

RANDOM HOUSE  BOOKS



Monkeyluv
Robert M. Sapolsky

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ALSO BY ROBERT M. SAPOLSKY

*A Primate's Memoir: Love, Death and
Baboons in East Africa*
*The Trouble with Testosterone and Other
Essays
on the Biology of the Human Predicament*
*Why Zebras Don't Get Ulcers: A Guide to
Stress,
Stress-Related Diseases, and Coping
Stress, the Aging Brain, and the Mechanisms of
Neuron Death*

To
l.l., k.q.
f.s.

ROBERT M. SAPOLSKY

Monkeyluv

And Other Essays on
Our Lives as Animals

VINTAGE BOOKS
London

AUTHOR'S NOTE

The articles included in this volume appeared in various magazines, as noted in the table of contents. In some cases, articles appear here in slightly different form than originally published, and, in all cases, the text has been supplemented with "Notes and Further Reading."

PART I



Genes and Who We Are

Introduction

IF YOUR CAR breaks down, we all know the best way to fix it—you don't find someone skilled at doing an exorcism rite over the engine. Instead, you find someone knowledgeable who can take the engine apart, find the tiny piece that is the problem, fix or replace it, and put the whole thing back together.

If a violent crime occurs, with the perpetrator a mystery, we all know a good way to figure out what happened—you don't take a suspect, set fire to him at the stake, and if he burns to a crisp, conclude that that's a sign he was guilty. Instead, you take the mysterious event apart, find a witness who observed steps A through C, another who saw C through E, and so on, to piece together the whole picture of what happened.

And if your body breaks down, we know the drill as well—you don't sacrifice a cow to appease the spirit of the cousin who died while you owed her money. You get an expert who takes the illness apart and finds the tiny piece that is out of whack—the virus or bacteria, for example—and then fixes it.

The “solve a big problem by finding the itty-bitty thing that's bugged and fix it” approach is called reductionism—if you want to understand a complex system, break it into its component parts. Reductive thinking has dominated Western science for centuries, helped drag the West out of the quagmire of the Middle Ages.

Reductionism can be a great thing. Having been a kid early in the Jonas Salk era, I'm mighty glad I got a fine product of reductive science, namely his vaccine (or maybe it was Albert Sabin's—let's not even go there), instead of having my pediatrician do a ceremony over me with some fetish gewgaw and goat innards to please the Polio Dybbuk. Reductive medical approaches have gotten us vaccines, drugs that block the precise step in the replication of a virus, have identified the precise piece of us that is broken in a variety of diseases. Our life expectancy has been extended to remarkable extents over the last century thanks to reductionism.

So if you want to understand the biology of who we are, of our normal and abnormal behaviors, the reductive approach gives you a pretty clear game plan. Understand the individuals who make up a society. Understand the organs that make up those individuals. Understand the cells that make up those organs. And way down at the foundations of the whole edifice, understand the genes that instruct those cells what to do. This approach gave rise to an orgy of reductive optimism in the form of the most expensive research project in the history of the life sciences, namely the sequencing of the human genome.

So genes seem to be pretty fundamental reductive building blocks of biology, including the biology of behavior. What does it mean to most people to say that a behavior "is genetic"?

That the behavior is innate, instinctual.

That the behavior is going to happen no matter what you do.

That (if you're operating in a public policy realm) you shouldn't bother wasting resources trying to prevent that behavior, because it's inevitable.

That (if you're a bit outdated about what evolution is about) the behavior is somehow adaptive, has some reason why it is actually a good and useful thing, reflects some

sort of wisdom of nature, how an “is” is actually a “should be.”

The first third of this book considers what genes have to do with behavior, with who we are. And you might already see where I’m heading, which is to debunk the ideas just listed, to show how little genes often have to do with the biology of who we are.

In the first essay, I consider what genes might have to do with one of the most important issues facing our troubled planet—explaining who gets into *People* magazine’s special issue on the fifty most beautiful people in the world. As will be seen, there is a tragic paucity of good research in this area; I’ll consider this book to have served its purpose if the first essay inspires even a single young scientist to tackle this daunting question.

The second essay, “A Gene for Nothing,” introduces the reader to what genes actually do. As will be seen, you can’t begin to understand the functions of genes without appreciating how the environment regulates those genes. Essay three, “Genetic Hying,” takes this theme in a different direction. One of the most important concepts in all of biology is that you can’t really ever state what the effect is of a particular gene, or what the effect is of a particular environment. You can only consider how a particular gene and particular environment interact. “Gene/environment” interactions are so important that you can’t be taught the biologist secret handshake until you use the phrase in conversation at least once a day. And like any concept that is that ubiquitous and foundational, it winds up getting ignored in all sorts of settings. Essay three tries to counter this, reviewing a study showing that imperceptibly subtle differences in environment can utterly change the effects of genes on behavior. Essay five, “Of Mice and (Hu)Men Genes,” considers gene/environment interactions in fetal and early postnatal life and how they affect adult behavior, including in humans.

