

## Parallel Lives

**Indivisible by Two:  
Lives of Extraordinary Twins**  
by Nancy L. Segal.  
Harvard University Press,  
280 pp., \$24.95

**Frank J. Sulloway**

Which of us has not wondered how our life might have turned out had certain circumstances been different? Like characters inhabiting parallel universes in science fiction plots, we all live only a tiny fraction of the lives that might have been.

As a teenager I won an acting award, spent two years learning the Russian language (which I have hardly spoken since), and avidly pursued astrophotography (my first publication, at the age of fourteen, was a photograph of an aurora borealis that appeared in *Sky and Telescope*). Each of these early interests somehow faded and was overtaken by others that ended up having a more lasting impact on my life. Yet had a teacher or opportunity encouraged me to concentrate on any one of these early preoccupations, I suspect that my life, and perhaps even some aspects of my personality, might be considerably different today.

In a reflection on the mysteries of human development, the behavioral geneticist Robert Plomin and the psychologist Denise Daniels once entertained a similar question about the life of Charles Darwin.<sup>1</sup> When Darwin was invited to sail as a naturalist on the voyage of HMS *Beagle*, his hopes, and perhaps with them the revolution that bears his name, were almost dashed. First, Darwin's father objected to the voyage as a "useless undertaking" that would divert his son from an intended career in the clergy. It was only through the strenuous intervention of Josiah Wedgwood, Darwin's enlightened uncle, who saw in young Darwin "a man of enlarged curiosity" and who drove thirty miles to confront his father, that Robert Darwin's objections were finally overcome.<sup>2</sup>

Then the captain of the *Beagle*—twenty-six-year-old Robert FitzRoy—balked at the selection of young Darwin. An ardent disciple of Johann Kaspar Lavater's theories about physiognomy and its relation to character and personality, FitzRoy was convinced that the shape of Darwin's nose indicated a lack of sufficient energy and determination for such an undertaking. Darwin eventually succeeded in winning FitzRoy over, and FitzRoy himself later came to the conclusion that Darwin's nose "had spoken falsely."<sup>3</sup> How might the history of science have differed had Darwin not circumnavigated the globe on HMS *Beagle*, visited the Galápagos Islands in 1835, and developed his earliest ideas about evolution based on his five-week visit to this veritable laboratory of evolution in action? We can only

<sup>1</sup>Robert Plomin and Denise Daniels, "Why Are Children in the Same Family So Different from One Another?" *Behavioral and Brain Sciences*, Vol. 10 (1987), pp. 1–16.

<sup>2</sup>Charles Darwin, *The Autobiography of Charles Darwin, 1809–1882*, edited by Nora Barlow (Norton, 1958), pp. 228, 230.

<sup>3</sup>Darwin, *Autobiography*, p. 72.

speculate about such counterfactual historical possibilities.

Nancy Segal's *Indivisible by Two* makes use of a particularly powerful research method for answering such vexing questions about why our own and other people's lives turn out the way they do. Segal studies twins—identical, that is, from a single fertilized egg, and fraternal, from two eggs fertilized by different sperm—as well as pseudotwins, children of the same age who are raised together. She does so with a passion that derives in part from the fact that she is a fraternal twin herself. A Distinguished Professor



Jack, left, raised as a Jew in Trinidad, and his identical twin Oskar, who grew up in Germany as a member of the Hitler Youth. The photograph was taken in 1954, during their first reunion, when they were twenty-one.

in Humanities and Social Sciences and director of the Twin Studies Center at California State University, Fullerton, Segal has published extensively on twins, including her 1999 book *Entwined Lives: Twins and What They Tell Us about Human Behavior*.<sup>4</sup> That work has been justifiably praised as one of the most convincing scholarly treatises yet written on the subject.

Segal's principal aim in her new book is "to bring humanity and science together" through expanded biographical accounts of twelve particularly remarkable sets of twins, triplets, and quadruplets discussed in *Entwined Lives*. In some cases, these involve life histories so remarkable that the standard methods of science could never do them full justice. Laboratory studies, Segal insists, have a valuable place in science, but they unfortunately "miss the vitality of twins' lives—and maybe some important reasons twins differ."

