

# The Cooking Ape

## An Interview with Richard Wrangham

PRIMATOLOGIST RICHARD WRANGHAM might be best known for the 1996 book he coauthored with writer Dale Peterson, *Demonic Males: Apes and the Origins of Human Violence*, where he used his research on intergroup aggression in chimpanzees to reflect on combative male behavior. Wrangham's twenty-five years of research have always been based on a deep interest in human evolution and behavior, and recently he's shifted his focus to the evolution of cooking in humans.

An anthropology professor at Harvard University, Wrangham, fifty-six, was first mesmerized by Africa when he spent a year working in Kafue National Park in western Zambia before going to college. There he assisted a research biologist in studying the behavior and ecology of the waterbuck, falling "in love with the excitement of finding out about African habitats and species." He's been back to Africa every year since then, with only one exception—the year when his first son was born.

That first year in Kafue determined Wrangham's course of study at Oxford University and in his life. After Oxford when his plans to study Ugandan mongooses fell through, his advisor suggested he contact Jane Goodall about working with her and the chimpanzees in Gombe National Park in Tanzania. As her research assistant, he spent a year recording the behavior of eight siblings, choosing one each day to observe. Later Wrangham returned to Gombe to do his doctoral research on the behavioral ecology of chimpanzees, and he has continued to collaborate with Goodall.

Eventually, using money from a MacArthur Foundation Fellowship, he launched his own chimpanzee study in Kibale, Uganda, where it took six years to get the chimpanzees habituated enough to get good observations. At Kibale, spending from two to seven months a year with his six Ugandan field assistants and several graduate students, he has focused on both chimpanzee behavior and the way their behavior has been affected by the exploitation of the environment—from finding food and escaping from predators to forming social relationships. He has also analyzed how their social

organization has evolved, especially female social relationships and aggressive male behavior.

Though Wrangham has made his reputation explaining the similarities and differences across species in primate social organizations, he expects that his work on cooking will have the broadest impact because cooking affects many human behaviors—such as those associated with food choice, familial relationships, and food production that can satisfy a huge world population. His favorite part of the day is when he can steal an hour from teaching to analyze chimp data or to work on his new book, *The Cooking Ape*. But Wrangham is happiest at his Ugandan research site, enjoying those quiet moments alone with the chimps, watching their relationships and catching up on the social gossip. He hasn't eaten a mammal since 1976 because of his profound empathy for the ones he has enjoyed and spent so much time with in the wild. Occasionally, his vegetarianism makes life a bit harder, as when a host offers him meat, but he'll never turn down seconds on a chocolate roulade. Wrangham spoke from his home in Weston, Massachusetts.

**ET:** *What prompted your research into how cooking affected human evolution?*

**RW:** As a primatologist, I am often asked to think about human evolution. I sat one evening in my living room preparing a lecture for the next day, thinking about the standard story that involved hunting being important around two million years ago. As I was staring at the fire, I had an almost ghostly experience where I just allowed my eyes to be drawn deep into the fire. I could feel around me the presence of hominids, from up to one million years ago, sitting in the African bush.

I started thinking about the fact that fire is something that has been on the Earth ever since there's been plant vegetation and how when I'm in the bush there is no way that I'm going to spend a night without sitting next to a



fire. I was thinking about the impact of fire on the “cookability” of food.

Then I thought, “Well, would there really have been a fire for our early ancestors—a million years ago, say?”

I realized I didn’t know the answer to the question. But I also realized that it was extremely difficult to imagine that they did not have cooking, because even as long as 1,500,000 years ago humans looked incredibly similar from the neck down to humans living today. Even our heads are very similar—though we have larger brains and we don’t have quite as big a mouth or teeth as they did. So surely, if those million-year-old ancestors were generally like us in the size and shape of their bodies, they should have been eating cooked food. After all, cooking has this huge impact. It changes so much about how we relate to the natural environment: it changes the ease with which we digest the food; it changes the availability of calories; and it changes the distribution of food.

