



**NEWS, VIEWS & COMMENTS**

## The Value of Twin Studies: A Response to *Slate Magazine* / Research Reviews / Twin News Worth Noting

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## The Value of Twin Studies: A Response to *Slate Magazine*

In late August 2001, the online magazine *Slate* published a series of twin-related articles covering twinning frequencies, twin relationships and related topics. Among them was an article authored by Brian Palmer, 'The Methodological Confusion of Twin Studies',<sup>1</sup> August 24). The article argued strongly against the value of twin research, citing the various challenges that have been raised against twin studies (e.g., failure to fulfill the equal environments assumption; difficulties with heritability estimates), all of which have been carefully addressed by

twin researchers in numerous scientific papers and chapters. However, Palmer cited neither original sources, nor did he consult with major twin researchers in the field.

The article attracted 148 responses. One letter, reprinted below, was submitted in the capacity of several twin researchers (myself included) as professors and scientists, not as representatives of professional organizations. Palmer's original article and the other comments it invited can be found at [http://www.slate.com/articles/life/twins/2011/08/double\\_inanity.html](http://www.slate.com/articles/life/twins/2011/08/double_inanity.html).

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*Slate Magazine's* Brian Palmer has published one of the most inaccurate, misleading and uninformative essays on twin research to come along in a while ('The Methodological Confusion of Twin Studies', August 24, 2011). His work manifests both sloppy journalism and poorly informed scientific opinion. Findings from twin research have made important contributions to our understanding of human development and disease. Twin research has attracted both enthusiastic supporters and harsh critics. However, the various challenges to the validity of twin research designs, and their results have been carefully addressed by the scientists responsible for these studies. Despite these efforts, misinterpretations still abound, as evidenced by Palmer's article. He simply repeats the words of twin research's harshest critics, while failing to consult primary sources or rebuttals from the original scientists.

As scientists who have been involved in twin research for decades we will address some of the unfair criticisms that Palmer has put forth as fact. More detailed analyses of these issues appear in a forthcoming book, *Born Together-Reared Apart: The Landmark Minnesota Twin Study* (Harvard University Press, Spring 2012), a comprehensive overview of the Minnesota Study of Twins Reared Apart, as well as the journal *Twin Research and Human Genetics* (published since 1952 with various titles), the Institute of Medicine's web page chronicling studies of veteran twins (going back to 1958), the textbook *Behavioral Genetics*

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(2008) and the *Handbook of Behavior Genetics* (2010) to name a few.

- **Genes as Destiny.** Palmer's opening remark, 'One of the main messages of science over the last couple of decades is that genes are destiny' is a grotesque caricature of genetic research in general and twin studies in particular. Who exactly is supposed to have said this? Indeed, genetic factors have been shown to contribute to individual differences in virtually all measured traits including general intelligence, personality, social attitudes and major mental illnesses. However, the degree of genetic influence varies from trait to trait, the mechanisms of genetic influence are highly complex and dependent on environmental input, and genes alone are never determinative of anything, except perhaps for rare single gene disorders like Huntington's Disease.
- **Populations vs. Individuals.** Palmer tells us that 'half of your altruism [and] one-quarter of your financial decisions' are explained by your genes. This statement represents the most basic error that can be made about inference from twin studies. Genetic and environmental explanations of behavior apply only to *differences* among individuals. It is meaningful to say that 80% of differences in height among individuals in the modern world are associated with genes; the statement that 80% of a single person's height is explained by genes is completely meaningless. To take a more controversial example, genetic influence on individual differences in general intelligence has been estimated to be about 50% in adulthood, but if an individual person has been severely deprived of nutrition or educational experiences then the environment will count for much more than genetics.
- **Genetic Identity of Identical Twins.** Identical (monozygotic or MZ) twins result from the early division of a single fertilized egg (zygote). Identical twins are not strictly identical genetically given copy number variations or co-twin difference in DNA segments; Palmer points these out, and they are widely acknowledged in the field. At the same time, Palmer ignores other sources of differences between identical twins, such as unequal prenatal blood supply (twin-to-twin transfusion syndrome), differential prenatal infections, differential X-inactivation between identical female twins, and epigenetic (gene-regulating) events that are also widely recognized by twin researchers. Despite these biological differences, MZ twins (whether reared apart or together) are more alike than any other pair of individuals. Moreover, to the extent that MZ twins are not genetically identical, the true importance of genes is actually underestimated by the MZ-DZ comparison.
- **Equal Environments Assumption (EEA).** A fundamental assumption of twin research is that environmental factors relevant to traits under study are the same for both types of twins. A common criticism, cited by Palmer is that identical twins receive what he calls