Amid all this gene-bashing, essay four, “The Genetic War between Men and Women,” reviews a realm in which genes have some major effects on the development of brains, bodies, and behavior. In this case, the main point is that these genes are some of the weirdest ever uncovered, ones that violate all sorts of cherished beliefs in genetics. What is strangest is that they make perfect sense as soon as one recognizes that throughout evolution, there has been a genetic war going on between females and males, including human females and males. Warning: this essay does not make pleasant wedding-night reading.

Finally, essay six, “Antlers of Clay,” returns to the foibles of relationships between the sexes. In species in which males and females go their separate ways after mating, all a female gets from a male are the genes contained in his sperm. The essay reviews how in many of these species males have evolved ways to advertise to females that they’d be great to mate with because of what terrific genes they have. And what females have evolved are ways to figure out if the guy is actually telling the truth. As we’ll see, amid these intersexual battles over truth in advertising, genes may be getting a lot more credit than they deserve.

Nature or Nurture? “The 50 Most Beautiful People in the World” Assess the Source of Their Good Looks

AS A SCIENTIST doing scads of important research, I am busy, very busy. What with all those midnight experiments in the lab, all that eureka-ing, I hardly have any time to read the journals. Nonetheless, I stopped everything to thoroughly study the May 10, 1999, issue of *People* magazine, the special double issue, “The 50 Most Beautiful People in the World.” It was fabulous. In addition to the full-color spreads and helpful grooming tips, the editors of *People* have gone after one of the central, pressing issues of our time. “Nature or nurture?” they ask on the opening page, as in, What gets you in our special issue? “About beauty, the arguments can be endless” (*P. Mag.* [1999] 51, 81). Best of all, the write-ups on each of the fifty contain some thoughts from the Chosen Ones or from members of their entourage (significant other, mom, hairdresser ...) as to whether their celebrated states are a product of genes or environment.

Now, one should hardly be surprised at the range of answers that would come from a group that includes both a seventeen-year-old singer named Britney Spears and Tom Brokaw. What was striking, though, and, frankly, disappointing to this reporter was that our Fifty Most Beautiful and their inner circles harbor some rather

militant ideologues in the realm of the nature/nurture debate.

Consider first the extreme environmentalists, who reject the notion of anything being biologically fixed, with everything, instead, infinitely malleable with the right environmental intervention. There's Ben Affleck, newly arrived on the movie scene in the last few years, who discusses the impact of his pumping iron and getting his teeth capped. "Oh my God, you are a movie star!" one of his advisers is reported to have gushed in response to the dentistry (*P. Mag.* [1999] 51, 105). Mr. Affleck is clearly a disciple of John Watson, famous for the behaviorist/environmentalist credo, "Give me a child and let me control the total environment in which he is raised, and I will turn him into whatever I wish." It is unclear whether Mr. Watson's environmentalist hegemony included turning people into the Fifty Most with cosmetic dentistry, but a torch appears to have been passed to young Mr. Affleck. Thus, it hardly becomes surprising that Mr. Affleck's much celebrated affair with Gwyneth Paltrow, clearly of the genetic determinist school (see below), was so short-lived.

A strongly environmentalist viewpoint is also advanced by one Jenna Elfman, apparently a successful television star, who attributes her beauty to drinking one hundred ounces of water a day, following the teachings of a book that prescribes diets based on your blood type, and religiously making use of a moisturizer that costs \$1,000 a pound. However, even a neophyte in the studies of human developmental biology and anatomy could quickly note that no amount of said moisturizer would result in the inclusion on *People's* list of Walter Matthau or, say, me.

Then there is Jaclyn Smith, having moved into the stage of life where *People* mostly exclaims over the extent to which she still looks like the Charlie's Angel that she once was, explaining how her beauty has been preserved with

good habits—not smoking, drinking, or doing drugs. This seems reasonable, until one reflects that that salutary nurturing of her self couldn't quite be the whole story, since no similarly ascetic Amish appears on the list of fifty. (A close friend of Ms. Smith's countered that her beauty is, in fact, maintained by her "humor, honesty, and unpretentiousness" [*P. Mag.* (1999) 51, 98], which left this reporter sincerely confused as to whether that should count as nature, nurture, or what.)

Perhaps the most extreme stance of this band is advanced by the actress Sandra Bullock, claiming that her beauty is all "smoke and mirrors" (*P. Mag.* [1999] 51, 81), a viewpoint that aligns her squarely with the Lysenkoism of the Soviet wheat experiments of the 1930s. One need merely to examine her work—for example, the scene in which she first takes the wheel of the bus in *Speed*—to detect the undercurrents of this radicalism in her oeuvre.

