

### Book Review

#### The Cooking Hypothesis Revisited: Fresh Food for Thought

A review of Richard Wrangham, *Catching Fire: How Cooking Made Us Human*. Basic Books: New York, 2009, 309 pp., US\$26.95, ISBN 978-0-465-01362-3.

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Richard Wrangham and colleagues first introduced the cooking hypothesis in a 1999 article entitled “The Raw and the Stolen: Cooking and the Ecology of Human Origins” (Wrangham, Jones, Laden, Pilbeam, and Conklin-Brittain, 1999). This hypothesis posits that because cooking greatly increases the quality of food, its origin and subsequent boost in energetics must have resulted in major transformations in the human lineage, both morphologically and behaviorally. Wrangham argues that the greatest transition in the fossil record, and hence the origin of cooking, occurs with *Homo erectus* at 1.8 million years ago. Skeptics argued against this hypothesis in its original form largely on two grounds. First, there is little archaeological evidence for controlled use of fire that early. Second, many saw the cooking hypothesis as the antithesis to the Man-the-Hunter hypothesis, namely that the changes from ape-like australopithecines to human-like *Homo erectus* were the result of meat-eating, not cooking. In his latest book, *Catching Fire*, Wrangham provides a wealth of new evidence in support of his theory, drawing from the paleontological and archaeological records, modern primate studies, ethnographies, and experiments in digestive physiology. While some called his original article a “just-so” story, this new book is so broad in its scholarship that it marks one of the most masterfully constructed hypotheses in human behavioral evolution today.

*Catching Fire* essentially serves up a three-course meal. First, Wrangham presents a wealth of evidence that cooking yields major nutritional benefits. Second, he reviews the archaeological and fossil records, examining several major transitions in the hominid lineage as potentials for the origin of cooking, and he argues that cooking originated with the appearance of *Homo erectus*. Finally, he explores the behavioral ramifications of the origin of cooking, including the evolution of the sexual division of labor and pair bonds.

Wrangham effectively establishes the significance of cooking by examining the consequences of a raw food diet in humans as well as experimental manipulations of diet in captive animals. His argument begins by examining people who choose to eat only raw food. Studies reveal that raw foodists are under energy deficits that cause half of raw foodist women to suffer amenorrhea. Such a rate of infertility would be devastating in hunter-gatherer populations

today, suggesting that once hominids had similar energy requirements to our own, a raw food diet would not have been feasible. Wrangham's argument here effectively establishes the importance of cooking somewhere in our evolutionary past, but in order to attribute cooking directly to *Homo erectus*, the raw foodist data would be more relevant if embedded in an analysis of energy budgets. How many calories does a chimpanzee eat in a day? How many calories might we expect *Homo erectus* to have needed with our body and gut size but a smaller brain?

Wrangham then presents a wealth of evidence that digestion is a costly process, and he describes in detail how cooking reduces those costs, focusing on both meat and plant foods, each of which comprise about half of a tropical hunter-gatherer's diet. Cooking increases digestibility of starchy plant foods by gelatinization, while it increases the energy we obtain from protein by denaturation. As an example, cooked eggs are over 90% digestible, while raw eggs are only 50-60% digestible. Furthermore, cooking tenderizes foods. Wrangham cites a study of rats raised on hard versus soft food pellets. Despite both kinds of pellets having the same caloric content, rats raised on soft pellets were larger and had more abdominal fat simply because it was less costly to digest soft pellets. In a Burmese python study, grinding or cooking meat led to a reduction in cost of digestion of about 12%, and a combination of grinding and cooking led to a reduction of 23%.

