

For this Sunday, March 10, 2019, the Today's Issues group will discuss two essays from the March 7th edition of the New York Review of Books:

Page 33, Raja Shehadeh, "Bearing Witness in the West Bank" about the Palestinians

Page 38, Tim Flannery, "Our Twisted DNA," a review of a book about the powers, perversions and potential of heredity.

The group meets in the Religious Education building next to the church at 9:30 on Sunday mornings. Please do the reading and join our lively discussion.

A copy of the readings is attached.

Bearing Witness in the West Bank
Raja Shehadeh MARCH 7, 2019 ISSUE
Freedom and Despair: Notes from the South Hebron Hills
by David Shulman
University of Chicago Press, 198 pp., \$54.00; \$18.00 (paper)

Kobi Wolf/Contact Press Images

Israeli soldiers detaining a Palestinian during clashes at a protest, Hebron, West Bank, February 2018

On June 2, 1980, three members of an offshoot of the right-wing Israeli settler movement, a terrorist group that became known as the Jewish Underground—Menachem Livni, Uzi Sharabaf, and Shaul Nir, all West Bank settlers—placed bombs under the cars of the Palestinian mayors of Ramallah, Bireh, and Nablus. The mayor of Nablus, Ghassan Shakaa, lost both his legs; Kareem Khalaf, the mayor of Ramallah, lost a foot. A rumor circulated that Menachem Livni worked at the military governor's office in Ramallah. If so, I must have seen him there. When I heard what he had done and saw his picture, I wondered at the incongruity of his innocent-looking face.

The three were apprehended in 1984 and convicted in 1985 after another attack, which killed three Palestinian students at the Islamic College in Hebron. They received life sentences, but these were commuted by Israeli president Chaim Herzog. In 1990 they were released from prison, to the cheers of Jewish settlers and no real show of public protest. Menachem Livni now produces cabernet sauvignon at his winery in the settlement of Kiryat Arba next to Hebron.

After the bombings, Al-Haq, a Palestinian human rights NGO, met with the Association for Civil Rights in Israel and urged an investigation of settler violence in the West Bank. In 1981 a committee to carry one out was formed by the Israeli attorney general, headed by his deputy, Judith Karp. The Karp Report: On the Investigations of Suspicions Against Israelis in Judea and Samaria, published in 1984, described numerous acts of violence carried out by Jewish settlers against Palestinian Arabs in the West Bank, including assaults, destruction of property, armed

threats, shootings, obstructed access to places of employment, and attacks on schoolchildren. It was not followed by any significant change in the ways settler violence was addressed by the Israeli police and security services.

Such criminal behavior is more widespread now than it was in the 1980s. Then, the Israeli army was solely responsible for security and the pursuit of criminals in the West Bank. Since the signing of the Oslo Accords in 1995, security has been shared between Israel and the Palestinian Authority (PA), with the latter restricted to Area A, which constitutes only 18 percent of the Palestinian territory. The violence takes place mainly in Area C, where the Palestinian police cannot operate. Yet even within their jurisdiction, the PA police, with whom the Israeli security forces coordinate, do not assist Palestinian citizens during army or settler raids.

During the first intifada, which lasted from 1987 to 1993, Palestinians in the West Bank confronted the settlers who tried to intimidate Arab farmers. Not so anymore. Now the farmers are on their own, except when solidarity groups like Ta'ayush, the Arab-Jewish Partnership, come to their aid. Many villagers fear that if they fight back they will lose their security clearance to work in construction and agriculture in the settlements. With nearly total immunity from prosecution, settlers now commit acts of violence almost weekly.

For fifteen years, David Shulman, a renowned scholar of South Asian languages and religion and a frequent contributor to these pages, has been involved with Ta'ayush, whose name is the Arabic word for coexistence. The group has been protesting in the South Hebron Hills, in Area C of the West Bank, where some 300,000 Palestinians, most of them farmers and shepherds, live, in about thirty villages. The Israeli government has been methodically working to displace these communities by refusing to grant building permits to Palestinians and then demolishing houses that have been built without a permit. Orders are also issued for the demolition of cisterns where water is collected. Shulman's *Freedom and Despair: Notes from the South Hebron Hills* is an account of his experiences there and an attempt to understand the deep antipathy that drives the violence and destruction in the region.

