BRINGING UP BABY

AN EVOLUTIONARY VIEW OF PEDIATRICS

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Chapter 1: From A Certain Point Of View

> When the blind men had felt the elephant, the raja went to each of them and said . . . 'what sort of thing is an elephant?' Thereupon the men who were presented with the head answered, 'Sire, an elephant is like a pot.' And the men who had observed the ear replied, 'An elephant is like a winnowing basket.' Those who had been presented with a tusk said it was a ploughshare. Those who knew only the trunk said it was a plough; others said the body was a grainery; the foot, a pillar; the back, a mortar; the tail, a pestle, the tuft of the tail, a brush. Then they began to quarrel . . . till they came to blows over the matter.
>
> From an old Indian Fable

"I'm not into newfangled stuff like breastfeeding." I heard those words in 1984, shortly after returning from a tiny atoll in Micronesia, where my wife and I had been doing anthropological fieldwork. Women there wear knee-length skirts woven from the fibrous bark of hibiscus trees. Modesty requires covered thighs, but breasts are in plain view—and so are attached infants and toddlers. Micronesians, it's safe to say, wouldn't describe breastfeeding as newfangled. The individual that claimed otherwise is a college-educated mammal from Michigan. She was not breastfed, and neither was her mother. Feeding babies with bottles is a time-honored tradition in her family. It's the old fashioned way of doing things.

So perspective is important. From a sufficiently limited point of view, organisms as obvious as elephants can be misconstrued, and so can the primary function of breasts.

Physicians tend to have particularly narrow perspectives, and the overarching message of this book is that Darwin's theory of evolution by natural selection is the cure for this ailment.

A Tortuous Journey

At age 39, I went to medical school. I got there by a circuitous route, with stops along the way in anthropology, evolutionary biology, and immunology. The more typical route is straight and narrow; and littered with multiple-choice exams. Exams and more exams, from high school to retirement, they validate every doctor's career. Personally, I don't think much of exams. They conflate factual recall with understanding.

I'm not sure why I was let in, and I hope this book doesn't trigger an investigation. It's quite possible, though, that someone with a name similar to mine got an undeserved rejection letter. I entertain this suspicion because an informant—a doctor friend on the faculty of one of the two medical schools to which I applied—explained how the selection process had proceeded at his institution. My Ph.D. in anthropology, the articles I'd published, the classes I'd taught, letters of recommendations from colleagues, none of them mattered. Four thousand applications were plopped on a secretary's desk, and she was instructed to send rejections to all but the top ten percent, judged solely on the basis of undergraduate grade point average and Medical College Aptitude Test score. The remaining applicants were granted interviews, and I was mysteriously among them.

I left mine feeling as though I'd been hazed. Not the tame kind of hazing that occurs at college fraternities, where mortality rates are fairly low, but more like the hazing that elders have committed on adolescents, throughout much of the world, over much of human evolutionary history. Anthropologists refer to these affairs as 'rites of passage,' which is an overly dignified label for ceremonies that generally include septic circumcisions.

My interviewer was a sixty-something female pediatrician who looked kindly enough but wasn't. Pleasant conversation was not her forte. As an icebreaker, I mentioned that it was a nice day, adding that we nevertheless needed rain. Her response was to ask whether I was interested in medicine or meteorology. Things deteriorated from there, and I soon found myself scanning the room, hoping not to spy any dirty scalpels. She was unimpressed with my background, and quite concerned that my interest in certain theoretical issues would interfere with the care of patients. Her disdain for theory surprised me because she was employed by one of the largest and most highly regarded research hospitals in the country. Moments later she closed our session with a question, muttering as she got up to leave, "Are you incapable of giving a concise answer to a question?" My quick reply was, "no," which—and I resisted rubbing this in—is pretty concise.

In retrospect, I may have been more qualified to become a lawyer than a doctor. An educational system that sorts students on a scale of willingness to memorize and concisely present ‘the facts’ produces at one extreme free-thinkers who completely lack a factual foundation from which to think, and at the other extreme a more constrained (not to say stultified) group that can instantly recall the number of carbon atoms in short, medium, and long chain fatty acids. Whereas law schools select from the former pool (the rationale, I believe, is that distorting the facts is helped along by not knowing any), medical schools select almost entirely from the latter.

And once a pool of sufficiently dutiful students is chosen to enter medical school, any residual breadth gives way to an even more intense focus on the tasks at hand. First year medical students have very little time to ponder anything but anatomy, physiology, genetics, and, of course, chemistry.