'special treatment' from parents, teachers, and others, explaining their greater similarities relative to non-identical twins. Palmer fails to mention that numerous twin studies have examined this challenge and have found it to be wanting in most cases. The landmark 1976 twin study by Loehlin and Nichols showed that identical twins who were dressed alike, or who had the same teachers were not more behaviorally alike than those who did not. Others have found that identical twins whose parents mistakenly thought them to be fraternal twins were not less alike behaviorally than those who were correctly classified as identical. Further, adoption studies, which make a very different set of assumptions, have confirmed the basic findings from twin strategies. And recently, new statistical genetic techniques making use of molecular genetic data in large samples of unrelated individuals (i.e., no twins), have estimated genetic variance for height and IQ consistent with traditional estimates of heritability from twin studies (Davies et al., 2011; Yang et al., 2010).

- **Father of the Twin Method.** True, the biology of twinning had not been established when Sir Francis Galton conducted the first twin study in 1875. However, he correctly surmised that there were two types of twins, recognizing the value of comparing twins who were 'closely alike [in childhood]' with those who were 'exceedingly unlike'. He stated: 'It is, that their history affords means of distinguishing between the effects of tendencies received at birth, and of those that were imposed by the circumstances of their after lives; in other words, between the effects of nature and nurture'. He did not draw his conclusion that 'nature prevails enormously over nurture' based (as Palmer tells us) on the 'incredible similarities he found between twins in 80 questionnaires'. Galton obtained information from 80 twin pairs, 35 of which showed close similarity and 20 of which showed much less similarity from an early age. And his studies that shaped his thinking about hereditary contributions to eminence were based not on twins, as Palmer tell us, but on fathers and sons. In any case, Galton's concern with the contest between nature and nurture has not occupied modern scientists for a long time now. Palmer may still be fighting this battle, but we are not. The field recognized long ago that both genes and environment are required for the development of any trait in any organism, and has advanced to deeper questions about *how* genes and environments combine to create individuals and the differences among us.

It is the hope of those signing this letter (twin researchers representing diverse psychological and medical disciplines), that anyone who reads Palmer's essay will read this one as well. Understanding of a topic as complicated as genetic effects on human behavior must be built on careful study of original materials, not on repetition of the one-sided comments of a handful of critics. The danger lies not in twin studies and what they might tell us about behavior,

but rather in feckless editorializing that is not grounded in a thorough understanding of the scientific issues.

Davies et al. (2011). *Molecular Psychiatry*, 9 August 2011; doi:10.1038/mp.2011.85/

Galton, F. (1875). *Journal of the Anthropological Institute* 5, 391–406.

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Martin et al. (1997). *Nature Genetics*, 17, 387–392.

McClearn et al. (1997). *Science*, 276, 1560–1563.

Plomin et al. (2008). *Behavioral Genetics*. NY: Worth.

Yang et al. (2010), *Nature Genetics*, 42, 565–571.

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The fact that the same arguments are raised repeatedly may partly reflect failure by some individuals to read the relevant literature. More importantly, it may reflect a biased view of twin studies that will not be amended

despite empirical findings to the contrary. Other recent examples of articles unsympathetic to twin studies include those by Wyatt and Midkiff (2006, 2007). Such work should not go unanswered by our membership.

## Twin Research Reviews

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### MZ Twin Case Study of Migraine Headache

A case study of transient global amnesia (TGA) associated with migraine headache without aura (MO) was documented in a pair of MZ male twins by Dr. Ferdinando Maggioni from the University of Padua in Padova, Italy, and colleagues (Maggioni et al., 2011). The twins developed MO in their late forties, and their mother also suffered from MO. The co-morbidity of these conditions has been well documented, but the underlying mechanisms linking them together have been debated. The researchers proposed that common genetic factors, possibly in a subset of patients, may be involved. Unfortunately, the investigators did not document the methods used to establish the zygosity of the twins, an error that casts some question on their findings.

### Twin Study of Dermatological Manifestations

A prospective study of benign and transient dermatological conditions was undertaken by Dr. Priyanka Gupta and colleagues at a tertiary care hospital in Delhi, India (Gutpa et al., 2011). The investigators followed 14 MZ and 66 DZ

twin pairs during the first seven days of life, documenting the presence of Palatine Epstein pearls (PEP; small white or yellow cystic vesicles, often seen in the infant's mouth), milia (M; small bumps on the skin), erythema toxicum neonatum (ETN; noncancerous condition seen in newborns, marked by white or yellow elevations of the skin and surrounded by redness) and physiological desquamation (PS; flakiness especially in the trunk area). Maternal age was unrelated to the different conditions. However, longer gestation and higher birth weight were associated with PS; multigravida mothers were more likely to have babies with PEP and M; and primigravida mothers were more likely to have infants with ETN.