Shulman does not like to use the word "evil." He prefers "wickedness" to describe the behavior of both the settlers and the army. In the 1980s, when I was involved, through my work as a human rights lawyer, in trying to save Palestinian property from the settlers, I used to believe that Shlomo Moscowitz, the head of the Central Planning Council at the Civil Administration, was wicked. He would plan Israeli settlements over large swaths of land and confine Palestinians to tiny enclaves. When I reminded him that these cities and villages needed room to grow naturally over the forty-year life of the statutory plans he was preparing, his answer was, "Let them build up."

Moscowitz was implementing the policy of the state he served. The widespread use of the Planning and Building Law to confine Palestinians in small areas and separate them from other Palestinian villages, while leaving the bulk of the land for Israeli settlements, was similar to the policy that was used against Palestinians who stayed in Israel after its creation in 1948.

Shulman argues that to call such policies “wicked” reduces the element of the deliberate, calculated strategy out of which they arise. But he believes that the officers and bureaucrats of the Civil Administration are worse than the “sociopathic settlers,” who are blinded by ideology. He writes:

All evidence on the ground points to the existence of senior [Civil Administration] bureaucrats who are motivated by outright malice.... The technicalities, indeed the entire abstract language of permits and approvals, are profoundly corrupt from start to finish. They embody malice of a high order, different in kind from the indeterminate wickedness of the courts or the police.

He concludes, “If causing great harm to innocent beings is morally, humanly, unacceptable, then a system like that of the Occupation that is entirely rooted in such acts of inflicting pain must be wicked.”

As for the Israeli army, which enables the occupation to continue, Shulman reports that on several occasions he tried to challenge the soldiers on the legality of the orders they were carrying out, hoping to prick their consciences. He never succeeded. Invariably, they said they were engaged in the preservation of order. He put the question to one soldier: “What about your conscience?”

The soldier answered, “Are you asking me to disobey orders, to refuse to serve?”

“No, I’m not, but I’m curious about the state of your conscience.”

“I have my orders.”

Throughout the book there are moments of black comedy. After settlers beat a fifteen-year-old Palestinian and stole his donkey, the boy was taken to the police station in the settlement of Kiryat Arba to submit a complaint, but the donkey remained with the settlers. Shulman reminds his readers, “If you live in a tent or a cave in Tuba, on the edge of the desert, with no access roads to the outer world and the settlers at our throat day after day, a donkey is no small matter.” The Israeli solidarity activists were determined that the donkey be found and returned. So they began to chant in rhythmic Hebrew: “Ha-hamor hayyav lahzor! The donkey must come home!”

At moments like these, some soldiers admit how preposterous their situation is: “Crazy? Of course it’s crazy. Everything down here is crazy.... The settlers are crazy, the Palestinians are crazy, even the sheep and goats are crazy. That is why I stick to my orders. They are clear.... My job is to keep the peace.” After other soldiers tell him that they “feel nothing when they carry out their orders,” Shulman muses that “after half a century of occupation, numbness of this order is, I think, endemic to the Israeli male.”

In an afterword to *Khirbet Khizeh*, the 1949 novella by S. Yizhar about the violent expulsion of Palestinian villagers by the Israeli army in the 1948 war, Shulman wrote of his own army experience:

One day before we were to swear our oath of allegiance and obedience unto death, an officer from the General Staff in Tel Aviv was sent to talk to us, to explain the meaning of the oath. Someone asked him what we should do if faced with an order that we regarded as immoral. To his immense credit, he answered: "There is no rule for such a situation. It is between you and your conscience." I'm not sure today's recruits would hear such an answer.

In *Freedom and Despair*, Shulman attempts to distinguish army behavior then and now by quoting Benny Gefen, an eighty-something veteran, who was with him on one occasion in South Hebron. Gefen tells the soldiers, "I am ashamed of the uniform I used to wear, the uniform you are wearing now. In the Palmach [the elite army 'strike forces' before and during the 1948 war], they always taught us: think of what the other is feeling, put yourself in his place." Yet was it really so different in the past? Did the Palmach not force the Palestinians out of their homes in the village of Lydda in 1948, and did they not commit the massacre at Dahmash Mosque, as Yerachmiel Kahanovich, a member of the Palmach, has testified?

