Taking the bite out of evolution—critical review of *Evolution's Bite*

Evolution's Bite: A story of teeth, diet, and human origins
Peter S. Ungar
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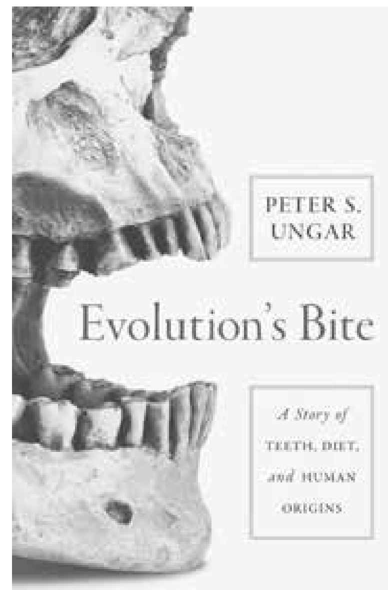

Jean O'Micks

Peter S. Ungar is a distinguished professor and director of the Environmental Dynamics Program at the University of Arkansas. He has published a couple of books on teeth, diet, and human origins. His new book, *Evolution's Bite*, follows a similar theme, describing how long-term global climate change, vegetation, food availability, dietary habits, and dental morphology all affected each other with regards to human origins.

How the structure and function of teeth affect each other

A key idea throughout the book is that since food and nutrition is necessary for organisms to keep living, the method of food acquisition and processing is also fundamental to an organism's well-being. The better an organism can acquire nutrients and energy, the more offspring it will leave behind. Teeth are 97% minerals, and are much stronger than bones, allowing them to survive over time, so are a major source of inferring dietary habits of extinct organisms. In the case of teeth, function and morphology go together largely hand in glove. Thus, carnivores such as lions have sharp teeth which can be used for tearing and slicing flesh, whereas herbivores such as cows have flat teeth for grinding leaves and plants. In the case of primates, such as monkeys and apes, teeth have a rectangular crown, with four or five cusps, crests running up and over the cusps, forming basins in between them. Food can be sheared between individual crests, while it can be crushed with cusps pressed into the basins of the opposing teeth (p. 18).

The fact that certain animals have teeth with a given morphology seemingly designed for processing a certain kind of food does not exclude them from processing other types of food, something which the author also asserts. For example, gorillas in the Central African Republic are seasonal frugivores, in that they sometimes eat fruits, even though their teeth are designed to process leaves (pp. 43–45).

Ungar describes the Cope–Osborn 'tritubercular' model of mammalian

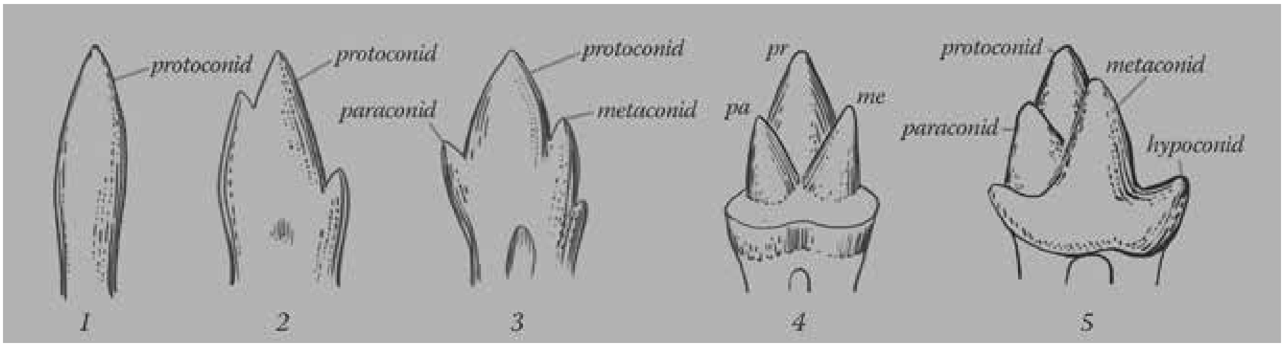

Figure 1. Supposed evolution of teeth from reptiles to mammals from the monoconodont stage to the tritubercular stage. The number of cusps on the teeth may vary from animal to animal, but the origin of the tooth itself is not addressed. (From Beddard, ref. 1.)

