptomatic at their 3-month follow-up visit. The twins returned to the hospital 7 months after their first visit in order to have a tonsillectomy for one of the twins. The operation progressed smoothly with lessons learned from the previous operation.

It appears that the twins share a significant amount of sensory information. Tactile and taste stimuli presented to one twin are experienced by the other twin. Eyeglasses are also poorly tolerated by the twins due to the exchange of information between them. This case report is an excellent illustration of the creativity and innovation required to treat children with special needs, in general, and twins with special needs, in particular.

### **Cryopreserved Double Embryo Transfer (DET)**

The first study to identify specific variables predictive of live twin births following cryopreserved DET was recently reported (Kaser et al., 2013). Data were gathered between 2002 and 2011 from patients at the Brigham, and Women's Hospital in Boston, Massachusetts. Participants included 207 women who had undergone DET, followed by the successful birth of twins or singletons. Embryos were transferred at day 3. Mothers of twins and singletons did not differ with respect to age at freezing, day 3 follicle stimulating hormone (FSH), number of prior failed fresh or frozen cycles, time of embryo storage, use of assisted hatching at transfer, and endometrial thickness.

Regression analyses indicated six DET-associated variables that predicted multiple birth. These variables were age at transfer, intact survival of the lead embryo after thawing, resumption of mitosis, cell number of the non-lead embryo, transfer of a superior quality lead embryo, and number of viable cells from the two embryos combined. A superior embryo was defined as one having  $\geq 7$  cells, a fragmentation score of  $< 10\%$  and blastomeres with little or no asymmetry. The lead embryo was defined as the one having the best composite morphology score, while the non-lead embryo was defined as the other embryo that was transferred.

The authors noted that their prediction model now requires application and testing with larger samples.

The authors also noted that their one surprising finding was that younger women had a higher chance of producing twins than did older women. The association between maternal age at transfer and pregnancy outcome has been controversial. It was speculated that older women may experience decreased uterine blood flow, impaired sensitivity to progesterone, and altered endometrial receptivity.

### **Gender Options in Multiple Pregnancy**

Fetal reduction (FR) is a means for reducing the number of fetuses in high-risk multiple pregnancies (e.g., triplet fetuses to one or two, or twin fetuses to one) to improve the chance of a favorable birth outcome. FR is typically applied when major or minor anomalies are detected in fetuses. However, FR has also been sought by some parents for the sole purpose of having a son or daughter. Initially, the Mt. Sinai Hospital team of Evans et al. (2013) refused to honor such requests. More recently, and in consultation with a bioethicist, they decided to prioritize FR decisions as follows: (1) Major fetal anomaly, (2) suspected or diagnosed minor fetal anomaly, and (3) gender preference if options (1) and (2) did not apply. A study was conducted to assess parental gender preference as a function of these three situations.

The sample was drawn from a pool of several hundred patients whose pregnancies had begun with twins or triplets, and who had undergone chorionic villus sampling (CVS) for detection of fetal disorders and defects. Seventy-nine women who reduced triplets to twins due to a major or minor fetal anomaly had a gender option: 71 chose a male–female pair or had no preference, one chose a male–male pair, and seven chose a female–female pair. Twenty out of 35 women who reduced monozygotic (MZ) twins in a triplet set to a singleton birth had a gender option — 10 chose male and 10 chose female. Forty-four out of 162 women who reduced twins to a singleton had a gender option — 20 chose male and 23 chose female. The investigators admitted that they did not maintain careful records of previous patients' prior gender preferences. However, they sense that gender preferences have shifted in recent years such that most people either prefer one male and one female, or lack a preference. It is worth noting that when FR involved reducing twins to a singleton, over half the families preferred a female. Evans et al. (2013) emphasized that generalization beyond their present sample may not be appropriate.

## **Current Events**

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### **Appendectomy in One Twin**

Identical twins David and Travis Wear play basketball for the UCLA Bruins. In October 2013, Travis was sidelined

for 2½ to 4 weeks following an operation for appendicitis. His twin brother David held his own on the court, contributing a double–double with 12 points and 13 rebounds

(Pucin, 2013). In contrast, some twin athletes are unable to maintain their usual high level of performance in the absence of their co-twin, such as Marcus and Markieff Morris, who were drafted by separate basketball teams (the story of these twins and their eventual reunion were discussed in a previous issue of *Twin Research and Human Genetics*; Segal, 2013). It is to the Wear twins' credit that they play well both together and apart. It was insensitive of the author of the news article to claim that, based on Davis's impressive performance, 'The Bruins didn't miss Travis Wear'.

I was curious as to whether appendicitis has a genetic component. A recent report noted that the etiology of appendicitis has remained controversial for over 100 years (Ergul, 2007). Positive family histories have been reported for affected individuals, as compared with surgical controls, indicating an elevated risk, most likely polygenic in nature (Basta et al., 1990). A review of past studies suggests that half the variability of risk for appendicitis is associated with genetic factors (Ergul, 2007).

### Autistic Twin Marathon Runners

Alex and Jamie Schneider are identical twins who recently made news for two reasons (Janis & Shaw, 2013). First, the 23-year-old twins participated in the 43rd annual New York City Marathon held on November 3, 2013. Second, the twins are both severely autistic. According to their mother, running has given them an effective means for coping with the frustration of being unable to communicate. Fortunately, their sensitive parents noted how much they enjoyed

chasing their father when they were 8 years old. When they turned 15, it was clear that running was something they could both do and enjoy.

In addition to the New York Marathon, both twins also entered the April 2013 Boston Marathon. Alex finished with a time of 3 hr, 23 min, while a time was not listed for Jamie. Distance running has become a family activity as a result of the twins' interests and accomplishments in that sport.

### 3D Facial Recognition

Security is a high priority for the February 2014 Olympics in Sochi, Russia. The Broadway 3D Facial Recognition system, developed by the Artec group, provides high security by accurately identifying individuals via their facial characteristics (Designboom, 2013). Recognition is based upon analysis of 40,000 points on an individual's face, followed by comparison with faces in an existing database. The system is reputed to even distinguish between MZ co-twins.

Several years ago, MZ male twin brothers visited my laboratory, one of whom unlocked his computer by means of a visual recognition system. That is, the computer was designed to unlock only upon scanning the eyes of the owner. We tested the system using his twin brother and discovered that he was also able to unlock the machine. This system, while effective, was not completely foolproof. It would be interesting to identify and study identical twins who could not be distinguished by the 3D Facial Recognition system. The number of twins that have been tested with that system was not indicated.

## Twin Biathletes

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Lanny and Tracy Barnes, identical twins from Durango, Colorado, are planning to participate as biathletes at the 2014 Winter Olympics (AP News, 2013). Biathlons involve competing in shooting and skiing, an event in which Americans have never won a medal. The twins recently underwent surgery for compartment syndrome, a serious condition marked by increased pressure in a muscle compartment. If untreated, compartment syndrome can cause damage to the muscle and nerves (American Academy of Orthopaedic Surgeons, 2009). Both twins had experienced prior leg pain that interfered with their balance and prevented them from properly pushing off during skiing events. Both twins have recovered from their surgery and have participated in Olympic trial events held in August and October of 2013. The complete US team had not yet been decided at the time of this writing.

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