Intrapair concordance was highly significant for both twin groups. Such results suggest environmental effects, although the investigators concluded that the results were 'consistent with a genetic regulation'. It is also true that some of the skin conditions examined (e.g., milia) occur frequently among newborns (PubMed Health, 2011), so MZ-DZ twin differences might not be expected. Follow-up studies by this research team and others are needed to confirm these findings and their interpretation.

## Twin News Worth Noting

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### Selective Termination

The August 14, 2011 issue of the *New York Times Magazine* included a cover story titled, 'The Two-Minus-One Pregnancy' (Padawer, 2011). The article details the recent trend toward reducing assisted (ART) twin pregnancies to

singleton pregnancies, due to a variety of social reasons. These reasons include lack of resources, career concerns and/or the suspected difficulties of parenting two same-age children. Some physicians initially opposed to the idea of interfering with a normally progressing pregnancy are

now honoring the wishes of their patients. This situation has launched continuing debates among the public and among specialists in reproductive medicine.

I submitted an unpublished letter to the *Times* acknowledging the difficulties of raising twins, but also emphasizing the benefits, such as the twins' companionship (that frees parental time) and the fascination of witnessing the development of two same-age children. Furthermore, each year hundreds of twins gather at special events to celebrate their twinship. I am concerned about the surviving children who may wonder what it would have been like to have had a twin; I suspect that these survivors will be both sad and bitter. A study of the psychological consequences of knowing that your twin was terminated due to social reasons would be important and timely in view of the trends cited above.

### The Power of Two

Several years ago I read the wonderful book, *The Power of Two: A Twin Triumph Over Cystic Fibrosis*, by identical twins Isabel Stenzel Byrnes and Anabel Stenzel. The book chronicles the story of these twins as they struggled with cystic fibrosis (CF), a potentially fatal recessive genetic condition associated with severe respiratory problems. The condition is known to affect people of northern European descent; the twins were born to a Japanese mother and German father. Both twins underwent extensive hospitalization, but both also received lung transplants that let them survive and become successful authors and advocates of organ transplantation. Their new film, 'The Power of Two' was released in the summer 2011 ('Using their power for good', 2011).

### Countess Consuelo Crespi and Gloria Schiff

The fascinating lives of identical twins, Countess Crespi and Gloria Schiff, were documented in a recent issue of the magazine *Vanity Fair* (Colacello, 2011). The twins were born in 1928 in Larchmont, New York, and became well-known models and socialites. The two were the original models for the advertisement, 'Which twin has the Toni?' and also appeared in issues of *Sports Illustrated* and *Look*. They led very public lives in New York and Rome, and their beauty was a source of great envy. When Countess Crespi passed away on October 18, 2010, her twin sister Gloria was angry: 'We were so close over 82 years. That's longer than any marriage' (p. 326).

### Baseball Players

I was recently contacted by Jennifer Charnofsky, a mother of twins and the former wife of Harold (Hal) Charnofsky who with his identical twin, Stanley (Stan), played baseball for the Yankee farm teams. A wonderful picture accompanying the message shows the twins with the famous baseball player, Casey Stengel, who is trying to tell them



FIGURE 1

Identical twins with baseball great, Casey Stengel, who is trying to determine which twin is which. Photo courtesy: Jennifer Charnofsky.

apart (see Figure 1). Both twins later entered academia, Hal as a sociology professor at California State University, Dominguez Hills and Stan as a professor of educational psychology at California State University, Northridge. Ms. Charnofsky wrote, 'They gravitated toward each other at family gatherings, and it was lovely to see their closeness.'

### Criminal Confusion

When an identical twin commits a crime it can create confusion for law enforcement officials because DNA evidence and eye witness accounts of the event are ambiguous and inconclusive. I have described such cases in previous issues of *Twin Research and Human Genetics*, but another such case has come to my attention (Lacey, 2011). The individual responsible for a murder in Chandler, Arizona cannot be determined because the initial culprit, Orlando Nembhard, has an identical twin brother, Brandon. This case lacks forensic evidence and has rested on the reports of people present at the scene. It is possible that the twins will both go free if the jurors have reasonable doubts.

### Endnote

1 Palmer's article is referenced in our letter as 'The Methodological Confusion Over Twin Studies'. That is the title of *Slate Magazine's* section called The Fray, another discussion area relevant to his article.

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