

THE 10,000 YEAR EXPLOSION

HOW CIVILIZATION
ACCELERATED HUMAN EVOLUTION

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TO OUR FAMILIES

went in search of him, *he* died of fever before getting far. We presume you've heard of Dr. Livingston—Dr. David Livingston, that is, the nineteenth-century British medical missionary to central Africa. His wife died of malaria during their travels, and the doctor himself later died of malaria and dysentery. John Speke and Sir Richard Francis Burton, nineteenth-century British explorers, sought and eventually found the sources of the Nile—but both men fell ill of tropical diseases. Speke suffered greatly when a beetle crawled into his ear. He removed it with a knife, but he became temporarily deaf and later temporarily blind. Consider that these are the famous explorers, the ones who enjoyed some degree of success. What happened to the unlucky ones?

Europeans had a vast technological edge over most of the inhabitants of sub-Saharan Africa. In most ways (except for their use of iron tools), African technology and social organization were simpler than that of the Amerindians—at any rate simpler than the Andean and Mesoamerican civilizations. (Here we're speaking of the inhabitants of what has been called the "isolated zone," areas that had not been much influenced by Islamic civilization—especially west, central, and southern Africa.) Literacy, the wheel, sailing ships, and guns gave the Europeans a huge military advantage, but nothing came of it for hundreds of years, except in the far south, where a temperate climate allowed Dutch colonization.

In the 1800s, quinine became widely available, and that allowed Europeans to venture into interior Africa with moderate success, since falciparum malaria had been the deadliest of many African diseases. Later scientific advances controlled or eliminated a number of other local diseases, including yellow fever

and sleeping sickness. This made possible the "scramble for Africa," in which European countries ranging from Great Britain to Italy conquered almost the entire continent. In these efforts, European military technology was a trump card. As Hilaire Belloc wrote in a poem, "Whatever happens / We have got / The Maxim gun / And they have not."

But Africa did not become another America: Africans were not displaced by Europeans. In order for limited numbers of colonists to become the predominant population, the locals must die off, and Africans didn't. Powerful tropical diseases, combined with the local biological defenses (evolved at vast cost), kept Africa African. As in the case of the Columbian expansion, recent human evolution played a key role in determining the victors.

THE COWBOYS

The genetic advantages in the two examples we have just discussed—for the Europeans in America and for the Africans in Africa—were huge: Those lacking the required resistance to the infectious diseases in play were almost wiped out. There is no reason to think that differences in disease resistance were the only biological differences between Europeans and Amerindians, or the only advantage, but they must have had the largest impact. European colonization could not have prevailed without a huge edge. Africans, too, may have needed a large biological advantage to resist Europeans, considering their technological and social disadvantages. Although we can't be sure, it looks as if anatomically modern humans also needed a fairly large advantage during the Upper Paleolithic as they displaced the Neanderthals, since they had to outcompete populations of

archaic humans that must have been better adapted to Eurasian climates than they were.

And yet, there must have been occasions in which smaller biological advantages were enough to drive a population expansion, particularly when those expanding didn't have to cross oceans. Again, we're not saying that *all* expansions had such causes, but some could have, and the enduring nature of biological advantage makes it a good candidate for the cause of particularly widespread and long-winded expansions.

One of the largest of all known expansions—the spread of the Indo-Europeans—was likely driven by the mutation that conferred lactose tolerance, one of the most strongly selected alleles that Europeans possess.

“Indo-European” refers to a family of related languages that have spread over western Eurasia, the Americas, and Australasia. In terms of numbers, it is the largest of all language families, with about 3 billion native speakers, half of the human race. The largest Indo-European languages are Spanish, English, Hindi, Portuguese, Bengali, Russian, German, Marathi, and French.

In these languages, basic words in a number of categories are recognizably similar. In each of them, many of the words for numerals from one to ten, body parts (head, heart, and foot), plants and animals (oak, wolf, bear), natural phenomena (air, snow, moon), and close relations (father, mother, daughter) ultimately derive from a common ancestral language. For example, the word for “three” is *treis* in Greek, *tres* in Latin, *drei* in German, *tri* in Russian, *tri* in Bengali, and *tre* in Tocharian A, an extinct language of central Asia.