molar evolution. Cope and Osborn described the basic primitive tooth anatomy of the first mammals as being derived from the cone-shaped monoconodont teeth of reptiles. As different mammals adapted to different environments, newer cusps were added in different positions on the teeth (pp. 7–12). All this is fine and well, however, the model only deals with modification of a basic dental plan, but does not describe how teeth evolved in the first place. Nothing is mentioned about how dentine or enamel parts of the tooth evolved. This process is depicted in figure 1.[1]

Organisms don't live alone, however, but live together with other species vying for the same source of food. It has been widely observed that different primate species living in the same habitats each have different diets, despite access to the same food. This phenomenon is called species-specific dietary adaptation. For example, brown lemurs and ring-tailed lemurs on the island of Madagascar both eat fruits, leaves, flowers and bark, yet brown lemurs concentrate on leaves and travel a greater distance for food than the ringtails, which eat more fruits and move less, confined within the canopies of trees (p. 37).

Pages 41–47 describe the differences between the diet of mountain gorillas in the east (*Gorilla beringei*) and western lowland gorillas (*Gorilla gorilla*) in Africa. Mountain gorillas mainly eat stems, leaves, and the pith of non-woody plants, and even bamboo shoots. As such, they have big, sharp, molar teeth with long crests for shearing and slicing leaves and stems. They also have long intestines to extract as much as possible from the plants they eat. As opposed to the eastern gorillas, western lowland gorillas eat much more fruit during the rainy season, and only fall back onto eating leaves, stems, and bark during the dry season.

This is pertinent to the account of the creation of land animals in the book of Genesis: "And to every beast of the earth and to every bird of the heavens and to everything that creeps on the earth, everything that has the breath of life, I have given every green plant for food. And it was so" (Genesis 1:30). The question is often asked as to how modern-day carnivores could have eaten plants at the beginning, after creation. Just as the two gorilla species that were just mentioned, which probably belong to the same created kind, can eat two different kinds of foods (fruits versus leaves and stems), so we could consider that carnivores, such as lions could also have been created in a similar way to be able to adapt to different diets. In comparison with gorillas, chimpanzees have large incisors and small molars for husking fruits and pulping their flesh (p. 74).

Differences in tooth morphology

This is an important aspect to consider, since in chapter 3, Ungar discusses how species must adapt to a changing environment over evolutionary time. Three basic options were open to different organisms when the environment changed, thereby changing the type of foods which were available: they could either move, change (or as evolutionists claim, 'evolve'), or go extinct (p. 85).

In the case of our own species, this meant that humans evolved from tree-climbing monkeys in such a way as to be able to survive in a grassland environment, with sparsity of food and water, and with the presence of competitors and predators, also known as the savanna hypothesis of Raymond Dart. This supposedly pushed human evolution in the direction of bipedalism (freeing up their hands for tool use). Also, this came with a decrease in jaw size, in parallel with an increase in brain size, and therefore also intelligence. This allowed humans to escape predators and hunt other animals, so their teeth also changed to adapt to this new source of food (p. 66).

For example, the genus *Paranthropus* had large molars and premolars (hence the sobriquet "Nutcracker Man"), with relatively small front teeth and thick enamel, used for grinding shoots and leaves. *Australopithecus*, on the other hand, had larger front teeth, including canines, used for eating a more varied diet, including meat. The genus *Homo* had even smaller teeth in comparison to the previous two genera. It was supposed therefore that *Australopithecus* lived during a dry period, whereas *Paranthropus* and early *Homo* lived during wetter periods.

Environment, food sources, diet, and tooth morphology

Chapter 4 in the book deals with the way the environment supposedly changed during the past four and a half billion years, due to the eccentricity of the tilt and precession of Earth's axis. Furthermore, dust produced in larger quantities during dry periods affects the strength of Earth's magnetic field (since dust particles are easily magnetized). Plate tectonics also influence global climate in shaping landscapes, and altering the flow of heat, water and salt. This is important to the theme of the book, since environment affects vegetation and food sources, which in turn affect the diet and oral morphologies of mammals (figure 2). Ungar presses the well-known propaganda of the environmentalist left, that average sea and land surface temperatures are on the rise, due to pollutants, supposedly including carbon dioxide accumulating in the atmosphere (p. 89). However, carbon dioxide is not a pollutant but rather the initial building block in sugar metabolism in plants.