Twins provide a natural experiment in the relative influence of genes and

<sup>4</sup>Dutton.

the environment, as twin researchers have appreciated since the work of Darwin's evolution-minded cousin, Francis Galton. It was Galton, in the 1870s, who posed the influential distinction between "nature and nurture," using predominantly anecdotal evidence about twins to support his own view that most physical and behavioral characteristics are innate.<sup>5</sup> Darwin was greatly impressed by some of Galton's arguments, which indirectly supported his own views about heritable variation among animals and its critical part in the evolutionary process. "Nothing," he wrote to Galton in 1875, "seems to me more

similar results from one testing session to another) and that have also proven their validity (by measuring what they claim to measure). One common method for assessing the relative contributions of genes versus the environment is to compare test results for identical and fraternal twins. Because fraternal twins share, on average, only half their genes, the influence of genes on any particular trait can be measured as twice the difference between the correlations for the two sets of twins. For example, if identical twins raised together correlate .85 for a particular intellectual ability and fraternal twins correlate only .60 for this same ability, then genes would appear to account for 50 percent of the "variance" in these test outcomes. The remainder of the variance is attributable to environmental influences, including chance events, as well as to errors in measurement. Such twin studies do not tell us about all the nuances and idiosyncrasies of individual personality. Rather, they tell us in broad terms that some people are more predisposed than others to behave in a generally outgoing and self-confident manner, for example, as opposed to a shy and anxious manner.

During the last several decades the resulting accumulation of often surprising findings in twin research has had a dramatic influence on thinking about human behavior. Genetic influence is now known to account for between 80 and 90 percent of individual differences in height, which is why identical twins usually differ in stature by less than an inch. Similarly, genes are responsible for about 70 percent of individual differences in weight, about 60 percent of individual differences in general intelligence, and contribute less, but still substantial amounts of variance, to most behavioral traits. According to Segal and other twin researchers, as much as 50 percent of the variance in personality traits appears to be explained by genes, with somewhat smaller degrees of variance accounting for occupational interests (40 percent), social attitudes (30–40 percent), and job satisfaction (30 percent).

Twin research is not just about proving the substantial contribution of genes to human development and behavior. Such studies can also tell us a lot about the effects of the environment. In one of the biggest surprises in behavioral genetics to date, one set of psychological attributes turns out to be almost entirely determined by the environment, namely, "love styles." Whether we fall in love gradually or are swept off our feet, for example, is not predetermined by our genes, although no one knows exactly why this is the case since, in statistical surveys of large groups of twins, much else apparently is, including the expression of emotions.<sup>6</sup>

Segal's fascinating explanation of the lives and experiences of twins involves her consideration of four kinds of natural experiment: (1) twins who have been separated at birth and have

curious than the similarity and dissimilarity of twins."<sup>6</sup>

The methods used in twin research, and the quality of the resulting empirical evidence, have improved dramatically since Galton's time. In particular, the development of twin registries around the world has provided behavioral geneticists with an immensely useful source of willing subjects, who now number in the tens of thousands and have been studied in almost every conceivable detail.

In addition to measuring physical traits, twin studies typically assess cognitive abilities and behavioral attributes using test instruments such as surveys that have previously demonstrated their reliability (by being internally consistent and also by yielding

<sup>5</sup>Francis Galton, "The History of Twins, as a Criterion of the Relative Powers of Nature and Nurture," *Fraser's Magazine*, Vol. 12 (1875), pp. 566–576.

<sup>6</sup>*More Letters of Charles Darwin*, edited by Francis Darwin and A. C. Seward (Appleton, 1903), Vol. 1, p. 361.

<sup>7</sup>Segal, *Entwined Lives*, pp. 213, 215, 314.

<sup>8</sup>Niels G. Waller and Phillip R. Shaver, "The Importance of Nongenetic Influences on Romantic Love Styles: A Twin-Family Study," *Psychological Science*, Vol. 5 (1994), pp. 268–274.

later encountered one another in adulthood; (2) twins who differ in unusual ways, such as sexual preference; (3) twins who have lived through extraordinary circumstances, including two sisters who survived Josef Mengele's notorious experiments at Auschwitz; and (4) what Segal calls "everyday wonders," a general category that includes identical twins who have married identical twins, and the challenges faced by a family with six children, including quadruplets, one of whom was stricken with cerebral palsy. Each of these four sections of Segal's book has a specific purpose—namely, to acquaint us, by describing the kinds of remarkable life events that cannot normally be quantified and assessed in scientific research, with what it is like to go through life as a twin.

Stories about identical twins separated at birth who have later chanced upon one another in adulthood are sources of much fascination and often make their way into the news. Such instances are also vital to twin research, allowing behavioral geneticists to assess the impact of the differing environments in which the separated twins were raised, thus facilitating a controlled glimpse into the relative influences of nature and nurture.