I remember my first day. During an orientation lecture, an administrator went through our upcoming class schedule and outlined the number of hours we were expected to spend studying. She concluded that it was possible to get six hours of sleep most nights, but only if we used little tricks like taping a diagram of the Krebs cycle to the bathroom mirror, so as to memorize and brush at the same time. I thought she was kidding. In fact I thought my new teachers were kidding about a lot of things.

At the close of orientation, we were given a long list of facts to memorize for our first exam in anatomy; the topic was the human skeleton, and we were told it would be easy compared to what was to come. I flunked it. Every groove, notch, hole, and ridge on every bone has a name—generally a long name, and I honestly could not believe that they really expected us to learn them. Two years before, while on a fellowship, I had been teaching courses at the University of Michigan on the evolution of social behavior. I was writing the exams, not taking them, and I never would have expected my students to memorize, even in an entire semester, the extraordinary amount of detail that I was now expected to swallow and regurgitate each week. What was extraordinary about the classes I had been teaching was not the length of the list of facts to be memorized; it was concepts, first laid out by Charles Darwin in 1859, that are so broad in scope, and so insightful, that they give a foundation for understanding every facet of biology, including the health and happiness of *Homo sapiens*. I therefore felt that my students needed some time to think, and therein lies the principal difference between training for a Ph.D. and an M.D.

"What have I done?" I asked myself again and again during the early days of medical school, and what is it, anyway, about the Krebs cycle that so enthralls medical school faculty? As a scientific discovery, it's quite an accomplishment, and I'm thoroughly impressed with Krebs, but my inability to recall whether fumarase works its magic before or after malate dehydrogenase has never harmed any of my patients. Could it be that learning the Krebs cycle is just a test of memory? Is it meant to screen out recruits that somehow made it this far and yet are still too desultory to have much chance of surviving medical school? If so, those in charge of the curriculum should conduct ongoing screening with tasks that have greater intrinsic utility to future doctors, like memorizing the phone numbers of the complaint departments of all major health insurance companies.

I spent most of the first few months of medical school grieving over my drop in status, buoyed only by occasional bright spots, one of which appeared, of all places, in my new two thousand-page biochemistry textbook. There it was, on the first page, sans any hedging (i.e., without mention of intelligent design), the claim that Darwin's theory of evolution is the foundation on which all biochemistry rests. I was of course thrilled to read this because I knew quite a bit about that theory. Unlike the students who were now my peers, I had never taken a course in biochemistry, but hey, I had 'the foundation' down, or, as my teenage son might put it, I was down with the foundation, so I was pretty sure that I would be able to do well in the course.

My optimism was short lived. I don't claim to have read the entire book, or even most of it (or hardly any of it), but I did search the index for references to Darwin, evolution, and natural selection—and found none. Some foundation.

The first biochemistry exam consisted of twenty multiple-choice questions. I pretty much guessed on the answers to five of them, and I was fairly unsure about a couple of others. As time ran out, I figured that it was likely that I had just flunked another exam, which would make me two for two. As I left the testing site, heading to the medical school administration building, I began to compose a speech explaining why I was withdrawing from the program. I had trouble deciding whether to be nice, thus leaving on a high note, or whether a more honest, four-letter-word approach would be most appropriate. When I arrived in the lobby, however, I saw that the biochemistry instructor had already posted our scores. This is the beauty of the multiple-choice exam. It can be run quickly through a machine and in less than an hour you know your fate. This rapid reporting of results is great because it minimizes anxiety, which I assume is in violation of medical school policy. (As a concerned alumnus, I hope that this has by now been corrected.) Anyway, I had missed only two questions.

By the end of my first year, I had adjusted. Memory function, like muscle function, improves with use. I flunked no subsequent tests, implying, perhaps, that my patients need not panic. Nevertheless, as a doctor in training, there is no denying that I was a bit of an odd duck. My perspective was unusual then, and it is unusual now.

A genetics instructor was the first to discover this. It's possible that no one would have found me out, but she did a remarkable thing: she asked each of us to write a paper on any genetical topic of our choosing. Nothing like this had happened in any other course, nor would it at any subsequent stage of my medical education. I was so happy, and I'm pretty sure that I'm the only one who was. In fact, I believe I saw a look of panic spread through the classroom—these were smart kids, and it didn't take them long to realize that writing a paper requires more thought than simply circling a, b, c, or d.