Having established how cooking significantly reduces digestion costs, Wrangham considers when this human adaptation evolved. Cooking requires the control of fire, and the archaeological record yields only scant traces older than 800 thousand years. However, the fires of Hadza hunter-gatherers today are often small and temporary and therefore unlikely to leave a record over time. Wrangham justifiably argues that better evidence for cooking comes from biology, namely the fossil record. Given the huge nutritional benefits of cooking, its origin should have had major effects on hominid morphology. The hominid fossil record yields several significant evolutionary transitions, and Wrangham considers them each in turn. The transition from apes to australopithecine predates any scant evidence for fire and, according to Wrangham, was likely due to a shift from rainforest to more open habitat, and from a diet of primarily fruit to one of tubers. In the second transition, from australopithecines to early *Homo* (the habilines), hominids remain ape-like but with larger brains. Wrangham attributes this shift to meat-eating. The next transition, from habilines to *Homo erectus*, is the most dramatic in the hominid record. *Homo erectus* is the first hominid to appear more human rather than ape-like. It has reduced tooth and gut size while body size increased, all marks of a higher quality, softer diet. *Homo erectus* is also an obligate biped, having lost features associated with climbing, and it is presumed to be the first hominid to leave Africa, with a geographic range extending into Southeast Asia as well as more temperate regions of China. Wrangham suggests that only cooking can explain the anatomy associated with higher quality diets, and that loss of climbing abilities likely indicates use of fire, for how else could a hominid in open habitat sleep on the ground? While convincing evidence of fire is associated with the next hominid transition, to *Homo heidelbergensis*, the morphological changes are less impressive and not likely to be associated with a radical change in diet. Wrangham suggests these more subtle differences could be due to more efficient hunting or better cooking methods. Unfortunately, Wrangham does not incorporate any life history reconstructions into his arguments. Evidence suggests that while *Homo erectus* appeared more human-like than its ancestors in many respects, it was still maturing at an ape-like rate (Dean et al. 2001; Zihlman, Bolter, and Boesch, 2004). The transition to a slower human life history occurs later, as does another jump in brain size, making the post-*Homo erectus* transition more significant than facial morphology alone would suggest.

Finally, Wrangham explores how cooking could have radically shaped behavioral evolution. While many past theories have stressed the Man-the Hunter scenario for the origin of the sexual division of labor and pair bonds, Wrangham argues that cooking was essential for Man-the Hunter to be effective. If men spent all day hunting with no luck and then came home to raw food, they could be chewing for an extremely long time. Wrangham estimates that chimpanzee spend approximately six hours a day chewing. If cooked, then foods would be softer, people could have eaten more quickly, and with fire, they could have eaten safely after dark. Without cooking, hunting could have only been opportunistic. From a female perspective, females with a pile of food to cook were at risk of theft. The pair bond ensued because females needed a male to protect their food, and in return females cooked for their mates. Wrangham is therefore suggesting that the human pair bond evolved not out of mating competition but rather out of competition for food. Wrangham reminds us that in animal species, the mating system is adapted to the feeding system. Thus cooking led to great nutritional benefits, and it freed men to hunt, but for females, cooking also meant increased vulnerability to males. This section of the book is the most provocative if not the best supported. Much of Wrangham's arguments rely on ethnologies, but unfortunately the fossil record that Wrangham convincingly employed in his earlier arguments is missing here. How well established is the increase in female body size and decrease in sexual dimorphism for *Homo erectus*? What can be made of its facial sexual dimorphism? Males had large brow ridges advertising they were big, strong males. Surely faces as dimorphic as those of gorillas do not indicate monogamy. Could *Homo erectus* males have had harems of females cooking for them? Could pair bonds exist without language, especially given a sexual division of labor? Why not female bonds, as in bonobos? Certainly Wrangham might evoke evidence from our violent sister taxon the common chimpanzee for lack of female bonds, or he might cite lack of female dominance and bonds in tropical hunter-gatherers today, but no arguments are made in *Catching Fire*. I do not raise these questions to belittle Wrangham's arguments, rather I find his hypothesis to be so intriguing and well supported that I hunger for more.

In sum, *Catching Fire* is inspiring in not only its breadth of scholarship but also in the clarity with which Wrangham constructs his theory. Indeed, Wrangham makes it seem so obvious that cooking was critical to human evolution that one has to wonder why it has not been considered in detail before. For anyone interested in the deep roots of human behavioral evolution, *Catching Fire* is a provocative must read.

## References

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