As a member of Thomas Bouchard's pioneering Minnesota Study of Twins Reared Apart, Segal began her career with just this kind of research. In Bouchard's laboratory during the 1980s, she studied half of the 135 reared-apart twins who were involved in this research project, conducting in-

terviews and administering batteries of tests during week-long assessments that included chest X-rays, heart examinations, stress tests, and answers to roughly 15,000 questions, including those designed to probe numerous aspects of personality. Segal observed the interactions between twins, and was "riveted by their stories of separation and reunion." Her aim in the first section of her book is to introduce her readers to the extraordinary similarities so often observed among identical twins who have been reared apart—thereby underscoring the power that genes have in shaping our lives—while also questioning the limits of this genetic blueprint by exploring the lives of twins who were reared in radically different environments.

Bouchard's research team in Minnesota often gave nicknames to their twins brought up apart. There were the "Giggle Twins," named for their frequent and spontaneous laughter; the "Jim Twins," both given the same first name by their adoptive parents; and the "Fireman Twins," who were adopted by separate families living just thirty miles apart and who both grew up to become volunteer firemen. The last two twins were reunited in their mid-thirties after one of them was mistaken for the other at a firemen's convention. The resemblances were uncanny. Besides both being volunteer firemen, they each had a loud, staccato-like laugh; liked to issue one-word responses to questions: enjoyed hunting, fishing, and forestry; hated bad cooking; drank the same brand of beer; and held their beer cans in the same peculiar manner, supported by a

pinky finger underneath. Their IQs differed by only two points. Although one might be tempted to ascribe these and other similarities to chance, they occur with much greater frequency among identical than fraternal twins, indicating a role for genetic factors. When the twins first met, they found themselves to be so alike that, in the words of one of the twins, "there was no need to get acquainted."

The story of the Fireman Twins, however, could not be more different from that of another pair of identical twins described by Segal. Oskar and Jack were separated shortly after their birth when the marriage of their German parents broke up. Jack remained with his Jewish father in Trinidad. Their Catholic mother returned to Hitler's Germany with Oskar. There she changed her son's last name and raised him as a Christian to hide his Jewish identity. Young Oskar became an eager member of the Hitler Youth, "convinced that what the Nazis said about the Jews, war, and country was true."

In 1954, when the twins were twenty-one, they met with an "icy handshake." "We saw each other as enemies," Jack recalled, thinking "neither one of us would change." (See illustration on page 39.) Despite their similarities—they both liked to read books from back to front and both wore rubber bands around their wrists—the ideological gulf between the brothers was something they could never overcome. They disagreed about the causes of World War II, the Israeli-Palestinian issue, and various other political matters. Intensely concerned, however, by their broken twinship and by the love-hate relationship it inspired, they tried for nearly fifty years to surmount these barriers. The brothers took more than a half-dozen vacations together and occasionally visited each other. Governed in substantial part by their equally aggressive, demanding, and critical personalities, the twins' relationship deteriorated bit by bit each time they met.

The story of Jack and Oskar illustrates how the environments in which people are reared can matter much more for some people than for others. Statistics about "genetically explained variance" in attributes such as personality and social attitudes apply only to groups, not to individuals. These statistics also apply only to groups that have been studied in relatively typical environments; other environments may defy these statistical averages. As Oskar himself commented to Jack one day, "If we had been switched, I would have been the Jew and you would have been the Nazi."

In Part Two of her book, Segal turns to what she calls "Variations on Common Themes," a discussion of the differences—sometimes extraordinary—as well as the similarities between identical twins raised together. Her first example involves a pair of twin girls who, at age four, both developed "selective mutism," a social anxiety disorder that affects one in every hundred thousand children. This affliction caused the twins to be silent at school, where they nevertheless communicated with one another by whispering into each other's ears. They were fortunately quite expressive in nonverbal ways, which allowed some degree of

communication with their frustrated teacher.

At home, matters were very different: the two twins talked normally, at least with people they knew. The presence of just one stranger at home, however, would induce their mute demeanor and whispering. Oddly, the twins were the most popular members of their kindergarten class, being treated maternally by the other girls, who chattered on with them and were not discouraged by their lack of verbal responses. By the age of eight, the twins began to talk with other children, but only those who had visited them first at their home. Of particular note in Segal's account of this unusual pair is the fact that one of the twins, the shy of the two, was much more affected by her selective mutism. The more affected twin also exhibited a substantially greater incidence of specific fears and nightmares, as well as episodes of bedwetting.

