The Grandmother Effect

PERHAPS THE SECRET TO SUCCESS

A strange thing happened to primates about two million years ago. After being fairly successful for a few million years as mostly ground-dwelling apes, one lineage—the hominins (modern humans and all our closest extinct ancestors)—started to change in several important ways. Over thousands of years their bodies and brains grew larger, and they began foraging greater distances and making use of a wider range of plants and animals. A bigger brain, larger overall size, and greater foraging range cost them nutritionally. And yet, paradoxically, even as their need for food grew, their teeth and chewing muscles became smaller and their intestinal tract grew shorter and more compact. They started the extraordinary practice of fracturing certain kinds of rock to make simple stone tools with sharp, cutting edges, capable of slicing through the muscles of prey animals. All these changes developed slowly over many hundreds of thousands of years.

It has taken more than a century of research for archaeologists' ideas about this period of change to come together, and new pieces of evidence have been emerging more rapidly in the last several decades. Even so, paleoanthropologists are still working to piece together this puzzle and find explanations for what exactly went on during this crucial era in the human story.

RESEARCHERS FIRST BEGAN to find evidence for these larger-brained ancestors in the early twentieth century. In 1924, the anatomist Raymond Dart (1893–1988), working at the University of the Witwatersrand in South Africa, found evidence of the first australopithecine, *Australopithicus africanus*. Some workers had come across a large quantity of bones in a limestone deposit and shipped some specimens to the university. Dart recognized some of the bones as ape-like, but with brains too large to be chimps or baboons. The news was discounted as anomalous by some in the scientific establishment because at the time most researchers thought modern humans had first evolved in Europe or Asia. But as more fossils were found, the case for an African origin of our lineage gathered support. One fossil that Dart found was of a three– to four–year–old hominin that came to be known as the "Taung Child."

After discovering this australopithecine Taung Child, Dart and several other researchers found other kinds of more modern apes in southern and eastern Africa. Through the 1930s and 1940s, they began to devise a rather

ABOVE Grandmother and grandson—lin2867 from Pixabay

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extreme theory for the phase of human evolution linking *Australopithecines* with *Homo erectus*. They argued the more modern apes had developed a way of life based on meat-eating. The larger brains, smaller teeth, and smaller gut, they argued, was the result of adding a lot of meat to their diet, much more than earlier apes had eaten.

But evidence accumulated, casting doubt on the meat-eating theory. The same sites that Dart studied were found not to be full of the food remains of hominins, but rather the accumulation of prey by large carnivores, such as hyenas, big cats, and even eagles.

Evidence also began to accumulate showing that plants made up a much larger part of our ancestors' diets. Members of the genus *Homo* ate less of the foliage of plants than earlier apes but more of the seeds, fruits, and roots, even if these parts required more processing. The roots became especially important because they are often the most nutrient– and energy-dense parts of plants. Although roots, such as yams (*Dioscorea spp.*), yam beans (*Sphenostylis stenocarpa*), and other fleshy tubers contain a lot of a plant's nutritional energy, they are tough to digest when raw; it is easier for our guts to make use of them if they are cooked, or at least pulverized or ground up.

The control of fire helped in cooking both roots and meat. Not only does cooking improve the digestibility of food and transform it so its nutrients can be absorbed, it kills some of the parasites and microorganisms that cause sickness. The evidence now suggests that the habitual use of fire began sometime between 1.8 million and 500,000 years ago, but it is debated when people became adept at using fire routinely.

Another development since the time of Dart's research is that careful study did not show a substantial increase in the amount of faunal remains after the transition to larger-brained hominins. A large 2022 study of fifty-nine archaeological collections concluded, "Our analysis shows no sustained increase in the relative amount of evidence for carnivory after the appearance of *H. erectus*." The question is far from settled, however, and is made more complex by the fact that our ancestors were clearly scavenging from carcasses that other predators had killed, as well as hunting themselves.