I chose to discuss a gene that had been discovered to cause extremely high cholesterol, even in children. At the time, effective cholesterol lowering medicines were just becoming available, and were not yet widely in use, so individuals carrying this gene were having heart attacks and dying in their twenties and thirties. The question I asked was why has such a gene persisted in the population? I pointed out that natural selection should generally work to eliminate genes that produce deleterious effects during the prime of life, and then I framed an approach to address the problem, giving a couple of hypothetical solutions.

The genetics instructor then did another remarkable thing. At the top of my paper, in bright red ink, she wrote, "You're thinking like a scientist; I'm not sure that's appropriate for a medical student."

She gave me an "A," so maybe she meant to be funny—a bit of sarcasm from a frustrated scientist stuck teaching a large class of medical students. At least that's how I took it. Jokes, though, especially sarcastic ones, tend to get a laugh only if they capture a grain of truth. For example, "What's the difference between God and doctors?" "God doesn't think he's a doctor."

Proper science, as I've been hinting, pays equal attention to theory and evidence. A new observation can reify an existing theory, destroy it, or require its revision; equally, a revised or new theory generates new predictions, leading to the search for new findings, or leading to the recognition of findings that were known but unappreciated, which, full circle, reify, destroy, or revise theory. Medical science lacks this egalitarian interplay of ideas and data. During the past 100 years, medical science has catalogued plenty of new facts, but they have not been fitted into a whole, and their discovery has been due to advances in technology much more than to advances in theory. If medical scientists had built and been in charge of the Hubble telescope, they would have made many new observations, but I doubt that they would have seen Einstein's universe.

Tortured Parents

This excessive empiricism has consequences. For example, several months ago, at the end of a long day at the office, I was interviewed by a young couple that was considering transferring the care of their eleven-month-old son from his current pediatrician to my partner and me. The little boy looked healthy and happy, but his parents were exhausted. He was walking, saying a few words, and still being breastfed, which apparently troubled his pediatrician.

The young mother had been in the habit of breastfeeding her little guy at the end of each day, at which time he would usually fall asleep. This system had been working well, but the pediatrician claimed that it would have dire consequences. She insisted that they needed to wake the baby, after breastfeeding him to sleep, so that his teeth could be brushed—both of them.

Even if you're not a medical expert like me you can probably see why this might cause problems: breastfeeding puts the boy to sleep, which means that he needs to be awakened, which means that he needs to be put back to sleep, which generally requires more breastfeeding, and so on through the night—hence the exhausted parents. The child, however, as noted, was happy and smiling, frequently showing off both pearly whites. I'm certain, though, that he would not have looked so carefree had he understood that they soon would be discolored and badly decayed—due to dangerous night-time exposure to breast milk.

What happened here is that the doctor took one fact, viewed it as narrowly as possible, and extrapolated to a point of absurdity. A child that's given a bottle filled with, say, juice, to carry around day and night does indeed end up with dental problems. However, breasts make milk, not juice, and few babies and toddlers are strong enough to carry a breast with them at all times, owing to the fact that breasts are attached to mommy. (And while mommy may be working on getting her figure back, she's not quite there yet.) Historically, newborns breastfeed nearly constantly but they generally don't have teeth; historically, toddlers breastfeed until age three or four, but more and more intermittently as they become older, eat other foods, and get more teeth. We have a photo in our family album of my wife sitting with friends on a couch with one breast exposed. We were guests at a wedding, and the photographer was snapping pictures. Our fifteen month-old, an intermittent nurser, had just run off to play, and my wife had not realized she was gone.

I've not yet identified the most egregious error made by the aforementioned pediatrician. For more than one hundred million years baby mammals have been breastfed to sleep without any dire dental consequences, whereas toothbrushes have become widely available only quite recently. By the way, I recently saw the baby in question for his one-year well-child exam. His parents are rested and he now has four shiny white teeth.

Evolution Is Why

You might think that advice as bad as the foregoing is a fluke. The anecdote illustrates narrow-mindedness well enough, but it applies to only one child, and it indicts only one doctor. Unfortunately it's not a fluke. Untoward outcomes can be expected to occur with regularity when advice or treatment that is meant to guide or modify traits and behaviors is given without considering their history, which, foremost, requires knowing something about why the traits and behaviors exist in the first place.

Imagine taking your car to a mechanic who doesn't understand what it's been designed to do. He knows the names of most of the components, and has some understanding of how they fit together, but he can't fathom, or doesn't try to fathom, why the car has a backseat and a little engine. Your goal is to get the kids to soccer practice, whereas he's a fan of NASCAR. Is it any wonder that you'll probably not be happy with his work? What happened to the back seat, you'll ask, and why won't the car turn to the right?