Segal next introduces us to two other sets of identical siblings whose sexual preferences are not identical. The Marks triplets, Owen, Tom, and Frank, pose the question of how people with the same genes can differ in their sexual preferences. While Owen and Frank are straight, Tom is gay. Identical twins are three times as likely to share homosexual tendencies as are fraternal twins or siblings; from this evidence it seems clear that genes can affect sexual preferences. Why identical twins should nevertheless differ among themselves in this particular attribute is still unclear.

The identical Marks triplets differed in another noteworthy manner. All three of them suffered from multiple sclerosis, but only one of them was seriously affected. A second triplet had mild symptoms and the third was nearly symptom-free. The nearly symptom-free triplet, Tom, realized during childhood that he somehow diverged from his brothers in ways that gradually revealed his differing sexual identity. He was more "emotional and sensitive" than his brothers, took less interest in sports, and "was fascinated by the urinals in the [public] bathrooms because of all the varieties [of male organs]" that were on display. By sixteen, Tom knew he was gay.

Segal follows the story of the Marks triplets with that of identical twin sisters Agnes and Audrey. Even in childhood Agnes knew she wanted to be a boy. When she was five she prayed to God to make her into a boy for Christmas. At age thirty-three, Agnes became Andru through a series of operations and hormone treatments that transformed her from female to male. "I am a better man than I was a woman," Andru commented to Segal in one interview. Her twin sister would probably agree and has said she envies Andru's happy marriage, remarking at one point, "I wish that my husband was so nice and affectionate."

How can we explain such remarkable instances in which identical twins, who share the same genes, nevertheless end up differing in something so central to selfhood as sexual preference and sexual identity? The seeming puzzle is substantially lessened when we appreciate that shared genes do not mean shared bodies or minds. Considerable research has shown that twins, who compete with one another in the

## WATER by Bapsi Sidhwa

\$16.95 Paperback Original

Based on the motion picture  
by critically acclaimed filmmaker  
Deepa Mehta

Also available by Bapsi Sidhwa in  
paperback: *Cracking India* (adapted  
into the film *Earth* by Deepa Mehta),  
*An American Brat*, and *The Crow Eaters*.

"Brilliant. . . Sidhwa historicizes the images, lends greater  
poignancy to faces and provides speech where the film must  
leave the women silent." —Sara Suleri Goodyear, Yale University



The Debut in English of a major  
voice in World Literature

## THE BLUE SKY by Galsan Tschinag

Translated from the German  
by Katharina Rout  
\$22.00 Hardcover

"The hero may be a simple shepherd boy,  
but his tale is nothing short of epic.  
With this novel, a Mongolian shaman  
has stepped onto the stage of world  
literature." —Der Spiegel

Milkweed Editions  [www.milkweed.org](http://www.milkweed.org)

uterus for their mother's resources, do not develop in exactly the same manner. For example, various biological factors, including whether twins share the same placenta, can cause differences in their exposure to hormones in the womb and in the nutrition available to them during gestation.

As a consequence, twins generally differ at birth in their weight and degree of physical development, which helps account for their overall differences since their shared genetic blueprints—gene by gene and molecule by molecule—have been biochemically translated into different physiological realities. Imagine several different architects being given the same detailed blueprint for a huge city and being told to build that city from scratch in different locations. Were we to examine these urban constructions upon their completion, we would inevitably find that local contingencies had required construction crews to deviate here and there from the basic blueprint. Like these imagined cities, identical twins are identical only in their blueprints. By the time they are born, they are already disparate in countless neurological and physiological ways that mostly we cannot see.

In her third section, Segal gives moving accounts of twins whose unusual circumstances in life illuminate the remarkable strength of the bond between them. So intense is this bond that many twins are more attached to one another than they are to their own spouses or children. Two twins who were subjected to Josef Mengele's ghastly experiments at Auschwitz—and who survived Mengele's medical whims against all odds—epitomize this altruistic sense of identity. "We are two bodies and one soul," they repeatedly told Segal, who traveled to Australia to interview them. Other twins in Segal's account reinforce this portrait of the remarkable intimacy among identical twins, through stories of twinships broken by the death of one twin, followed by the enhanced sense of loss that often engulfs the surviving twin. Segal also writes of a woman who bore two artificially inseminated children for her sister, an identical twin who turned out to be infertile. She also describes a pair of identical twins who specifically sought mates "who would allow their twinship to flourish" and who solved their problem by marrying another pair of identical twins. Segal's book is a rich source of answered and still unanswered questions about twins and twinships, and it leaves us wanting to know more.

