

nature via nurture theme finds its most persuasive and instructive elucidation in this portion of the book (pp. 125–176). I read it three times, and continued to learn on each run.

Having praised the book's merits, what might be said in criticism? I feel that his enthusiasm leads Ridley to underestimate the extent of the attachment to the nurture-only point of view. The American Anthropological Association, for example, has adopted a statement on race which declares, directly contrary to Ridley's view, that 'human cultural behaviour is learned, conditioned into infants beginning at birth, and always subject to modification Our

temperaments, dispositions, and personalities, regardless of genetic propensities, are developed within sets of meanings and values that we call 'culture'. Studies of infant and early childhood learning and behavior attest to the reality of our cultures in forming who we are ... it is a basic tenet of anthropological knowledge that all normal human beings have the capacity to learn any cultural behavior' (<http://www.aaanet.org/stmts/racepp.htm>). This is exactly where Franz Boas positioned anthropology 80 years ago. It is a perspective that optimizes the meliorist vision. But what if all normal persons cannot learn algebra or excel in sport? What if

there are indeed heritable race differences in behaviour? The struggle isn't over yet.

Endnote

1 While this review was in press, Bruce Lahn and associates published two articles in *Science* on Microcephalin and ASPM variants, showing that they arose 37,000 and 5800 years ago, respectively, probably under strong selection pressure. This exceptional finding is likely to figure in future investigations of the evolution of intelligence.

Hiram Caton

Griffith University, Brisbane, Australia

Indivisible by Two: Lives of Extraordinary Twins

Nancy L. Segal

(2005). Harvard University Press. 280pp, \$US24.95, ISBN 0-674-01933-4.

Nancy L. Segal, Distinguished Professor in Humanities and Social Sciences and Director of the Twin Studies Center at California State University has delivered a second delightful book about twins that will appeal to anyone fascinated by the similarities and differences of those who are genetically identical. In her first book, *Entwined Lives: Twins and What They Tell Us About Human Behavior*, published in 1999, Nancy Segal compiled a unique mix of research findings and personal stories. In *Indivisible by Two*, Professor Segal focuses on 12 diverse case studies of, almost exclusively, monozygotic (MZ; or identical) twins or higher multiples. Each example is so unique in its own way that the reader is left to wonder at the extensiveness of Professor Segal's case notes that she is able to create a book with so

many examples that are so different. It is a credit to her that so many twins and their families are willing to share their experiences with her, invite her into their lives and agree to have their stories included in a book. Her attention to detail, humor and chatty style will ensure the book's appeal to a far-reaching audience.

Indivisible by Two is divided into four sections, each of three chapters. In the first section, 'Separated at Birth', we meet three sets of twins who have been reunited after being reared in different families. All three examples have been reported elsewhere, including by Professor Segal herself. Nonetheless, these examples are so interesting that the repetition is justified and it is nice to have the breadth of detail allowed by this book. First, we meet Mark and Gerry, who grew

up 30 miles apart and first met in their early 30s after both entering the fire service. Later we meet Oskar, raised a Catholic by his mother in Hitler's Germany, and Jack, raised a Jew by his father in Trinidad. Their extremely different cultural environments made their first meeting in 1954, aged 21, difficult. They were finally brought together 25 years later by the University of Minnesota 'Twins Reared Apart' program. Their story was the subject of the 1995 documentary *Oskar and Jack*. In both these cases, it is the numerous ways in which these twins are similar that makes such fascinating reading — the pinky held under the beer can for Mark and Gerry, the obsessive sensitivity to germs of Oskar and Jack. Of course, cynics might say that if you took two unrelated people and compared enough habits that you

would find that they shared some trait by chance alone. However, the volume of shared characteristics described by Nancy Segal and the sheer quirkiness of some of the examples (how many people do you know who flush the toilet both before and after use?) that one is left with an overwhelming rush of ‘wow, even in our most unusual habits we seem to be greatly influenced by our genes!’ The photos are an added bonus and I found myself studying the picture of Oskar and Jack in 1979 for a long time and trying to work out what exactly it was that made Jack look American (the States is his adopted homeland) and Oskar look German.