The book doesn't offer an explanation for why criminal behavior in the West Bank has become so widespread in the past decade and a half. There is little doubt that the reluctance of the Israeli police to prosecute settlers is a contributing factor. But that cannot be the only reason.

I believe a prime factor is education. In 1983 an Israeli friend of my father who was engaged in a tour of Israeli schools and speaking to students came to visit. He told my father that he found the students were being encouraged to view Palestinians negatively, not as neighbors with whom Israelis could live in peace. He proceeded to warn my father, who lived in Ramallah, that Palestinians living under Israeli rule should be prepared for difficult times.

The intervening years proved him right. Israel and its apologists have often accused the Palestinian Authority of refusing to recognize Israel in its curriculum for Palestinian schools and of encouraging anti-Semitism in its students. This is utter hypocrisy. Nurit Peled-Elhanan, who conducted a study of more than twenty Israeli geography and history textbooks published between 1994 and 2010 for use in both the government-run school system and independent ultra-Orthodox schools, concluded in her 2012 book *Palestine in Israeli School Books: Ideology and Propaganda in Education* that the negative representation of Palestinians in these curricula "is quite contradictory to the persistent Israeli claim...that 'Palestinians teach their children to hate us and we teach Love thy neighbor.'" Peled-Elhanan also points out that none of the geography books she examined is called *The Geography of the State of Israel*. "The titles are usually *Israel* or *The Land of Israel*, which entails the inclusion, in all maps, of territories beyond the state's official borders, including the occupied areas"—not, of course, so identified.

This erasure has startling effects. Leaving Israel this spring, I was asked by the border official reviewing my passport, "What is the West Bank?" She was a woman in her twenties and had never heard of the West Bank. Before she was born, the Israeli government had changed the name to Judea and Samaria. She thought "West Bank" referred to a city in the US.

Peled-Elhanan argues that the process of influencing future army recruits starts at school:

With such distorted pictures and skewed maps firmly fixed in their minds, Israeli Jewish students are drafted into the army, to carry out Israeli policy vis-à-vis the Palestinians, whose life-world is unknown to them and whose very existence they have been taught to resent and fear.

In Shulman's confrontations with the Jewish settlers, he is often told acerbically that Judea and Samaria is their God-given land. Their argument is that any non-Jew is a trespasser who interferes with the coming of the Messiah and must be removed. Shulman writes of these views, "Their patent foolishness embarrasses me.... It is even hard to believe that Jewish people, of all the peoples in the world, can believe them."

In another encounter, Shulman is told by a senior commander from the Civil Administration to tell his "Palestinian friends to leave." Instead Shulman tells him, "You're the one who should go away. You shouldn't be here in the first place, you're no better than a common thief." The settler answers, "Where do you want me to go? back to Auschwitz?"

Confused as they seem, such invocations of the Holocaust to justify the requisition of land from Palestinians are not uncommon. In 1988 the Auschwitz survivor Yehuda Elkana wrote in Haaretz on "the need to forget," arguing that Israel's emphasis on remembrance prevents the nation from moving forward and finding peace:

the deepest political and social factor that motivates much of Israeli society in its relations with the Palestinians is not personal frustration, but rather a profound existential "Angst" fed by a particular interpretation of the lessons of the Holocaust, the readiness to believe that the whole world is against us, and that we are the eternal victim. In this ancient belief, shared by so many today, I see the tragic and paradoxical victory of Hitler.

Shulman believes that the settlers' "claim on the lands in question is pale, 'mythical' in the bad sense of the word." But he seems to confine the problem to the occupation in the West Bank, without taking account of how the Israeli state has historically exploited Palestinians. Surely the occupation policies are an extension of earlier policies pursued by Israel. For there to be a real change Israel will have to take responsibility for its earlier actions of expelling Palestinians and robbing those who stayed behind of most of their land. Otherwise the state will continue to feel it can get away with repeating the practice of land confiscation and the designation of these lands for the sole benefit of the Jewish citizens of Israel.