If cooking has such a big evolutionary impact, in other words, and we haven’t changed much, then there are only two possibilities. Either we somehow managed to adopt

cooking without it affecting us very much, which would be very mysterious, or it happened so early that cooking had already been adopted by a million years ago.

**ET:** *What’s an example of how changes in the food supply affected primates and how that led you to think cooking had a significant impact on humans?*

**RW:** If you compare chimpanzees to gorillas, they eat very similar things. They both like to eat fruits when fruits are available. They both eat more leaves and stems when there aren’t many fruits available. But there’s one relatively small difference: when there’s a shortage of fruit, gorillas will switch entirely to eating leaves and stems, whereas chimpanzees absolutely insist on finding their daily ration of fruits before they go bulk up on leaves and stems. That’s why gorillas can live entirely without fruit—in the mountains of Uganda, for instance—whereas we don’t know of any place where chimpanzees can live entirely without access to fruit.

That small difference in food supply between chimps and gorillas can account for the fact that the gorillas are

three to four times the body size of chimpanzees and that they live in more-stable groups. Therefore, gorillas have an entirely different set of sexual relationships, with males being enormously bigger than females, and so on. This is just one example where a relatively small difference in the food supply creates a big difference in the way that two species look and behave. And to shift from eating raw food to eating cooked food is a much bigger change!

**ET:** *How did cooking change calorie intake and thus the human species?*

**RW:** Amazingly, we still don't have a good picture of the most important ways in which cooking changes food. There are different effects on plant foods and meat, though. One impact on plant foods is probably to increase digestibility. That means that our food has a relatively low proportion of indigestible material; in modern surveys you see that 10 percent or less of what we eat is indigestible plant material (fiber, in other words). Whereas in chimpanzees, for instance, fiber is over 30 percent, which therefore seems a reasonable guess for what it might have been like in our raw-food-eating ancestors. Well, if we ate 30 percent fiber, compared with 10 percent now, that 20 percent of the food our ancestors were eating was just bulk material passing through the gut. So, they simply absorbed less energy.

That 20 percent figure is a lot. When we compare the actual rate of energy expenditure in human foragers, which is between 1.5 and 2.2 times the basal metabolic rate, as compared with 1.4 times for chimpanzees, we're getting a lot of extra energy from somewhere compared to the chimpanzees. Where are we getting it from? I think it's because the food that humans are eating is more digestible. Instead of spending all day with our guts holding a high proportion of indigestible material, we're able to have a higher continuous stream of calories going through our guts.

What's the result? Maybe, it explains why humans used so much energy, starting around 1.9 million years ago. First, that's when we got our bigger body, made by the greater amount of energy. Second, it means that we can have a relatively large proportion of expensive organs, such as brains (they're expensive in the sense of using calories at a particularly high rate). For a long time people have been interested in the notion that, since the brain is unusually expensive, our ancestors needed to have some way of getting more energy in order to afford having a bigger brain. At 1.9 million years ago, you have arguably the largest increase in brain size in evolution. Third, there's the opportunity for longer travel distance per day because you just got more energy to

put into traveling. Chimpanzees are quite long-distance travelers at 2.5, 3, 4, 5 kilometers a day, but humans, males in particular, are traveling 9, 10, 15, 20 kilometers a day—a lot more than chimps.

This extra energy probably comes from the fact that, as a result of cooking, we're able to eat a relatively compact food that is full of calories. And then at the same time, of course, the food has become softer, and that enables us to have smaller teeth and smaller jaws, a flatter face, and less prognathous jaws. At the same time we, in fact, have smaller guts and a shift in the arrangement of our guts that reflects the fact that we're eating food that is relatively highly digestible. So we have long small intestines, the part of the gut that absorbs the products of digestion, and we have short large intestines where fermentation goes on when you retain food that takes twenty-four hours or more to be fermented under the action of bacteria. We have relatively little food that comes in that needs to be fermented. All of these changes are easily explained by the adoption of cooking.

