

NEWS, VIEWS, AND COMMENTS

Switched-at-Birth Twins in the Canary Islands: Revisited / Research Reports: Parkinson's Disease Discordance, Assisted Reproductive Technology and Neonatal Surgery, Double Embryo Transfer in a Cynomolgus Monkey, Mathematical Analysis of a Twin Convention Conundrum / Media Highlights: Twin Inventors, Basketball Duo, Two Comedians, Paired Designers, Two Musicians, Two Comedians, Twins' Birth Interval

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Switched-at-birth twins from Las Palmas, Gran Canaria in Spain drew international attention in May 2008 following news reports of their unexpected reunion. I visited Las Palmas in September 2009 to research this case and presented the findings in Segal and Blandón-Gitlin (*Twin Research and Human Genetics*, Vol. 13, 2010, pp. 115–119) and in a book, *Someone Else's Twin: The True Story of Babies Switched at Birth* (Segal, Prometheus Books, Amherst, New York, 2011). I traveled again to Las Palmas in November 2012 to meet with the twins, their families, and their attorneys and have updated my findings in this article. Next, new twin research on Parkinson's disease discordance, neonatal surgery, double embryo transfer in a cynomolgus monkey, and a convention conundrum are presented. Media highlights concerning twin inventors, basketball players, rappers, designers, musicians, and birth intervals are also summarized.

Switched-at-Birth Twins in the Canary Islands: Revisited

Switched-at-birth twins are rare in that only seven or eight documented cases have appeared in the literature (Segal, 2011). Of course, these unusual separated twins must find each other, either through mistaken identity, family records, or other means, and that is not easy. In fact, every known reunited switched-at-birth twin pair has been monozygotic (MZ), and it has been their matched ap-

pearance that led to their confusion by others and eventual meeting. It is much less likely that switched-at-birth

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fraternal twins might meet because of their different physical appearances.

In September 2009, I learned of switched-at-birth MZ female twins (Begoña and Delia), reunited after 28 years apart (Segal and Blandón-Gitlin, 2010). Begoña had been mistaken for Delia by a sales person in a shopping mall, a chance meeting that ultimately led to the discovery of the switch. I conducted detailed studies of their life histories and behavioral traits, and interviewed the attorneys managing their lawsuit against the national health services. It is suspected that one of the nurses was responsible for the twins' unintentional separation and the consequent creation of an unrelated 'fraternal' twin pair (Begoña and Beatriz). The result was a book, *Someone Else's Twin: The True Story of Babies Switched at Birth* (Segal, 2011).

The families in question were from the Spanish city of Las Palmas, in Gran Canaria, situated off the western coast of Africa. The island is beautiful and it was an easy decision to return in November 2012, following a Congress I attended in Madrid. This time my meetings with the twins were oriented toward assessing the impact of the switch on their current lives and relationships, rather than on recording their behavioral similarities and differences. (However, in the course of our meetings I discovered new similarities and differences of which I was unaware in 2009.) Our 2012 meetings included a formal session with one of the lawyers, serious discussions, as well as more casual discussions at an 'asadero' (barbeque) at one twin's home. I also met privately with each attorney, José A. R. Peregrina (who had represented Begoña, Beatriz, and their mother) and Sebastian Socorro Perdomo (who had represented Delia). The twins' case had been decided in March 2009, was appealed in April 2009, and was eventually settled in December of that year. More recently, Peregrina had represented Delia's parents, Débora and Juan, in a case that had settled in their favor several months prior to our 2012 meeting.

Sr. Peregrina (Law office of Sr. Peregrina: November 9, 2012). A visit to Sr. Peregrina's office felt familiar as I had been there many times. He recalled that the twins' case had attracted considerable attention at the national level in 2008 and remains the best known of all the cases he has handled. However, his more recent lawsuit involving Delia's parents (the couple who unknowingly raised an unrelated child) proved even more newsworthy, leading to prime time interviews on national television. Each parent was awarded 220,000e (approximately 283,460 US dollars) for the pain and suffering they experienced from not having had the opportunity to raise their own biological child. There has been no contact between Delia and her parents since the DNA test determined their lack of biological relationship. Débora and Juan still suffer, feeling as though they lost a daughter whom they loved.

Sr. Socorro (Law office of Sr. Socorro: November 9, 2012). Sr. Socorro's office was another familiar place that I had visited many times in 2009. Looking back, he affirmed that

the twins' case was very significant with reference to media attention. However, its real impact came from the fact that it was the first one of its kind to be presented in court. Socorro continues to feel that the legal system did not provide adequate compensation to the twins and their families (900,000e [1,195,460 US dollars] in total, distributed among the four clients as follows: Delia (360,000) and Begoña, Beatriz, and their mother (180,000e each); nor did it justify reasons for offering less than his specified sum. He justified his higher request of 3,000,000e (approximately 3,866,290 US dollars) by likening the twins' situation to people deprived of freedom. He reasoned that two children grew up in the wrong family and Delia (his client), who became sick with cancer as a teenager, was denied access to a perfect bone marrow donor (Begoña). Despite the monetary outcome, Socorro is confident that his actions and decisions were appropriate because negligence and irresponsibility on the part of the hospital staff were demonstrated and were compensated for.