Kobi Wolf/Contact Press Images

Palestinians watching Israeli soldiers through the separation wall, Hebron, January 2018

In his afterword to *Khirbet Khizeh*, Shulman went further than he does in his new book. There, he made the connection between what was taking place at the time of writing (2007) and what had happened in 1948. He wrote, “What began in 1948 under different circumstances continues today, and there is at the moment no war to provide even the semblance of a rationalization.” He ended by declaring, “Maybe I’ll make one [sign] for myself: ‘No More Khirbet Khizehs.’” Why did Shulman not make such linkages in *Freedom and Despair*?

Perhaps it’s because his intended audience is the Western reader, not the settlers who refuse to listen to him and whose claim to the land he finds absurd. He reports that after his book *Dark Hope: Working for Peace in Israel and Palestine* was published in Hebrew, he met with a group of settlers. “They had asked to meet me,” he writes, because “I had tended to lump all settlers together with the savage ones who so often had assaulted us on the hills of South Hebron.” He came out of the meeting convinced that the settlers tend to be “thoroughly imbued with the fierce ideology of the religious right, which is mostly immune to claims based on universal values.” They tell him, “If you believe the word of the Bible, you know that God gave this land to the Jews—only to us. All that we do follows inevitably from that.” Against such conviction there is little room for rational arguments.

But Shulman is also writing for himself, to try to understand why he gets out of bed on a cold Saturday morning to go out to the hills and engage in a futile struggle. The book begins with a meditation “on the usefulness of despair.” Shulman writes, “If I didn’t despair, I wouldn’t keep going down to South Hebron.” He quotes the pre-Islamic poet al-Harith ibn Hilliza: “Nothing consoles you like despair.” He recommends despair as a place to start and adds, “Sometimes the worse things get, the more hope there is.”

All too often, he writes, his efforts feel like “battering at windmills.” One of his answers is that he wants to bear witness: “Maybe we can do something useful, in our own small way, for truth—by bearing witness, by not turning away. Truth, surprisingly, requires such assistance. The alternative is not appealing.” The reportage in the book itself is an act of witnessing, whether it tells of settler violence, weddings, meals, visits with farmers, or solitary walks in the hills.

Shulman recognizes that “we are unable to change the political situation itself. Some day the Occupation will end, but it will not be because of our small victories. And yet, in my own sense of what all this means, it is the micro-moments that matter most.” He then muses over “the strange beauty of fighting a hopeless battle,” for, as he says elsewhere, “a moral act that emerges out of true perception...will set me free.” “In fact, truth itself may be more of a feeling than an act of thinking.”

Guy Hircefeld, a longtime member of Ta’ayush, told Shulman how he came to the group: “[It] is the most real thing there is. We speak only the truth, with no facade, no cover-up. We tell it as it is, no apologies.... The more poisoned the public space is—by the government and the general public—the stronger I feel the need to act.”

Shulman agrees: “As it happens, long experience in South Hebron also teaches you something about seeing, or not seeing, what is truly there.” He tells us, “Often it’s like a litmus test: you can see in broad daylight who the thief is and who the innocent victim.”

Some of the Palestinian farmers Shulman speaks with tell him that “as far as they’re concerned, the settlers can stay; there is plenty of room—but only on condition that they act like human beings.” With the passage of the Nation State Law last July, which in effect legitimizes the state’s discrimination against its Arab citizens and declares in Article 7 that “the state sees the development of Jewish settlement as a national value and will act to encourage and promote its establishment and consolidation,” even such a low standard seems ever more unreachable.

What also seems to keep Shulman going through the apparently futile battles is that he is happy in the South Hebron Hills. He writes, “I sometimes think I am happiest when I am walking, either alone or almost alone, under the sun and wind in South Hebron.... A dimension of solitude inheres in the heartscapes of South Hebron.” He believes that

such expansiveness is intrinsic to true perception. A broader vision overrules a constricted one. Similarly, what expands my own self, and my awareness, has a natural relation to truth. An existential truthfulness would then be linked to what makes me more, rather than less, alive.

It is in these reflections that the strength of the book lies.