These languages were first acknowledged as a family when various Europeans in India noted similarities between Indian

languages and European languages, particularly in regard to their connections with Latin and Greek. It was then suggested that a wide swath of languages in Europe and India had a common origin, just as it had long been recognized that the Romance languages (Spanish, Portuguese, French, Italian, and Romanian) derived from Latin. Most of those early observations were not followed up, but after Sir William Jones, an eminent scholar and chief justice of India, mentioned the pattern in a lecture on Indian culture in 1786, people began to take the idea seriously. Many people studied Indo-European language over the next two centuries, and today it is the most successful theory in historical linguistics.

People of many races and ethnic groups speak an Indo-European tongue: There is nothing genetic about that. Chinese pilots talk to Japanese air-traffic controllers in English, for that matter. But there is every reason to believe that the ancestor of all of these languages was once spoken by a particular people, living in some particular region. They were relatively few in number, and the region they occupied was small compared to the lands inhabited by Indo-European speakers today. There were many other small ethnolinguistic groups in Eurasia in those days, but this group spread, while others did not. Perhaps there was something unusual about them.

THE PROTO-INDO-EUROPEANS

What we know about the Proto-Indo-Europeans, as we call this group, is mostly derived from comparative linguistics, supplemented by archaeology.¹⁵ We know that they were stock-raisers and grain farmers, probably depending more on their

animals than on grain. They raised cattle and sheep, along with goats and pigs. The cow played a paramount role, both in daily life and in religion. They had domesticated the horse, and in fact may have been the first to do so.

The Proto-Indo-Europeans knew copper, and probably bronze, but not iron. They used silver and possibly gold. They had wheeled vehicles, probably carts pulled by oxen. Woolen textiles were produced by weaving. They made and drank mead.

Their system was patriarchal, with clans tracing descent through the male line. They were warlike, constantly raiding for cattle and revenge. They probably had egalitarian warrior brotherhoods made up of single young men, with difficult initiation rites. Those warriors sometimes acted as berserkers in battle, probably had a wolf as a totem, and often were not quite kept under control by older and wiser heads.

Proto-Indo-European society as a whole was divided into three orders: a clerical class that administered the sacrificial rites of a polytheistic religion, a warrior class, and herder-cultivators. This division of society shows up in far-flung parts of the Indo-European dispersal: Ancient India has *brahmanas*, *ksatriyas*, and *vaisyas*, while Rome had *flamines*, *milites*, and *quirites*. French linguist George Dumézil and others have argued that this “tripartition” plays a key role in the religion and mythology of the Indo-European peoples, as when Herodotus tells how the kingship of the Scythians was awarded to one of three brothers who could pick up a burning cup, an axe, and a plow with a yoke. The three orders were color-coded. Priests wore white, warriors wore red, and the common people were symbolized by blue or black.

The Indo-Europeans practiced epic poetry, a form that used stock phrases, some of which show up in poetry that has been

preserved to the present day, such as the *Iliad* or the *Rig Veda*. When someone refers to “driving cattle,” or “undying fame,” or “immortal gods,” they are not being very original. Some of the Proto-Indo-European myths seem to have involved a world-tree or a hero slaying a dragon.

What we *don't* know, at least with any precision, is when and where the Proto-Indo-Europeans lived. Comparative linguistics offers a few hints about the time in which they still lived as one people (and had not yet begun to spread out) through the identification of technologies they had or didn't have. The overall level of technology (for example, bronze but no iron) suggests that dispersal began in the early Bronze Age, perhaps around 3000 BC. It had definitely begun by 2500 BC, since a settled Indo-European state (the Hittite Empire) shows up in the historical record a few hundred years later. We also see other Indo-European languages, such as Luwian and Palaic, in areas adjacent to the Hittite homeland in central Turkey: They are clearly related to Hittite, but must have been differentiating for some time (several centuries, at least) before they appeared in the historical record.

It's fair to say that the problem of the location of the Indo-European homeland, called “the Urheimat” (German for “original homeland”), has been a subject of controversy—indeed, the question has had a tendency to drive men mad. Various fruit-cakes have suggested Tibet, North Africa, the shores of the Pacific, and the North Pole. There's a distinct tendency for scholars to place the wellspring of the European peoples somewhere in their own backyard. So far, thank God, we haven't seen any American linguists try that.