Begoña, Beatriz, Delia, and Sr. Peregrina (Law office of Sr. Peregrina: November 12, 2012). Discovering a twin can bring considerable pleasure and richness to one's life, as evidenced by the reunited twin participants in the Minnesota Study of Twins Reared Apart (Segal, 2012). Most separated twins grow up apart because of inadequate family resources, illegitimate birth, or related causes. However, discovering a switched-at-birth twin works differently because family relationships become unraveled and uncertain, and self-concepts are challenged and questioned — since someone in the hospital accidentally switched two desired babies.

Begoña. Begoña, the twin raised by her biological family, had been studying English over the past year. An accident at work had caused her to be discharged from her job and to receive unemployment benefits. Begoña reminded us that her older brother refuses to speak about the switch and is unwilling to meet with Delia because of the pain he fears he will experience. The twins' older sister has been more sympathetic, probably because she is raising a pair of identical twin children of her own. A younger brother suffers from Down syndrome.

Begoña explained that she and Delia lead separate lives, but are in contact by telephone. She does not think of Delia as her twin, but she feels a connection with her that is difficult to explain. The twins understand each other even when they do not speak for long periods. 'I know how she is going to react and reply; it's as if it were me'. In fact, they were reading the same book when they met at age 28 — a book about a girl who had fallen in love with a writer. Both twins love dogs, but dislike taking care of them. Both twins also love riding horses, a skill that Delia practices, but Begoña does not. According to Begoña, 'There are things my sister does that I have always wanted to do, such as playing the guitar'. In contrast, while never questioning that they were truly fraternal twins, Begoña never felt that Beatriz

(the unrelated sister with whom she was raised) was like a twin — they are too different.

Not wanting to hurt anyone, Begoña imagines herself in everyone else's place as a way of gaining clarity and insight into the emotional toll that the switch has taken. She knows that the situation has been difficult for everyone, but in a different way. She also hopes to accept Delia into her family in the future.

Delia. Delia was still working when I met her again, but less frequently than before because she, too, began studying English. Her long-term goal is to earn a high school diploma. Not surprisingly, Delia and Begoña think similarly about their relationship as twins. Delia does not have a sense that she and Begoña are twins because they grew up apart. In particular, they learned the truth about their family in a way that was 'really traumatic', even though she is no longer in contact with her rearing parents, she wonders if her fear of hurting them has interfered with her evolving relationship with her twin. Still, Delia feels more connected to Begoña than to the other members of her biological family. For example, she does not feel that her biological mother is truly her mother, although she would like them to grow closer. 'It's complicated', Delia maintains a relationship with one of her non-biological sisters, but not with the other.

Delia also recalled her teenage years when she became sick with cancer. When none of her family members proved to be a compatible bone marrow donor, the doctor questioned Delia's mother as to whether or not Delia had been adopted. However, Débora was adamant that Delia was hers. Her reaction is understandable given that she had delivered a baby in the Las Palmas Hospital.

Beatriz. Beatriz is currently unemployed and is devoted to helping her mother and younger brother. She explained

that her mother is slowly accepting the fact that one of her twin daughters had been inadvertently exchanged with another baby. Beatriz also mentioned that she has no contact with her biological parents and noted the rejection on both sides. Like Begoña, Beatriz has never felt that the two were twins in the way that people typically think about twins — they are just too dissimilar in all ways.

I continued to wonder about the sales person who first mistook Begoña for Delia in a clothing store, the event that eventually culminated in their reunion and the discovery of the switch. This woman was not a close friend of Delia's, but an acquaintance who Delia feared was trying to make money by speaking to the media about the case. I tried hard to meet her when I was in Las Palmas in 2009 because she was such a central part of the story. There is no contact now between Delia and this woman, and there was little contact in 2009.

When I look at the twins today, I am certain that they would never be confused for one another. Begoña has slimmed down since I met her in 2009 and the twins hairstyles are quite different. However, there is an unmistakable similarity to their facial contours, complexions, and gestures. It is gratifying to me that they have come to terms with their unusual situation and continue to lead productive lives. I am grateful to them for their generosity and trust as I completed my interviews both in 2009 and 2012.