The South Hebron Hills that Shulman has come to love are being destroyed by settlers, just like the Ramallah hills near where I live. We inhabit, in his words, “a landscape, ravishing beyond words or thought, that is being cruelly violated, torn apart, raped, poisoned, destroyed. It is in the nature of a colonial venture to do that.” It is painful to witness the expansion of existing settlements and the establishment of new ones, feverishly pursued by the Israeli government since the election of President Trump. I agree with Shulman’s faith in the transformative power of hope. We part ways when Shulman writes, “It is not for myself that I feel this despair but for the Palestinians whose pain I have made my own.” Israelis, whose own humanity is at stake, cannot afford to give up hope any more than Palestinians.

Shulman is told by Menachem Brinker, a philosopher and literary historian and one of the founders of the Israeli peace movement, that the Jews “had first to learn—decades ago—to overcome their deep passivity, to rediscover how to act in the world, defend themselves, fight back; and this lesson they truly learned. Now they have to overcome the fascism that comes with blind, autistic power: witness the settlers, their primitive malice, their adoration of brute compulsion.” It is in this battle against fascism that neither we nor the Israelis can afford to remain passive, and must fight together.

Our Twisted DNA

Tim Flannery MARCH 7, 2019 ISSUE

She Has Her Mother's Laugh: The Powers, Perversions, and Potential of Heredity

by Carl Zimmer

Dutton, 657 pp., \$30.00

Museum of Modern Art, New York/Art Resource/© 2019 Banco de México Diego Rivera Frida

Kahlo Museums Trust, Mexico, D.F./Artists Rights Society (ARS), New York

Frida Kahlo: My Grandparents, My Parents, and I (Family Tree), 1936

Tracing genealogies has become immensely popular of late, and numerous companies offer to help you search through historical records or analyze your DNA. The pastime is no doubt enlivened by the scintillating possibility that you might discover noble blood, or even a notorious rogue, hiding in your family tree. But such discoveries generally don't tell the searcher much; most of us have little idea of how our genes are bequeathed to us at all.

Carl Zimmer's interest in genetic inheritance began when his wife, Grace, was pregnant with their first child, and the couple met with a genetics counselor. Zimmer, who has written books on evolution, neuroscience, and bacteriology, didn't see the point of the meeting, for they had already decided to have the child regardless of any genetic flaws that might be found. It was only when the counselor asked the couple about their family histories that Zimmer realized how little he knew about his own, and began to be curious about his ancestry.

The result, many years later, is both two delightful, healthy daughters and *She Has Her Mother's Laugh*, a grand and sprawling book that investigates all aspects of inheritance, from ancient Roman law to childhood learning, and on to the bacteria that inhabit our belly buttons (which are surprisingly varied among individuals). Along the way, the book provides many amusing historical anecdotes and important scientific insights.

Inheritance, as a means of endowing privilege, has been of vital importance to people ever since the Neolithic period some ten thousand years ago. Pedigrees (from *pé de grue*, the foot of a crane, which resembles the connecting lines on ancestral trees) have long been used to justify social hierarchies. In times past, the European nobility would spend lavishly to draw up impressive (and often invented) pedigrees for themselves.

In 1715 the Irish noble Viscount Mountcashel published a pedigree in which he claimed to be able to trace his ancestry all the way back to Adam and Eve. In Mountcashel's time, the popular understanding of heredity didn't extend much beyond the theory that men planted seeds in the wombs of women, where they were nurtured. Yet it does seem odd for Mountcashel to have averred that, in all the ages since Adam, not one of his female ancestors had ever become pregnant by anyone but her wedded partner. "Son of a bitch" is such a powerful insult not just because it slanders one's mother, but because it questions one's pedigree, and therefore the legitimacy of one's position and inheritance.

If you are searching for your own noble blood, genetic research has both good and bad news for you. If you follow a pedigree, with all its forkings, back to the eighth century, you will trace over a trillion forks—an impossibility, because that is more than the number of people that have ever existed. When Joseph Chang developed the first statistical model of heredity in 1999 to explain the paradox, he established that many forks disappeared if our ancestors were closely related to one another, and that if you go back seven thousand years, “you reach a point in time when all the individuals who have any descendants among living people are ancestors of all living people.” So you might have pharaohs in your ancestry, and possibly caesars and Holy Roman emperors as well. Yet because of the swapping of DNA fragments during sexual reproduction, the DNA of our ancestors becomes diluted very quickly. Only 1 percent or less of an ancestor who lived four centuries ago is present in your DNA.