The two most popular theories regarding Urheimat locations place it either in Anatolia (modern Turkey) or the grasslands of

southern Russia. Anatolia is the origin in the British archaeologist and linguist Colin Renfrew's model: His idea is that the Indo-European languages were carried along by an expansion of early farmers out of the Middle East around 7000 BC. There certainly *was* such an expansion: There is plenty of archeological and genetic evidence for it. The question is whether that expansion spread Indo-European languages.¹⁶

That idea is powerful because of the great population expansion associated with farming; numbers usually bring the victory. The idea is even more powerful than Renfrew suggested, in fact, because those Anatolian farmers had already been farming for millennia when they began to expand into the Balkans. As early adopters, they must have already been somewhat better adapted to the agricultural way of life than the native Europeans, and so they almost certainly had biological strengths that Europeans could not duplicate through observation and learned behavior.

Unfortunately, Renfrew's theory also has many fatal weaknesses. Linguistic paleontology supports a far later common origin than would be possible if the Proto-Indo Europeans were part of that Middle East expansion to the northwest into Europe. For example, there are several words referring to wheeled vehicles that are shared among Indo-European languages, but wheeled vehicles simply don't go back as far as 7000 BC. Hittite shows clear signs of a strong non-Indo-European substratum, as if Hittite invaders imposed their language on some other group that was already present in Anatolia. This can't make sense for the zone of origin. Uralic languages (the language family containing Finnish and Hungarian) appear to have had extensive contact with early Indo-European, and they may share a common

ancestry. Since the Finnish peoples lived in the forest zone of what is now Russia, this suggests that the Indo-Europeans did not originate in the Middle East.

The second, more popular explanation is the Kurgan hypothesis, originated by Marija Gimbutas. In the 1950s she identified the Kurgan people of the Pontic-Caspian steppe (the grasslands between the Black Sea and the Caspian Sea) as the Proto-Indo-Europeans. If she is correct, they were a pastoral people who went through a series of expansions, which probably took the form of military conquests. Gimbutas thought they were mounted warriors and that their advantage stemmed from their early domestication of the horse. The problem is that there is no evidence at all of mounted warriors in this time period: indeed, not for at least another 2,000 years. The earliest horse-drawn chariots also appear far too late to explain Indo-European military expansion. Moreover, there is reason to believe that the winners in military conquests usually set themselves up as a dominant elite rather than wiping out those they conquered.

There is also a strain of thought that argues that Indo-European expansion was gradual and peaceful, in definite contrast to the way in which humans act today and have acted over the course of recorded history. Perhaps Gimbutas was correct in identifying the Kurgans as the Proto-Indo-Europeans, but had their *modus operandi* all wrong.

MILK AND THE KURGANS

Improved variants of the Kurgan hypothesis fit many facts, but what they don't do is explain *why* the Proto-Indo-Europeans expanded at the expense of neighboring peoples with similar

technology. Effective use of the horse in warfare doesn't seem to have occurred early enough to explain Proto-Indo-European expansion—but even if it had, what would have stopped other peoples from rapidly acquiring horses and using them in the same way? The Plains Indians certainly managed to master light cavalry warfare in short order: Why couldn't non-Indo-European peoples have done the same?

Later empires succeeded in part thanks to a snowball effect: The larger they grew, the stronger they were, until they were stopped by geographic barriers or long lines of communication. Once the Romans unified Italy, they were hard to stop. But as far as we can tell, nothing like this happened in the Indo-European expansion. It was too early for that kind of imperial organization. There was no central command, no capital, no state. If a peripheral Indo-European tribe had a dustup with neighboring non-Indo-Europeans, it had to win on its own, more or less. At most they had local allies. In order to expand as much as they did, early Indo-Europeans must have had some kind of edge, and in order to expand again and again over millennia, they had to have an edge that was hard to copy.