Naturally, similarly fringe opinions are coming from the opposing ideological faction, namely the genetic determinists among the Most Beautiful. Perhaps the brashest of this school is Josh Brolin, an actor whose statement would seem inflammatory to middle-of-the-roaders, but which could readily serve as a manifesto at the barricades for his cadre—"I was given my dad's good genes" (*P. Mag.* [1999] 51, 171). Similar sentiments come from the grandfather of the aforementioned Paltrow—"She was beautiful from the beginning" (*P. Mag.* [1999] 51, 169). Ah, young Brolin and Paltrow, an environmentalist adversary might counter, but what if your genetic destiny had encountered a good case of rickets or cowpox along the way, what magazine would you now be gracing?

The epitome of the natalist program, in which genetics is seen to form an imperative trajectory that is impervious to environmental manipulation, festers in the case of TV host Meredith Vieira. One is first told of various disasters that have befallen her—shoddy makeup application, an

impetuous and unfortunate peroxide job on her hair—and yet, and yet, it doesn't matter; at each juncture, she is still beautiful because of her “phenomenal genes” (*P. Mag.* [1999] 51, 158). This reader, for one, blanched at the boldness of this analysis.

Finally, we consider Andrea Casiraghi, he of the Grimaldis of Monaco, grandson of Grace Kelly. Amid the wonderment at his lovely complexion and classically sculpted cheekbones, the word comes out —“thoroughbred.” *Thoroughbred*. Oh, could it be so long before his advocates are pushing the eugenics programs that darkened our past? One searches the pages for a middle ground, for the interdisciplinary synthesist who would perceive the contributions of nature *and* nurture. Hope emerges with seventeen-year-old Jessica Biel, an actress celebrated for her skin, judiciously attributing it to her Choctaw blood *plus* getting regular facials with Oil of Olay.

And at last, one encounters one of the Chosen whose camp incorporates the most modern, most sophisticated and integrative insights concerning the nature/nurture conundrum, namely the idea that there is an *interaction* between genes and environment. For this, we consider a singer named Monica, who, despite lacking a last name, is not only one of the Most Beautiful People in the World, but apparently also one of the most important, because of the fame of an album of hers entitled *The Boy Is Mine* (a work unfamiliar to this reporter, whose association with popular culture ended somewhere around Janis Joplin). We are first informed about her wondrous skill at applying makeup and its role in gaining her acceptance into the Chambers of the Fifty. This, at first, seems like just more environmentalist agitprop. But then one asks, And where does she get this cosmetic aptitude from? Her mother supplies the answer: with Monica, “it’s something that’s inborn” (*P. Mag.* [1999] 51, 146).

One's breath is taken away at this incisive wisdom: *a genetic influence on how one interacts with the environment*. Too bad a few more people can't think this way when figuring out what genes have to do with, say, intelligence, or substance abuse, or violence.

— NOTES AND FURTHER READING —

At the end of each piece, I'll bring the reader up-to-date on any recent developments in the subject, reference the contents, and point to further readings.

This article, naturally, has become dreadfully obsolete, as is and should be the case with any such piece of investigative reporting by *People* magazine. Since that time, the fortunes of The Fifty Select have shifted. Ms. Elfman, I've dimly noted, seems to have appeared in a number of movies that tanked badly. Meanwhile, Mr. Affleck managed to spend at least two fifteen-minute blocks of fame as one-half of the world's most incandescently important couple, one so important that it even prompted the coining of a new word to describe it. Sadly, as a measure of his eclipse, current news (6/10/04) has been dominated by the revelation that J. Lo, at least this week, is married to someone else. And Ms. Spears, who only a few short years ago still had to be identified as "a singer," no longer needs an introduction for most readers; however, just around the time of career where most personal handlers would be convincing her that it's time for an image-burnishing trip to a Sudanese refugee camp as a special UN envoy, she is instead neurobiology's greatest teaching tool for demonstrating that the frontal cortex of the brain does not fully come online until around age thirty. As for what's happening with most of the rest of the

Legion of the Select, I haven't a clue, not having had any idea who they were in the first place.

Lysenkoism—for those who haven't specialized in the “Embarrassing Chapter of Science” category of *Jeopardy!*—was a movement that dominated Soviet genetics for some decades. Named for the marginal geneticist Lysenko, it was an extreme environmentalist viewpoint in which organisms can inherit acquired traits (for example, be Caucasian and spend enough time in the tropics to get darkly tanned skin, and your offspring will be born with the same dark skin). This thinking was very much in line with Soviet environmental optimism, but didn't have the slightest shred of science supporting it, having been discredited before Darwin's time. This didn't prevent Lysenko from gaining vast influence over Stalin and agricultural planning. A bizarre episode in science that would just leave one shaking one's head in bemusement if Lysenkoism hadn't played a role in the death by starvation of vast numbers of Soviet citizens.