The third case study in this section was much more thought-provoking reading, and my 12-year-old twins found the story quite distressing when we discussed it around the dinner table. It is the story of identical twins George and Brent, whose parents were unable to care for them in the first 2 months of their lives. They were cared for in a foster home, but when the parents came to collect them, a series of administrative blunders resulted in them taking home not George and Brent, but George and Marcus. Brent was adopted by another family and grew up only 10 miles away. The boys met aged 21 through a shared interest in playing board games. They became friends and it only gradually dawned on them that they could be related — it took a full 18 months to confirm their twinship through a DNA test. Once I got past the usual interest of the similarity and differences of these twins reared apart, the reality of what it would be like to be any one of the characters in this twist of fate dawned on me. Imagine, for example, the identity crisis felt by Marcus who realized that he was not the biological son of his parents. Or imagine the feeling of rejection felt by the adoptive parents of Brent when he discovered his biological family.

Although it is clear that this case must have been reported in the Canadian media at the time of the lawsuit against the Children’s Aid Society (for the errors that led to the mix-up in the foster home), it is brave for the families to share this traumatic experience in a book.

The second section ‘Variations on Common Themes’ gives three case studies of MZ twins who are certainly not identical. First we learn of the unusual case of the MZ twin girls who, from an early age (and one more so than the other), were selectively mute, talking only to those with whom they were very familiar. However, it was the remaining two case studies in this section, that were, for me, the most interesting in the book. They told, first, of ‘identical’ adult male triplets, one of whom was gay while the other two were straight, and then of ‘identical’ adult female twins, one of whom chose to have a sex change, while the other had never questioned her female identity. Differences between MZ twins must be a result of environmental or chance factors as their genetic makeup is the same. The differences between these MZ twins are extreme and the anecdotes of their childhoods suggest very early childhood or even prenatal environmental or stochastic influences. Professor Segal’s aim for the book was ‘to bring together science and humanity’ and this example would have provided an opportunity to explain to a nontechnical audience a new potential value of twin research. Exciting developments in gene expression techniques bring with them the ability to study differences in the way in which the genes of MZ twins are expressed, even though they have the same genetic blueprint. These techniques may herald a new era in the value of MZ twins discordant for disease or other phenotypes in their contribution to finding genes that are causal for these traits. This is a rapidly evolving field that will provide Professor Segal with

important material for future publications as results emerge.

The last two sections called ‘Extraordinary Circumstances’ and ‘Everyday Wonders’ contain stories of six sets of twins (or multiples), each of which is unique in its own way. We meet Stepha and Annetta, identical Jewish twins who escaped the gas chamber in World War II through selection for the scientific studies of Dr Josef Mengele, who had intended to inseminate them with sperm from identical twin men to see if they would conceive identical twins. It is easy to forget how truly unethical twin research was under the Nazis. We learn of the death of Brenda in the Twin Towers tragedy and the feelings of loss felt by her twin Linda, who, through this book, has been given an opportunity to commemorate and celebrate her sister’s life in a lasting way. We learn of Gillian and Lily, now 6, adopted separately from China by two Canadian families, who later discovered their MZ relationship and who are now endeavoring to raise the girls together but apart. Next we meet Marce who became the surrogate mother for her MZ twin Trace’s two children, and then we enter the lives of MZs Craig and Mark who married MZs Diane and Darlene. Interestingly, all four twins insisted that the alternate partner pairings would have been disastrous! Each couple has two children who are all, therefore, genetically full siblings. Last, but certainly not least, we meet the now 5-year-old, naturally conceived quads who are, in fact, two sets of identical twins. The similarities between one MZ pair and their DZ (dizygotic or fraternal) twin brother clearly demonstrate that the shared (or common) environment assumed by genetic researchers is ‘more common’ between MZs than between DZs. For example, MZ pair Matt and Mike shared a bedroom (and often a bed!) because they were both ‘good sleepers’, while the other boys were ‘nighttime screamers’ and for this reason, any attempt to split the MZ pairings at night had failed. The quad story also has

another dimension. One of the boys has cerebral palsy and so his development is considerably delayed compared to his genetically identical twin. This is one of the cruel twists of fate that is not infrequently dealt to families with twins: the daily and lifelong reminder of what their disabled child might have been like, if it were not for the problems encountered in those few hours around the multiple birth. The story of the

quads, I am sure, will be followed both by Nancy Segal and by the media as they grow up.

If twins or their families, who willingly give up their time (and blood!) to contribute to twin studies, were to ask for some examples of the benefits of twin research, I would direct them to Nancy Segal's first book *Entwined Lives* as it clearly demonstrates the value and breadth of twin research and considers the genetic insight

gained from both DZ as well as MZ twins. By contrast, *Indivisible by Two* provides a depth of investigation into the cases studied. It is a great read that should appeal to all those fascinated by the power of our genes and is guaranteed to provide plenty of topics for dinner table conversation!

Naomi R. Wray

Queensland Institute of Medical Research,
Brisbane, Australia