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Evolution in Real Time

I work in a borderland between social science and medicine, and I therefore often find myself trying to reconcile conflicting facts and perspectives about human biology and behavior. There are fellow travelers at this border, of course, heading in both directions, or just dawdling, but the border is both sparsely populated and chaotic. The border is also, strangely, well patrolled, and it is often quite hard to get authorities on both sides to coordinate activities. Once in a while, however, I find that my passport (never quite in order, according to officials) has acquired a new visa. This past year, I acquired the conviction that human evolution may proceed much faster than I had thought, and that humans themselves may be responsible.

In short, I have changed my mind about how people come to embody the social world around them. I once thought we internalized cultural factors by forming memories, acquiring language, or bearing emotional and physical marks (of poverty, of conquest). I thought this was the limit of the ways in which our bodies were shaped by our social environment. In particu-

like the staccato *plunk* of a customs agent stamping my documents and waving me on. The paper showed that the human genome may have been changing at an accelerating rate over the past eighty thousand years, and that this change may be in response not only to population growth and adaptation to new environments but also to cultural developments that have made it possible for humans to sustain such population growth or survive in such environments.

Our biology and our culture have always been in conversation of course, just not (I had thought) on the genetic level. For example, rising socioeconomic status with industrial development results in people becoming taller (a biological effect of a cultural development) and taller people require changes in architecture (a cultural effect of a biological development). Anyone who has ever marveled at the small size of beds in colonial-era houses knows this firsthand. Similarly, an epidemic may induce large-scale social changes, modifying kinship systems or political power. But genetic change over short time periods? Yes.

Why does this matter? Because it is hard to know where this would stop. There may be genetic variants that favor survival in cities, that favor saving for retirement, that favor consumption of alcohol, that favor a preference for complicated social networks. There may be genetic variants (based on altruistic genes that are a part of our hominid heritage) that favor living in a democratic society, others that favor living among computers, still others that favor certain kinds of visual perception (maybe we are all more myopic as a result of Medieval lens grinders). Modern cultural forms may favor some traits over others. Maybe even the more complex world we live in nowadays really is making us smarter.

This has been very difficult for me to accept, because, unfortunately, this also means that it may be the case that particular ways of living create advantages for some but not all members of our species. Certain groups may acquire (admittedly, over centu-

lar, I thought our genes were historically immutable and that it was not possible to imagine a conversation between culture and genetics. I thought we as a species evolved over time frames far too long to be influenced by human actions.

I now think this is wrong, and that the alternative—that we are evolving in real time, under the pressure of discernible social and historical forces—is true. Rather than a monologue of genetics or a soliloquy of culture, there is a dialectic between genetics and culture.

Evidence has been mounting for a decade. The best example so far is the evolution of lactose tolerance in adults. The ability of adults to digest lactose (a sugar in milk) confers evolutionary advantages only when a stable supply of milk is available, such as after milk-producing animals (sheep, cattle, goats) have been domesticated. The advantages are several, ranging from a source of valuable calories to a source of necessary hydration during times of water shortage or spoilage. Amazingly, just over the last three thousand to nine thousand years there have been several adaptive mutations in widely separated populations in Africa and Europe, all conferring the ability to digest lactose (as shown by Sarah Tishkoff and others). These mutations are principally seen in populations that are herders, and not in nearby populations that have retained a hunter-gatherer lifestyle. This trait is sufficiently advantageous that those with the trait have many more descendants than those without.

A similar story can be told about mutations that have arisen in the relatively recent historical past that confer ability to survive epidemic diseases, such as typhoid. Since these diseases were made more likely when the density of human settlements increased and far-flung trade became possible, here we have another example of how culture may affect our genes.

But this past year, a paper by John Hawks and colleagues in the *Proceedings of the National Academy of Sciences* functioned

ries) certain advantages, and there might be positive or negative feedback loops between genetics and culture. Maybe some of us really are better able to cope with modernity than others. The idea that what we choose to do with our world modifies what kind of offspring we have is as amazing as it is troubling.