This is important, in that it was originally assumed that the climate in Africa had remained the same inexplicably over millions of years, due to the uniformitarian idea that the present informs the past. Due to insight gained from the study of sediment layers on the ocean floors across the world, it was clear that the climate had changed in Africa. Massive environmental upheaval could possibly be explained by the Genesis Flood, which could have also caused the Ice Age.

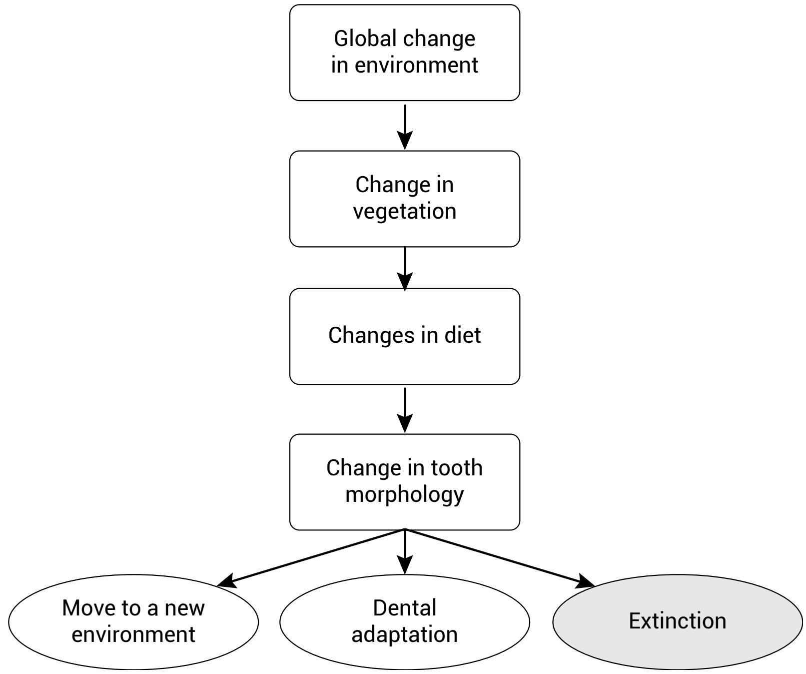

Figure 2. The process by which large-scale changes in the global environment cause changes in vegetation, causing changes to occur in available diet for mammals such as hominins. Three responses to this change are possible—relocation, dental adaptation, or extinction.

Finding and assessing 'foodprints'

Whimsically, Ungar describes foodprints in the following way: "Like footprints in the sand, foodprints give us evidence of actual activities of real animals at a moment in time in the past" (p. 114). Foodprints include scratches and pitting, caused by hard food sources such as nuts and seeds, which have to be crushed between teeth. However, dust also causes microwear on teeth and thus complicates the picture. Foodprints consist of not just microwear but also dental tartar and calculus which can inform us about the diet of a certain organism at a molecular level. Silica leached into the soil can accumulate in the cells of grass species, and can thus end up in the teeth of different species. In this amazing way, researchers can even track changes in climate.

In this way researchers also discovered that Neandertals were able to process and cook certain plant foods,[2] which implied controlled use of fire, and had knowledge of medicinal plants and herbs, which implies knowledge of plant taxonomy.[3] When viewed under the microscope, foodprints can aid in the taxonomic determination of different species. This is just a couple of ways in which Neandertals have been shown to be much more intelligent than previously imagined, virtually the same species as modern humans.[4]

Not only can microwear or dental calculus inform us about the diet of ancient primates and hominins, but also the ratio of ^{13}C to ^{12}C in their teeth as well. C_3 and C_4 plants, whose photosynthesis pathways are different, use ^{12}C and ^{13}C in different ratios, with C_4 plants using a higher ratio of ^{13}C overall. ^{13}C to ^{12}C ratios could also be influenced by the proportion of plants in a species' diet overall as well, and are also dependent on whether the species eats meat as well. This way it was found that both *Paranthropus* and *Australopithecus* had similar ratios of C_3 and C_4 plants in their diet (pp. 129–133).