Further reading: the issue of *People* magazine cited above, of course, and as long as we're at it, the entire collection of *People* magazines. And for the best read on the science of this piece, see Matt Ridley's *Nature via Nurture: Genes, Experience, & What Makes Us Human* (New York: HarperCollins, 2003).

A Gene for Nothing

REMEMBER DOLLY THE Sheep, the first mammal cloned from adult cells, in 1996? She was lovely, really an inspiration. She endured endless state dinners at the White House, all grace and cordiality. Then there was her triumphant ticker-tape parade down Broadway that won over even the most hardened New Yorker. Her appearances in those ubiquitous billboard ads for Guess? jeans (jeans, genes—get it? Those advertising guys are just awesome sometimes). Rollerblading at Disneyland for charity with the cast from *Friends*. Throughout the media circus, she was poised, patient, even-tempered, the epitome of what we look for in a celebrity and role model.

And despite that charm, people kept saying mean things about Dolly. Heads of state, religious leaders, editorialists, fell over themselves shortly after her debut to call her an aberration of nature, an insult to the sacred biological wonder of reproduction, something that should never remotely be considered in a human.

What was everyone so upset about? Some possibilities come to mind: (a) The Dolly Sheep/Dolly Parton connection unsettled everyone in a way that they just couldn't quite put their finger on. (b) Because the cloning technology that gave rise to Dolly could be extended to humans, we face the potential of droves of clones of someone running around, all with the exact same liver function. (c) Thanks to that technology, we might wind up with a bunch of clones who have the same brain.

Sure, the first two possibilities are creepy. But the disease prompted by Dolly was overwhelmingly, remains overwhelmingly, about the third option. The same brain, the same neurons, the same genes directing those neurons, one multibodied consciousness among the clones, a mind meld, an army of photocopies of the same soul.

In actuality, people have known that this is not really the case ever since scientists discovered identical twins. Such individuals constitute genetic clones, just like Dolly and her mother (what was her name? Why does she get shortchanged in the media?), from whom that original cell was taken. Despite all those breathless stories about identical twins separated at birth who share all sorts of traits, like flushing the toilet before using it, twins do not have mind melds, do not behave identically. As one important example, if an identical twin is schizophrenic, the sibling, with the identical “schizophrenia gene(s),” has only about a 50 percent chance of having the disease. A similar finding comes from a fascinating experiment by Dan Weinberger of the National Institute of Mental Health. Give identical twins a puzzle to solve, and they might come up with answers that are more similar than one would expect from a pair of strangers. Hook those individuals up during the puzzle-solving to a brain-imaging instrument that visualizes metabolic demands in different regions of the brain, and the pattern of activation in the pair can differ dramatically, despite the same solution. Or get yourself some brains from identical twins. I don’t mean pictures from a brain scanner. Get the real, squishy stuff, postmortem brains. Slice ’em, dice ’em, examine them with every kind of microscope, and every obsessive measure—the numbers of neurons in particular brain regions, the complexity of the branching cables coming out of those neurons, the numbers of connections among those neurons—and they all differ. Same genes, different brains.

The careful editorialists pointed this out about Dolly (and instead, some of the most disturbing issues about cloning raised by Dolly center on the possibilities of generating life simply for the purpose of banking away transplant-compatible tissues). Nonetheless, that business about identical genes supposedly producing identical brains tugs at a lot of people. And other gene/behavior stories keep getting propelled to the front pages of newspapers. One popped up shortly before Dolly with the report, headed by a Stanford team, of a single gene, called *fru*, that determines the sexual behavior of male fruit flies. Courtship, opening lines, foreplay, whom they come on to—the works. Mutate that gene and, get this, you can even change the sexual orientation of the fly. And that wasn't front-page news because of our insatiable fly voyeurism. "Could our sexual behaviors be determined by a single gene as well?" every article asked. And a bit earlier, there was the hubbub about the isolation of a gene related to anxiety, and before that, one for risk-taking behavior, and a while before that, the splash about another gene, whose mutation in one family was associated with their violent antisocial behavior, and then before that ...

Why do these command attention? For many, genes and the DNA that comprises genes represent the holy grail of biology, the code of codes (two phrases often used in lay-public discussions of genetics). The worship at the altar of the gene rests on two assumptions. The first concerns the autonomy of genetic regulation. This is a notion that biological information begins with genes and flows outward and upward. DNA as the alpha, the initiator, the commander, the epicenter from which biology emanates. Nobody tells a gene what to do. It's always the other way around. The second assumption is that when genes give a command, biological systems listen. In that view, genes instruct your cells as to their structure and function. And when those cells are neurons, those functions include