None of this, of course, was understood before the discovery of DNA in the 1950s. Early misconceptions about ancestry, along with a belief in superior breeds, were expressed in the eugenics movement in the late nineteenth century. In 1910 Henry Goddard, an American high school teacher turned psychologist, invented the word “moron” to describe people with mental deficiencies. He was director of research at the Vineland Training School in New Jersey, which had been established to care for “feeble-minded” boys and girls. He believed that “degeneracy,” in the form of children with special needs, was increasing. The deputy principal of the school argued that “we must stop the increase. And that means to find out where they come from, why they come and what to do to check the stream.”

Goddard soon convinced himself that moronism was an inherited condition, and he wrote a book about the delinquent ancestry of Emma Wolverton, one of the wards at the Vineland School, giving her the pseudonym Deborah Kallikak (from the Greek for “good” and “bad”). His best-selling book *The Kallikak Family*, published in 1912, propelled him to fame and remained influential well into the 1950s. It had made an impression on Hitler in the 1920s and informed the Reich’s racial hygiene laws, under which feeble-minded children and other “undesirable types” were sterilized or euthanized.

Goddard’s argument that feeble-mindedness was passed down from generation to generation turned out to be entirely spurious. In the 1980s two genealogists reexamined the Wolverton (Kallikak) family tree as given by Goddard and discovered that Emma Wolverton’s supposed pedigree was as false as Mountcashel’s claim of descent from Adam.

Fraud and error have been an ongoing theme among those interested in establishing the genetic basis of intelligence. When the British psychologist Cyril Burt published a series of studies of identical twins, he convinced many that intelligence was determined by inheritance. But in 1966 the Princeton psychologist Leon Kamin read Burt’s work and “within ten minutes...knew...that it just had to be fake.” The test scores given for identical twins were correlated to within a tenth of a percent: one such instance would be unlikely, but the twenty instances in Burt’s study were “astronomically improbable.” Not only had Burt invented his

research findings, he'd published scientific papers under false names to give the impression that other researchers supported his work.

Although Burt gave twin studies a bad name, other more honest researchers persisted in the field. They have established that about half of the variation in intelligence test scores can be attributed to inheritance, though just which genes are responsible remains a puzzle. As Zimmer says:

While identical twins often end up with similar test scores, sometimes they don't. If you get average scores on intelligence tests, it's entirely possible your children may turn out to be geniuses. And if you're a genius, you should be smart enough to recognize your children may not follow suit.

The nongenetic factors that bear upon intelligence are important because they can be influenced by technology and social policies. The introduction of iodine into salt in the US, for example, raised the average IQ by 3.5 points (because iodine is vital for the production of some growth hormones, even a mild deficiency during pregnancy can impede fetal brain development). Poverty, meanwhile, can dumb us down: studies show that although living in poverty does not reduce the heritability of intelligence in Europe, in the US it does. Could it be that the existence in Europe of universal health care and more generous social programs is protecting the intelligence of its most vulnerable citizens?

Some of the most fascinating material Zimmer covers concerns the phenomena of mosaicism and chimerism, in which individuals are made up of cells with differing genetic inheritances. Mosaicism can occur in a number of ways. For example, if a genetic mutation arises in a cell early in development, the descendants of that cell will make up a large proportion of the cells present in the adult. One outcome is a skin disorder known as CHILD, in which half of a person's body is darkly pigmented, while the remainder is pale. Cancer is a kind of mosaicism that often arises later in life, when some genetic mutation allows a cell and its descendants to grow in an uncontrolled manner.

Chimerism (from the Greek word for a mythological monster whose body is composed of parts from different animals) is an even more intriguing condition. Chimeric individuals are composed of cells originating from two or more separate origins. The term "genetical chimera" was first coined by Sir Peter Medawar, who used it to describe freemartins, female cattle that shared cells in the uterus with a male twin, and whose cellular makeup therefore includes both male (from the bull calf) and female cells.