Becoming human and the Neolithic revolution

According to Ungar, several differences exist between humans and other primates which make us unique. That is, we humans walk on two legs, carry and use tools, communicate with one another and can exchange information about the past and future, share and trade food, and hunt—even animals which are larger than us, and maintain a home base, or central place where food is brought to (p. 147).

Based on extant societies of hunter-gatherers still in existence in some parts of the world (the Australian Outback, sub-Saharan Africa and tropical South America), researchers could form theories as to how human society changed in transit to modern times. E.g. studies of the Hadza people in Tanzania showed that men had only a 3% chance of killing larger animals. So, to obtain enough food, women had to help out in collecting and harvesting vegetables, such as tubers (pp. 152–157).

Allegedly, a key element on the way to becoming human was the size of our teeth. Both *H. habilis* and *H. rudolfensis* had large incisors relative to their body size. *H. erectus* in comparison had smaller teeth. The author equates this with tool usage and cooking (signs of human intelligence), in that it allowed for preparation of food outside of the mouth. Cooked foods led to less microwear on teeth (p. 190). Furthermore, the length of a hominin's jaw depends on the stress that it has to bear during growth. On the other hand, tooth size is genetically determined, meaning that a tougher diet leads to more room in a person's mouth for teeth (p. 207). Indeed, certain markers of occupation or different kinds of activities can arise in the teeth due to the way they are used, such as dented incisors in carpenters while holding nails.[2] It is also interesting to note that based on this evidence (molar sizes), Bernard Wood of George Washington University and Mark Collins of Simon Fraser University both argue that *H. habilis* and *H. rudolfensis* should be moved from the genus *Homo* to the genus *Australopithecus* (p. 166), something which has been supported also by morphology-based baraminology studies.[5]

Ungar recounts an interesting theory called the 'oasis theory', so named by geologist-explorer Raphael Pumpelly (pp. 170–172), which was a key element in the Neolithic Revolution, which has strong parallels with the account of the Genesis Flood. The Neolithic Revolution, he claims, was propelled by climate change caused by the recession of a great inland sea in central Asia. For example, a note made on a map in a book of the writings of Confucius discovered in Xinjiang Province referred to the Gobi Desert as 'Han-hai', or the dried sea. According to a theory by Loius Agassiz, a great part of Asia had been covered in glacial ice. This was supported by the fact that shells had been discovered in ice-age deposits in central Asia. This makes perfect sense in the light of Genesis which says that the waters of the Flood covered the whole earth (Genesis 7:19). In 1903, Pumpelly excavated the archaeological site of Anau, at the foothills of the Köpet Dag Mountains just south of the city of Ashgabat in modern Turkmenistan. There he found remains of deer, gazelle, and other wild animals, besides those of oxen, sheep, and pigs, as well as remains of wheat and barley, signs of the farming lifestyles.

For Ungar, it is a mystery as to why farming only started during the Neolithic Revolution, and why not earlier during human evolution. From a creationist point of view, the answer is relatively easy, as we know that the Genesis Flood swept over the whole earth (thus accounting for great inland seas in central Asia which are still receding), destroying everything in its path. Afterwards, after the people's languages were confused at Babel, people groups would have spread out across the globe, starting farming communities here and there where there was good enough land. Indeed, in accordance with Genesis, many describe the geographical location of modern human culture as the Fertile Crescent, localized to the Near East and parts of northern Africa, extending from the upper Nile to the eastern Mediterranean to the sources of the Tigris and Euphrates rivers as they flow to the Persian Gulf (p. 175).

Conclusion

All in all, *Evolution's Bite* tells an interesting story on how environment affects food availability, which affects dietary patterns and tooth morphology in primates and humans. However, much of it is story-telling based on what the author imagines to be true, placing evidence into an evolutionary framework. However, several evidences presented in the book are also compatible with the story of human origins in Genesis. Therefore, we can trust in the Creator God Who revealed all of this information to us in the Bible.

References

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