With respect to asking and answering questions about why certain traits and behaviors exist and have the characteristics that they do, there are no scientific alternatives to evolutionary theory. It is an extraordinarily well-supported theory, and denying that life has a three billion year evolutionary history is no more tenable than denying that the earth is round. The most general theme of this book, concisely stated (I might add), is that physicians who ignore evolution can't avoid being myopic. Just as it would be for an explorer who clings to the notion that the earth is flat, doctors see the local landscape with some clarity, but in the distance the horizon is a blur, and beyond it is an abyss.

Grandmothers By Design

Consider menopause (a topic central to pediatrics, due to its historical relationship to child care). Doctors have long suspected that women over fifty are deficient in the hormones estrogen and progesterone, and, as an exacerbation of this silliness, they have concluded that being deficient in these hormones is bad. In one way, this surprises me because until recently 'normal values' for blood chemistries, cell counts, and the like, have been derived from blood taken from adult men. Thus, a consistent use of this approach would have led to the conclusion that women, by age fifty, finally are becoming normal (like men). However, as I've implied, this was not the mainstream conclusion. Perhaps the doctors in charge of drawing conclusions—middle-aged men—had middle-aged wives, which might have made it difficult for them to equate menopause with normalcy. Whatever the reason, the medical establishment long ago decided that older women are hormonally abnormal.

When doctors detect an 'abnormality,' they are quick to intervene, and therefore funds were soon granted to remove ovaries from a lot of rats—so as to see what happens when the hormones that were once produced by the now missing ovaries are either replaced or not replaced. It would have been better if rats underwent menopause on their own, but they don't, so their ovaries had to go.

I'm not one to suggest that these experiments were useless—in fact I'm certain they advanced the careers of the individuals who conducted them—however, in retrospect, it almost seems as though we should have known that the design of rats has been fine-tuned by millions of years of evolution by natural selection, such that specific hormones, at specific levels, at specific times of life are critical to health and function. But that's just my opinion, and it's important to remember that I've missed more than a few multiple-choice exam questions.

After years of this type of experimentation on rats, in was deemed OK to begin experimenting on women. Researchers soon recognized that women in their twenties and thirties who had lost their ovaries for whatever reason, hysterectomies and the like, tended to prosper under hormone replacement therapy (HRT). This, in turn, seemed to fit well with other findings, including data showing that women's risk of developing heart disease approaches that of men only after menopause has left them 'deficient' in ovarian hormones, particularly estrogen. It short, it was beginning to look like estrogen might be a panacea, at least with respect to heart disease.

Eventually, it was judged that there was enough science (and by science I mean evidence considered piecemeal without reference to a unifying theory) to begin offering HRT to virtually all women over fifty. At first the results seemed promising. There were fewer hot flashes, stronger bones, and less emotional lability; also, although HRT appeared to increase the risk of some cancers, the preliminary indication was that overall mortality rates declined under HRT, probably due to the heart-protecting effects of estrogen.

Unfortunately, these early results proved to be misleading. As it turns out, HRT is no longer recommended as much as it once was, owing to the fact that the overwhelming burden of evidence indicates that it increases a postmenopausal woman's chance of getting cancer *and* of dying from a heart attack. It almost seems, if we can be allowed to speculate, as though the design of women has been fine-tuned by millions of years of natural selection, such that specific hormones, at specific levels, at specific times of life are critical to proper health and function. To put that matter more bluntly, menopause is almost certainly an ancient human adaptation. Mess with an adaptation, especially one that involves hormones that have wide-ranging effects throughout the body, and the chances are good that you'll be saying "oops" to a lot of patients.

But let's digress for a moment. I know that many doctors will be confused by what I've just written because I know from experience how they usually react when told that menopause has the hallmarks of an adaptation. They roll their eyes, walk away, and if drinks are being served, that's where they head. A few, however, are thoughtful, in spite of their extensive training, and proceed to deduce that menopause can't be an adaptation: they claim that until recently women didn't live long enough to experience it, which if true would imply that the hormonal profiles of older women have been outside the purview of natural selection.

I once had my anthropologist credentials challenged by a physician who chastised me for apparently not knowing that the life expectancy of Neanderthals was on the order of only 20 years. This hurt. My grasp of complicated statistical concepts such as 'life expectancy at birth' is admittedly minimal, but I'm nevertheless pretty confident that having a low life expectancy at birth, even one as low as twenty years, does not necessarily mean that no one survives past age 50. There are many species of pelagic fish, for example, in which some individuals live to very ripe old ages, and yet their life expectancy at birth is less than a year. This is because small fry, in almost all species of fishes, tend to have very high rates of mortality; average-in a bunch of individuals that only live a few days, and you get a very low life expectancy at birth, even though a lucky few, the ones that eventually go on to reproduce, can live for decades.