To be sure, our ancestors did eat meat, and sometimes a lot of it. People living traditional lifestyles in the Arctic sometimes were getting close to 90 percent of their calories from animals, but this was far from typical. Most Paleolithic diets included more than half plant-based foods, with animal foods providing 10–40 percent of daily calories. Nevertheless, the number of books advocating a "paleo," meat-based diet have increased, with around 200 published in the last twenty-five years.

THERE WERE other factors besides diet changes that have contributed to our lineage's success—factors related to the evolutionary advantage of having a larger brain. However, while larger brains helped early hominins cooperate in hunting and scavenging, and in learning to make stone tools and to process a variety of plant foods, they also caused anatomical problems. As hominins became more upright and bipedal, their pelvises became narrower, making it more difficult for infants with large heads to be born. Giving birth is more difficult and dangerous for modern human mothers than it is for other mammals, including other apes. Our children are born in a rather unfinished state, in order for them to fit through a narrower birth canal. While a baby antelope or giraffe can stand and walk within minutes of being born, humans are completely dependent on others for a very long time. They cannot walk for around a year and cannot find their own food for many years. But here arises another paradox: Despite their dependence on their mothers, human children can be weaned relatively quickly—usually within nine to eighteen months. Other primates, such as orangutans and chimpanzees, often breast feed for three to five years or more.

ALTHOUGH HOMININ BABIES are born underdeveloped and remain dependent for a longer time than other primates, they have an advantage that has become increasingly recognized as a contributor to their success—and that is the role played in childcare by grandmothers or other senior adults. The "grandmothering hypothesis," championed by University of Utah anthropologist Kristen Hawkes, posits that the care provided by senior adults allows the newborns to be weaned more quickly, and for a mother to be able to have her next child sooner. Reproducing more quickly helps a species survive and compete. It is an important factor in the evolutionary separation of humans from other large apes, who tend to reproduce more slowly.

The grandmothering hypothesis might also help explain another curious difference among humans. Women tend to live longer than men, and they tend to live many years beyond menopause. This is exceedingly rare among mammals. The only species in which females live a significant part of their lifespans after menopause are humans, killer whales (*Orsinus orca*), and a few other toothed whales (including Belugas and some pilot

Cast in three parts of the "Taung child," an Australopithecine human relative discovered in South Africa and dated to about 2.86 million years ago. Collection of the University of the Witwatersrand (Evolutionary Studies Institute), Johannesburg, South Africa—Didier Descouens/Wikimedia Commons

whales). Humans and killer whale females live the longest after they stop reproducing [see "Endpaper: The Menopause Monologues" by Caroline B. Drucker, *Natural History*, June 2015]. They are still able to help care for offspring after they are no longer reproducing. In a few other species, females also live a significant time after their reproductive years (e.g., African elephants and chimpanzees), but not as long as humans and killer whales. Humans are the real outlier, sometimes living forty years or more beyond their reproductive years. The evolutionary argument is that it arose because lineages with women who lived a long time after menopause raised more children to adults than lineages where the post-menopausal women did not live as long.

It is not surprising that children with a grandmother around have lower mortality and better health than those who do not. The "Grandmother Effect" has been widely observed in both historical and modern human societies. Some studies show a 30 percent reduction in mortality for children aged 0-5 when grandmothers are around. This benefit to grandchildren is true for killer whales, as well. For migratory whales such as killer whales, having experienced grandmothers around also helps finding food-rich feeding grounds when hunting conditions are poor.

So, was it more meat, better stone tools, more social cooperation, broader diets, or a grandmother's help that accounts for the relative success of more modern hominins? Increasingly, the answer seems to be "all of the above." We became more successful in acquiring meat, and were able to butcher it and make it more edible with stone tools. Perhaps we were not vastly better at getting meat, but enough to make a difference. And processing plant parts like roots and nuts also increased nutritional access. We came to use fire as a reliable technique in making more things edible. Finally, grandmothers helped our lineage cope with childbirth and the long period of helplessness of infants.

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