To solve the mystery, let's start with what we know about the Proto-Indo-Europeans from the linguistic evidence. We know that the Indo-Europeans weren't especially skilled at grain agriculture or adapted to it, since they were primarily pastoralists. They were removed from the first centers of farming in the Middle East. We also know that the Proto-Indo-Europeans were rather backward in the realms of technology and social complexity. Sumerians invented the wheel, writing, and arithmetic and had cities and extensive irrigation systems at a time when the Proto-Indo-Europeans had, at most, domesticated the horse.

We suggest that the advantage driving those Indo-European expansions was biological—a high frequency of the European lactose-tolerance mutation (the 13910-T allele). The usual story about lactose tolerance is that it's the result of a cultural innovation, the domestication of cattle. That innovation led to selection for a new mutation that extended lactase production into adulthood. But there's more to the story.

Initially, selection favored individual carriers of the lactose-tolerance mutation, but the mutation was rare and had little social effect. Cattle were used for plowing and pulling wagons, for their beef, and as a source of secondary products like leather and tallow. But when the lactase-persistence allele became common, so that a majority of the adult population could drink milk, a new kind of pastoralism became possible, one in which people kept cattle primarily for their milk rather than for their flesh. This change is very significant, because dairying is much more efficient than raising cattle for slaughter: It produces about five times as many calories per acre.¹⁷ Dairying pastoralists produce more high-quality food on the same amount of land than nondairy pastoralists, so higher frequencies of lactose tolerance among Indo-Europeans would have caused the carrying capacity of the land to increase—for them.

Standard ecological theory indicates that when two similar populations use the same resources, the one with the greater carrying capacity always wins. In more familiar terms, the Proto-Indo-Europeans in our scenario could raise and feed more warriors on the same amount of land—and that is a recipe for expansion. The same basic idea is behind theories of the expansion of farming through local population growth (called *demic expansion*): Farming produces more food per acre, therefore

farmers will outnumber foragers, and so farmers will expand at the expense of foragers.

Proto-Indo-Europeans probably were most competitive in areas where grain agriculture was marginal. In the steppe, the problem was limited rainfall. Since raising cattle there had been competitive with grain farming even before dairying arose, milk-drinking Indo-Europeans would have had an absolute advantage and should have spread rapidly over the steppe. In much of northern Europe, shorter growing seasons must have interfered with production of cereal crops such as wheat, particularly when agriculture was new there, as those crops had had little time to adapt to the local climate. Eventually, other cereal crops, such as oats and rye that could do well in those climates, were developed—probably by accident, starting as weeds in wheat or barley fields. But that happened in the Bronze Age, long after the introduction of farming. Dairying may have been more productive than grain farming in northern Europe during the late Neolithic. Even if it was not, it may have been close enough to let other advantages of that pastoral way of life tip the scales. It seems clear that the Proto-Indo-European form of pastoralism did have other advantages in intergroup competition.

As the Proto-Indo-Europeans became dairymen, they should have come to rely more and more on their cattle and less on grain farming. As that happened, they would have become mobile, which is a military advantage, especially against farmers. Farmers have homes and villages that they must defend, whereas pastoralists can fight at a time and place of their choosing. Herodotus tells us how Darius, the head of the Persian Empire, decided to invade the Russian grasslands in 512 BC, then held by the Scythians. Scythians were a people whose way of life was probably similar to that of the Proto-Indo-Europeans,

but further developed in that they had fully mastered the horse. They appear to have been milk drinkers early on: In fact, this is mentioned in the *Iliad*.¹⁸

When Darius invaded, the Scythians kept retreating farther and farther into the sea of grass: They had no cities or fields and thus had nothing to lose by retreating. Darius eventually realized that his expedition had been fruitless and turned back before his army ran out of supplies.¹⁹

Darius at least had a powerful state and a powerful army: He could cope with Scythian invasions, even if he couldn't conquer Scythia. Back in the early days of their expansion, the Indo-Europeans appear to have encountered farmers in the Balkans who had been farming since about 6000 BC, but who weren't under a powerful central government. Around 4200 BC, things went sour. Ancient village sites were abandoned, advanced work in metals and ceramics became rare, and the inhabitants shifted to easily defended sites such as caves, hilltops, and islands. We find an increasing number of Kurgan burials similar to those found earlier on the steppe. (Interestingly, the bodies in those Kurgan burials averaged almost four inches taller than the earlier peoples of the region—milk does a body good.)