Medawar's pioneering studies of chimeras and immune tolerance led to breakthroughs in organ transplantation. He was also involved in the discovery of the first human to be recognized as a chimera. Known today only as "Mrs. McK," she was twenty-five years old in 1953, when she decided to donate blood. When her blood sample was analyzed, it was discovered to consist of both A and O types. A baffled doctor wondered if she had recently had a blood transfusion. But

Mrs. McK had not had one, so the doctor sent a blood sample to an expert in London, who thought to ask her if she had a twin. Mrs. McK replied that she had a twin brother, but that he had died when he was three months old. Her type A blood cells were all that remained of him. Medawar, in describing the case, wrote:

There is no telling how long Mrs McK will remain a chimera, but she has now been so for twenty-eight years; probably, in the long run, her twin brother's red blood cells will slowly disappear, and so pay back the still outstanding balance of his mortality.

Other kinds of chimeras are even more astonishing than those only detectable by blood tests. A baby born in a Seattle hospital in 1960 had a clitoris so large that it resembled a penis. When she was two years old she was operated upon to reduce the size of the organ. But after the removed tissue was examined, some cells were found to be genetically male. Further tests revealed that her entire body was a mixture of male and female cells. The child was the result of two eggs that had been fertilized by different sperm—one with male chromosomes, the other with female. Normally the result would have been twins, a boy and a girl. But the fertilized eggs had fused, creating a single chimeric individual.

Such phenomena illustrate the multifariousness of inheritance: we can be stitched together, from a genetic perspective, in ways that complicate our understanding of what an individual is. Unsurprisingly, the law is poorly equipped to deal with such nuances. In 2003 Lydia Fairchild, a pregnant, single mother of three living in Washington State, sought welfare benefits. In order to qualify she had to take a DNA test to prove that she and her former partner were indeed the parents of their children. The tests proved paternity but, according to the Department of Social Services, showed that Fairchild could not possibly be the mother of her children.

Suspecting abduction or a child surrogacy scam, the court put Fairchild's children in foster care and charged her with fraud. A court officer was present to witness the birth of her fourth child, but even that was not persuasive; only DNA would be accepted as evidence of the child's maternity. Even Fairchild's father, dazzled by science, began to have doubts about his daughter's honesty. Thankfully, her lawyer recalled an earlier, similar case that had resulted from chimerism. Through sheer good fortune a hospital had kept a cervical smear taken years earlier, and analysis of the sample revealed that the cells of Fairchild's body were derived from two genetically distinct female eggs that had fused to form one individual. Her sex cells came from one egg, while the parts of her body used in the DNA test came from the other. The court was finally convinced, and Fairchild's children were returned to her, but not before severely traumatizing the family. As we contemplate the potentially dire consequences of the case, the fact that supposed scientific evidence is so persuasive that eyewitness testimony, and even the love of a parent, could be negated by it should act as a caution.

Chimeras can also result from pregnancy. Cells from embryos regularly cross via the placenta into the mother during gestation, while her cells can end up in the embryo. It is astonishing how long such cells can survive. One woman who had given birth to a son still had cells with

Y-chromosomes in her body twenty-seven years later. In another case, an entire lobe of a woman's liver that had been damaged by disease was repaired by fetal cells that remained in her body after an abortion. A mother's brain cells, too, can be derived from offspring.

Émilie Regnier: *Maternal Bloodlines* (detail), 2018. 'DNA is drawing a self-portrait through the people who are genetically related to me,' Regnier writes. 'This series of work is my way to reconcile the past by creating my own family album. It's a story of the reappropriation of my own history, recognizing the figures in my maternal and paternal families, and consolidating the two branches of my polarizing entities: the black and the white, the Haitian and the Canadian.' As long as chimeras and mosaics were detected on the basis of physical manifestations or blood type, they were considered to be phenomenally rare—indeed freakish. By 1983, only seventy-five cases of human chimeras, as detected from blood type, were known, while mosaicism was mostly known from medical cases. Joseph Merrick, the "Elephant Man," suffered from a form of mosaicism known as Proteus syndrome, which left parts of his body deformed by monstrous growths, while other parts remained completely normal. For decades, his sad example defined the condition for many.

Recent advances in genetic analysis have revealed that chimerism is common. In fact, chimeric individuals may be the rule, rather than the exception, among mammals. One Danish study of the blood of 154 girls aged ten to fifteen discovered that around 13 percent of them had blood cells with Y-chromosomes. These cells probably originated from an older brother and had crossed into the mother, where they survived before crossing into, and taking root in, the daughter. A Seattle study of fifty-nine women who died, on average, in their seventies found that 63 percent had cells with Y-chromosomes in their brains.