I wish to acknowledge the assistance of my friends and colleagues, Jessica Crespo (professional translator) and Fernando Grijalvo Lobera (Psychology Professor, Universidad de Las Palmas), who provided expert assistance in 2012, just as they did in 2009. I am also grateful to the two attorneys for their time and attention. It is everyone's hope that *Someone Else's Twin* will be translated into Spanish so that it will reach a broader audience.

Research Reports

Parkinson's Disease Discordance

An interesting dialogue on the source of Parkinson's disease (PD) discordance in MZ male twins over 70 years of age is well worth reading (Xiromerisiou et al., 2012; Hardy, 2013; Hawkes, 2013). The original report by Xiromerisiou et al. (2012) notes that the twins were concordant for the LRRK2 mutation, the most common Mendelian cause of PD. Despite this, one twin expressed the disorder at age 60, while his co-twin has been symptom free. The explanation given for the variable penetrance of the mutation was stochastic initiation of the disease; the twins' lifestyle factors were unable to account for the difference. In a response to the original report, Hawkes (2013) suggested that

an as yet unknown environmental factor was a more likely source of the discordance than chance. Examples might include a protective factor that prevents the expression of the gene in the unaffected co-twin, or this twin's lack of contact with a factor or event that might trigger its expression. Hawkes further asserted that reliance on random mechanisms as explanations for co-twin discordance interferes with creative reasoning about the source of the disease. In reply, Hardy (2013) proposed somatic mutation, environmental differences, or chance as reasons for the twins' PD discordance. He emphasized chance because he claims it is a forgotten explanation. This dialogue is likely to continue.

Assisted Reproductive Technology (ART) and Neonatal Surgery

The twin birth rate has escalated in recent years due to the increased availability of ART. A key question addressed by Japanese researchers was whether infants conceived via ART are more likely to require neonatal surgery than infants conceived naturally (Yanagisawa et al., 2013). This five-year study targeted 1,891 babies born between 2006 and 2010. The sample included 198 infants (9 ART babies and 189 non-ART babies) referred for neonatal surgical consultation. A higher incidence of multiple births and low-birth-weight infants was found among the ART sample. However, the frequency of surgical procedures and birth defects did not differ significantly between the ART (4%, 7/160) and non-ART babies (8%, 143/1,731). Reviewing the 198 consultation cases showed that the percentage of infants requiring surgery did not differ between the two groups (ART: 7/9, 78%; non-ART: 143/189, 76%). This would seem to be positive news for families conceiving twins via ART, but only three twins were identified in the ART group, making it difficult to generalize. It is also unclear if the three twins were among those infants requiring surgical intervention.

Double Embryo Transfer in a Cynomolgus Monkey

Researchers in Japan reported a triplet pregnancy in a Cynomolgus monkey (*Macaca fascicularis*) following transfer of two embryos (Morichika et al., 2012). Double transfer is a typical fertilization procedure at the Tsukaka Primate Research Center in Ibaraki, Japan, because it increases the probability of pregnancy. The presence of two fetuses was confirmed after the 37th post-conceptual day. However, a miscarriage was reported on day 81, followed by a second one 2 days later and a third one 2 days after that. The third fetus was expelled with its placenta, while a second

placenta expelled on the same day showed two umbilical arteries. The researchers suggested that the first two fetuses may have shared this placenta as MZ twins. In fact, human studies have found an association between ART and increased MZ twinning, although increased DZ twinning following ART is higher (Aston et al., 2008). Unfortunately, DNA analyses were precluded, leaving open the possibility that the triplet pregnancy was trizygotic. Had the monozygosity of the first two fetuses been confirmed, it would have been a rare event.

Morichika et al. (2012) noted that twinning is infrequent among rhesus and macaque monkeys, ranging between 0.027% and 0.21%. It is also very unusual for both members of a twin pair to survive. Only three such infants born at the Tsukaka Primate Research Center have survived, assisted by artificial nursing.

Mathematical Analysis of a Twin Convention Conundrum

One of the more unusual papers to cross my desk this year was by Martin Griffiths (2013) from the Mathematics Institute at the University of Oxford, in the United Kingdom. Griffiths used his combinatorial mathematics expertise to illustrate the number of ways in which n pairs of MZ twins ($2n$ attendees) at a twin convention could be seated at k different tables for dinner. (In his paper, MZ twins were considered to be 'indistinguishable', in that while they might switch seats to yield two alternative arrangements, such an event is counted as only one option.) The problem Griffiths presents is complex and intriguing. His analysis could conceivably be applied in other contexts, such as assessments of twins' social and professional networks. For example, given a fixed number of interactant possibilities, are some twins more likely than others to stay together, to stay close by or to separate? Griffiths has also applied his mathematical formulas to seating arrangements at triplet conventions.