We suspect that pre-state farmers had a lot of trouble with invading Indo-European pastoralists. It wasn't just that dairying was productive and conferred increased mobility. It made cattle very valuable, and cattle are far easier to steal than heaps of grain: They can walk. It looks as if the early Indo-Europeans spent a lot of time rustling each other's cattle, fighting over cattle, planning revenge for previous raids, and in general raising hell. They became a warrior society. That general tendency of pastoral society—a gift for causing trouble—was a key theme in

Eurasian history for millennia. The threat receded as agricultural peoples built strong states, intensified again in the Middle Ages as states weakened and steppe techniques improved (reaching an apogee with Genghis Khan), and ended only with the invention of gunpowder.

Our picture of the Indo-European expansion begins with a very rapid spread across the steppe as soon as the increased frequency of the lactase-persistence mutation became common enough to allow the switch to a dairying economy. This rapid spread would have resulted in a population that spoke similar dialects over a wide region all the way from the Ukraine to the Urals—similar because there hadn't been time for linguistic divergence. The wave of advance continued on into Europe, where dairying was ecologically competitive with early agriculture and produced a far more aggressive culture. Most likely, Indo-European culture also became more warlike as their mobility, superior numbers, and better nutrition allowed them to win battles more often than other peoples. Their victories, in turn, may have led to further advantages in military efficiency: Success feeds success.

Judging from their relatively low contribution to the European gene pool, Indo-Europeans appear to have practiced elite dominance, conquering rather than exterminating and replacing the previous inhabitants. A relatively small elite population can often impose its language on the rest of the population. In addition, the Indo-Europeans would have added the lactose-tolerance allele to the local mix. Although it appears to have been rare or nonexistent in Europe before the Indo-European invasions, it became common in those areas where a dairying economy was favored, particularly in northern Europe.²⁰ Indo-

European languages and culture spread past those regions in which dairying was favored—for example, into southern Europe and Iran—but strong states probably limited their expansion into the Middle East.

As much as anything, those peripheral expansions were probably driven by what might be called historical momentum: Peoples with a long record of success in war and raiding kept expanding even in areas where they had no special ecological advantages. Something similar happened when the Indo-Aryans moved into India: Internal weaknesses, possibly even collapse, of the Indus civilization may have allowed that expansion to occur. Today the LCT 13910-T lactase variant has reached almost 100 percent frequency in some parts of northern Europe; it is common in northern India and can even be found at low levels among some pastoral peoples of sub-Saharan Africa, such as the Fulani and Hausa.

Moreover, there is reason to think that this historical phenomenon has happened at least three times. Cattle herders of East Africa in the region of the Upper Nile and further south are lactase-tolerant milk drinkers due to a younger mutation of their own.²¹ They, too, have expanded: They have become warlike, and there are fascinating parallels between their religions and social structure and those of the ancestral Indo-Europeans.²² Another separate pair of mutations causing lactose tolerance happened in the Arabian peninsula, driven in this case by the domestication of camels. This may have been an important cause of the explosive growth of Islam and the Arab conquests of the seventh century AD and later.²³

If this picture is correct, the occurrence of a single mutation in a particular group of pastoralists some 8,000 years ago

eventually determined the spoken language of half of mankind. It may not be possible to reconcile this with Tolstoy's ideas of the unimportance of the individual in history. Of course, champions of individual importance have typically emphasized ideas, intelligence, and character—not digestion.

7

MEDIEVAL EVOLUTION: HOW THE ASHKENAZI JEWS GOT THEIR SMARTS

The Ashkenazi Jews—the Jews of Europe—began as a distinct community about 1,200 years ago along the Rhine. The word “Ashkenaz” was the Hebrew name for Germany, so the Ashkenazim are literally “German Jews,” although they later came to inhabit other areas, particularly Poland.

Today the Ashkenazi Jews, some 11 million strong, live throughout the world, with the largest concentrations in Israel and the United States. There are many other Jewish communities—such as the Sephardic Jews who once lived in Spain, the Mizrahi Jews of the Middle East and North Africa, and the Bene Israel of India—but the vast majority of the world's Jews are Ashkenazi.