Among the Ache', Paraguayan hunter-gathers whose demography has been extensively studied by the anthropologists Kim Hill, Magdi Hurtado, and Hilly Kaplan, the life expectancy of women that have made it to age 20 is more than 50 additional years. This means that the majority of Ache' women who survive to reproductive age go on to experience menopause, and then live an additional 20 or 30 years. During this post-fertile span of life, Ache' women continue to effectively reproduce, but do so indirectly, by helping relatives such as their children and grandchildren. Essentially the same is true of the Hadza of East Africa, and my own work among atoll dwellers in Micronesia (the Ifaluk) also has demonstrated the reproductive usefulness of grandmothers.

What these findings imply with respect to HRT is that natural selection, probably over at least the duration of the Pleistocene, has had opportunity to mold the metabolism of older women to work optimally in a low estrogen environment. It therefore is not too surprising to find that problems arise when 60 and 70 year-old bodies are exposed to a lot of extra estrogen (i.e., extra compared not to 20 year-olds but to 60 and 70 years-olds over thousands of past generations). And replacing the hormones of thousands of ovarectomized rats, with good results, does nothing to challenge this inductive hypothesis. If doctors got around a little more—I suggest a cruise to the Galapagos—they would have been appropriately charier about the widespread use of HRT.

Perhaps it is important to emphasize that nothing in the above argument entirely precludes the possibility that tweaking human hormones at various ages can improve health. However, anyone who thinks that adjustments are generally needed, and that it will be easy to improve matters by adding a bit of this or a bit of that, must confront the question of why natural selection has not already done so. I will give a fuller discussion of the likely adaptive value of menopause in chapter 12.

It's Not Rocket Science

Astute readers may have noticed that I've not yet had much to say about the details of Darwinian theory. This is because Darwin's most important insight does not generally require much elaboration. It is, as I've alluded, that natural selection produces good design. The late Stephen Jay Gould said, good design by "an engineer's criterion," implying, since engineers generally produce things that work, that good designs are functional. And I should also note that to a Darwinist functionality occurs along a continuum. For example, our internal organs each have local jobs, but they ultimately are meant to work in concert to promote survival and reproduction. Thus, in a sense, all body parts are reproductive parts, which is yet another reason to keep a close watch over your teenage children.

Recognizing functional designs—i.e., adaptations—is often, but not always, straightforward. I can easily recognize, for example, that the whiteness of polar bear fur is an adaptation, but what about the redness of blood? The answer hinges on two questions. (1) Does blood's redness stem from a structure or process that due to its complexity could not have been generated by random forces alone, and therefore must have been fashioned by natural selection? Here the answer is yes—blood is red because the complex, highly designed entity known as hemoglobin absorbs all wavelengths of visible light except red. (2) Does blood's redness have a function? Here the answer is almost certainly no, implying that color in this case is epiphenomenal.

We can apply these same two questions to any component of phenotype, including the signs and symptoms that accompany illness or injury. Chapter 2, for example, looks at the design and functionality of pain and swelling in the context of a twisted ankle, and concludes that both are adaptations. Most doctors and sports trainers attack pain and swelling relentlessly, suggesting either that they know something that I don't, or, more likely, that they have failed to consider these responses to injury in the context that I have just outlined.

Demarcating adaptations by distinguishing them from epiphenomena is fundamental to evolutionary biology, and the anthropologist Donald Symons has graphically described this process as "carving nature at a joint." Doctors, as we shall see throughout this book, are not very good at carving nature at a joint (notwithstanding their prodigious surgical skills), largely because they don't recognize its importance.

Another difficulty inherent in an approach that seeks to identify and describe adaptations is that functional design sometimes occurs at conflicting levels of organization, such as when a once dutiful liver cell evolves adaptations that improve its own reproductive prospects at the expense of the individual in which it resides. Cancer, problems during pregnancy such as gestational diabetes, and even some aspects of child rearing, hinge on understanding conflicting levels of adaptive design. These specific topics are addressed in chapters 13 and 17.

Finally, there is the problem of identifying functional design in human thought and behavior—which I discuss in detail in chapters 5 and 6. Our mental machinations and the actions that result affect virtually all aspects of our health and happiness, and it therefore is not an exaggeration to claim that understanding why we think and behave as we do should be more important to healthcare providers than anything else—and under the mantle, 'anything else,' I include even the Krebs cycle.