Media Highlights

Twin Inventors

The EPI (epinephrine) pen has been a widely used emergency medical intervention for allergic reactions since the 1980s. It was patented in 1977 by the late Shel Kaplan, a former NASA engineer, and made publicly available in 1980 (Lovering, 2013). However, a new device has been invented by identical twins Eric and Evan Edwards, from Richmond, Virginia (Thomas, 2013). The Edwards twins developed serious food allergies as children and were required to carry medicine with them wherever they went. They disliked the

bulky feel of the EPI pen, so as adults created the slimmer EPI injection, the AUVI-Q, similar to a cell phone. Like the EPI pen, the AUVI-Q injects users with EPI, but does so with automated voice instructions. The AUVI-Q is manufactured by Sanofi, a large pharmaceutical company in France, and is marketed by Mylan Inc.

The twins purposefully chose different courses of study in order to achieve their goal. Evan studied engineering at the University of Virginia, while Eric earned a doctorate in pharmaceutical science from Virginia Commonwealth

University. One of Evan's classes was in invention and design. Their planned courses of study and constant cooperation appear largely responsible for the success of their finished product.

Basketball Duo

National Basketball Association (NBA) basketball players and identical twins, Marcus and Markieff Morris, were never apart until 2011 (Longman, 2013). That was the year when the Phoenix Suns drafted Markieff and the Houston Rockets drafted Marcus. Those decisions brought considerable anxiety to both twins, negatively impacting their sports performance. Fortunately, in February 2013, Houston arranged to acquire Marcus, reuniting the twins whose matched tattoos read: 'Family Over Everything', their reunion made them only the second pair of twins to play on the same professional basketball team — the Morrises were preceded by Dick and Tom Van Arsdale, both members of the Phoenix Suns in 1976–1977. In a recent interview, Tom recalled lacking motivation, experiencing depression, and crying frequently when he and Dick played for separate teams. He even left the team to enroll in law school before returning several days later when his twin insisted that he return to Detroit, where he had played for the Pistons. The twins eventually played together for the Suns during their last season.

Coaches and other sports professionals have been impressed by the matched abilities and striking camaraderie of identical twin athletes (Segal, 2000). Keeping twins together on the same team seems a wise decision.

Paired Designers

Teran and Teman Evans are identical twins, as well as interior and jewelry designers (Louie, 2013). The six-foot, four-inch tall twins studied together at Harvard University's Graduate School of Design. They have also served as DIY (do-it-yourself) consultants for HGTV television. Their current home in Brooklyn, New York is a 1,400-square foot complex in which all room decorations (with the exception of their bedrooms) have been collaborations. The twins are both involved in meaningful relationships, yet claim that they cannot imagine living apart.

Two Musicians

Cain and Cyle Barnes (who appear to be identical twins) are part of a five-person band known as The Weeks (Princes of Rock, 2013). The group began by playing in musical clubs in its members' hometown of Jackson, Mississippi. The lead guitarist, Sam Williams, describes Cain and Cyle as 'the closest set of twins I've ever known. They've never spent more than three days [in a row] apart in 22 years, so verbal communication is obsolete' (p. 28). Williams also noted that The Weeks exceeds the BeeGees for most records

sold by a band with twins. Having twins in one's group generates some unusual distinctions.

Two Comedians

Adam and Todd Stone are identical twins and New York comedians. I met them on April 2, 2013, when we were interviewed together for 'Live From the Table,' a weekly podcast taped at the *Comedy Cellar* in New York's Greenwich Village. The program is directed by Noam Dworkin, who invited me to discuss my recent book, *Born Together — Reared Apart: The Landmark Minnesota Twin Study* (Segal, 2012). He also invited the Stone twins to provide insights into twinship, as well as comedic substance, both of which they did admirably. The Stones, age 30, graduated in 2005 from Connecticut Wesleyan University and now performs at various clubs throughout New York City; to learn more about them, please visit <http://www.stoneandstone.org/aboutus.htm>. Our hour-long interview, 'Are Humor and Other Traits Genetic? Identical Twins Reared Apart', is both informative and funny and can be accessed at http://lnw.libsyn.com/p/d/1/2/d12922f253d0b446/ComedyCellar_053-Are_Traits_Genetic.mp3?s=1365218904&e=1365223922&c_id=5555458&h=d84a5984c3e65dffaff4a0e63be492c3.

Twins' Birth Interval

The birth of twins Amy and Katie Jones-Elliot in Waterford, Ireland, marks the longest birth interval between twins on record (Bennett-Smith, 2013). Amy was born on June 1, 2012, while her twin sister Katie was born on August 27, 2012, a difference of 87 days. Katie's survival after just 23 weeks into the pregnancy was considered remarkable. Prior to the delivery of these twins, the longest recorded twin birth interval was 84 days. The twins, Hanna and Eric, were born to Peggy Lynn of Huntingdon, Pennsylvania, in 1995 and 1996 (Segal, 2000).

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