As bizarre as chimeras might seem, they represent only the surface waters of Zimmer's deep dive into the nature of inheritance. Epigenetics, a fast-expanding area of science that explains how things experienced by individuals can influence the traits that are inherited by their offspring, seems to contradict our conventional understanding of genetics. The epigenome, "that collection of molecules that envelops our genes and controls what they do," as Zimmer puts it, operates through methylation—the process whereby methyl-group molecules are added to the molecular envelope surrounding the DNA, and so inhibit certain genes from operating (and, in some cases, from operating in descendants as well).

We owe one of the most penetrating insights into epigenetics to a laboratory accident. Michael Skinner of Washington State University was examining the impact of the anti-fungal agent vinclozolin on laboratory rats. He discovered that the offspring of rats exposed to the chemical produced deformed sperm. When a laboratory assistant accidentally used these offspring to breed a new generation of lab rats, researchers discovered that the grandsons of the poisoned rats also produced deformed sperm.

Skinner's rats sparked a flurry of new experiments that showed how methylation could lead to the inheritance of acquired traits. As some researchers commented, it was as if the work of Jean-Baptiste Lamarck (who famously posited that the necks of giraffes had lengthened over generations because they were stretched as the animals reached up to feed) had become reestablished. Science is rarely so simple—still, epigenetics has Zimmer wondering whether “poverty, abuse, and other assaults on parents also impress themselves epigenetically on their children.” The study of epigenetics is still in its infancy, so it may be years before we know the answer. With some recent studies showing that epigenetic effects fade over time, many researchers are unsure whether epigenetics is anything but an interesting codicil to the conventional genetic theory of inheritance.

The recent development of CRISPR-Cas9 technologies has elucidated yet another potential pathway of inheritance. Cas9 is an enzyme produced by the immune systems of bacteria that fights viruses by breaking up their DNA. As it turns out, it also offers a way to use RNA to guide precise editing of a genome by removing or adding genetic sequences to chromosomes. CRISPR-Cas9 could be used to edit out defective genes and even insert new ones. Reporting on CRISPR in 2014, Zimmer realized that he “was witnessing the beginning of something enormous.” One of the discoverers of the technique, Jennifer Doudna, was meanwhile having recurring nightmares about her discovery. In one nightmare she found herself on a beach staring directly at an oncoming tsunami. In another she met Hitler, who had the face of a pig. As Doudna spoke, the pig-Hitler jotted down notes.

In one of the first uses of CRISPR-Cas9 for biological control, attempts are being made to modify mosquitoes so that they cannot carry the malaria parasite. But because relatively few mosquitoes bear the inserted genes for malaria resistance, their genetic inheritance is quickly diluted when they are released into the wild. If the inserted genes are to spread, another technology known as a gene drive is required. A gene drive is an additional bit of genetic modification to propagate genes in a population by giving them a greater than 50 percent chance of being inherited.

As of 2015, results from the mosquito work were mixed, with some female descendants eliminating the gene that had been inserted into their ancestor's genome using CRISPR. But in 2018, after the publication of Zimmer's book, researchers announced that they had successfully propagated genes in mosquitoes using a gene drive. With both CRISPR and gene drive technologies becoming more powerful by the year, we must look to visionaries to comprehend its potential. George Church, a geneticist at Harvard and MIT, believes that CRISPR will inevitably be used to create genetically “superior” humans. Alterations to our genome will creep in the door through the treatment of diseases, he says. Imagine if gene editing can be used to treat wasting muscles, or Alzheimer's, or to prevent HIV infection (as was allegedly done to a pair of unborn twins recently in China)—how long would it be before those same techniques are used to create super-muscles or super-cognition?

Church is rightly concerned about CRISPR's potential to permanently alter human gene lines, as are other scientists. Marcy Darnovsky, the executive director of the Center for Genetics and Society, thinks it will lead to an "unregulated marketplace" in which gene editing, which can inflict harm on unborn children, will run rampant. Given the history of earlier misunderstandings of inheritance that Zimmer relates, it's a warning we better take seriously.

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