Returning to the question I posed earlier about Darwin's remarkable life and his fortuitous invitation to become the *Beagle's* naturalist, I am inclined to respond to such questions about chance events rather differently in the light of twin research. It helps us to appreciate that most people, driven in part by their genetic blueprints, chart adaptive routes during their long voyages through life by creating their own environments—a phenomenon that has come to be known as "niche picking." An identical twin who is adopted at birth, who turns out to love reading, and who is raised in a household with many books may tend to read those books one after another. This person's co-twin, if also adopted away but raised in a household that contains very few

books, is more likely to discover the satisfactions of public libraries. In *Indivisible by Two* and elsewhere, Segal has chronicled many such striking concordances in the lives and careers of identical twins. Examples include the skiers Phil and Steve Mahre, who in 1984 won gold and silver medals in the Olympic slalom; Harold and Bernard Shapiro, who became presidents of Princeton University and McGill University, respectively; and Judith and Julie Swain, who have both achieved distinction in medicine—one in cardiology research and the other in cardiac surgery.<sup>9</sup> In short, Galton's old distinction between "nature and nurture" has been substantially replaced in recent years by a view of life as a continuous process of genetically influenced interactions with the environment—a process that encompasses what has been termed "nature via nurture."<sup>10</sup>

How does this interactionist view of human development affect the way we might think about the life of Galton's famous cousin? It is often overlooked that young Darwin, who had dreamed of visiting exotic places since childhood, had already begun to organize his own oceanic voyage before receiving the invitation to sail on HMS *Beagle*. In fact, Darwin had diligently investigated passage on ships bound for the Canary Islands. He had even invited his beloved teacher, John Stevens Henslow, to join him on this planned natural history expedition. It was only a few months later that the British Admiralty asked Henslow to nominate someone to sail as naturalist on the *Beagle*. Had this chance invitation come just six months later, Darwin—in his efforts to satisfy his longstanding wanderlust—would probably have been on his way to the Canaries.<sup>11</sup>

Like the Galápagos Islands, the Canaries would have been an excellent place for Darwin to have begun questioning the reigning dogma of the immutability of species. After visiting the Canary Islands in 1815, the German naturalist Leopold von Buch developed a theory of evolution based on the effects of geographic isolation within this island group, just as Darwin himself did following his visit to the Galápagos in 1835. Two years after his Galápagos visit, Darwin came across von Buch's evolutionary insights about the Canaries and, in one of his research notebooks, praised von Buch's "admirable discussion." Von Buch's views, Darwin later acknowledged to botanist Joseph Hooker, represented "the nearest approach" to his own theory about speciation through geographic isolation.<sup>12</sup>

I like to think that Darwin, who

<sup>9</sup>Segal, *Entwined Lives*, pp. 210, 247–257, 270–272.

<sup>10</sup>Matt Ridley, *Nature via Nurture: Genes, Experience, and What Makes Us Human* (HarperCollins, 2003).

<sup>11</sup>*The Correspondence of Charles Darwin, Volume 1, 1821–1836*, edited by Frederick Burkhardt et al. (Cambridge University Press, 1985), pp. 120–127.

<sup>12</sup>*Charles Darwin's Notebooks, 1836–1844: Geology, Transmutation of Species, Metaphysical Enquiries*, transcribed and edited by Paul H. Barrett, Peter J. Gautrey, Sandra Herbert, David Kohn, and Sydney Smith (Cornell University Press, 1987), p. 210; *More Letters of Charles Darwin*, Vol. 2, p. 28.

believed he was a born naturalist, would have been comforted by the thought that some of the alternative lives he might have lived, had he not received that unexpected offer to sail with the *Beagle*, included a potential

for some of the same revolutionary science that grew out of his famous voyage. Like Segal's twins, Darwin and the rest of us are substantially the masters of our own vessels, sailing through our life courses, buffeted by

the frequent waves and occasionally larger swells of environmental influences, but still persisting in journeys that complement our genetically based predispositions. For those of us who desire to understand why lives turn

out the way they do, Segal's book invites us to stop and reconsider, in fresh ways, whether the shape of Darwin's nose and his uncle's fortuitous intervention really could have changed the course of intellectual history.