**ET:** *How much did our brains and bodies change as a result of eating cooked food?*

**RW:** The standard estimate is that female bodies increased in weight by about 60 percent around the 1.9-million-year mark. So, if you compare the body size of about 125 pounds for an average woman with the average range of 70 to 80 pounds for a chimp, it's really quite a big increase. And the brain size is going up...it might be 60 percent.

**ET:** *You've said that cooking and meat eating are the only two proposals for what transformed the ape into a human. Why couldn't the changes just be from eating more raw meat rather than cooking?*

**RW:** We don't know too much about what it's like to chew raw meat because people don't do it. But chimpanzees are a good model because they have teeth that are just about the same size in relation to their bodies as those of our early ancestors 1.9 million years ago. When we look at chimpanzees eating raw meat, it turns out that they're eating it so slowly that it would just take a tremendous amount of time to rely on eating nothing but raw meat. And that would be a problem.

Think about how many calories our early ancestors would have needed at that stage, estimated at somewhere in the low 2000s. This would take five to six hours a day of simply chewing *without* going out and finding more meat, cutting it up, and looking after your babies and so on. And they

would have had to develop some kind of tooth arrangement that was sharp and enabled them to chop it up quickly and swallow it in the manner of a carnivore.

It just seems very unlikely that, at any time since 1.9 million years ago, our ancestors were chewing for half the day, because animals that chew a lot have got deep jaws and robust bones in the mouth to accommodate the stresses of the chewing. That's not what you see—our ancestors' jaws have been built relatively lightly ever since 1.9 million years ago. So, it's not that I think that meat is unimportant; it probably was eaten a lot. It's just that to become important it had to be tenderized to allow it to be eaten easily. The tenderizing could have begun in a physical way by hammering it with stones, maybe, but cooking would have solved the problem much more efficiently.

**ET:** *When did humans learn how to master fire and then use it for cooking?*

**RW:** No one knows for sure. But there is such good evidence from caves in southern Europe that humans controlled fire by 400,000 years ago that essentially everyone accepts that fire was controlled by then. So the conservative view is that we started our control of fire then. The 800,000-year date recently published by Goren-Inbar and colleagues in *Science* (April 2004) is perhaps the best evidence yet for an earlier date for fire. It's particularly nice support for the notion that control of fire must have started before we can see it, because around 800,000 years ago even less happened in human evolution than at 500,000 years ago. People rarely lived in caves before 400,000 years ago, so the remains of earlier campfires can't easily be found. But the more radical view, which seems right to me, is that bits and pieces of archaeological evidence for control of fire at earlier dates, all the way back to 1.9 million years ago, are right. In other words, I believe our species started to control fire at 1.9 million years ago.

Then, the question is, what's the relationship between control of fire and cooking? Some people imagine a period when our ancestors had fire but ate raw food. But, once we had control of fire, I think that we would have started cooking very soon, maybe within a week, maybe within ten generations—but waiting 1,000 or 10,000 or 100,000 years? It's unthinkable. Modern primates, such as monkeys in captivity, allow foods to cook in fires before they take them out. It's obviously just not a big cognitive step from controlling fire to cooking.

So, if humans were cooking by 800,000 years ago, it seems likely that they had been cooking since 1.9 million

years ago, because that's when our modern frame evolved. Basically nothing happened in human evolution between 1.9 million years ago and 800,000 years ago to suggest any improvement in the diet—certainly nothing as radical as being able to shift from raw to cooked food.

**ET:** *Who was the first cook?*

**RW:** It was not fully human. It was one of these prehuman hominids around the 2-million-years-ago mark, living somewhere in Africa, perhaps an australopithecine or a species like *Homo ergaster* [an early form of *Homo erectus*].

Whenever cooking evolved, we've got this problem of how on earth did the first cook manage to solve the problem of getting to use fire and controlling it rather than running away from it.

One fantasy that I enjoy is the notion that there was something like the chimera that we now see in western Turkey. In western Turkey you've got a mountain, Mount Olympus, where there are several holes in the ground, quite small, just a foot or two across, with fire coming out of them. This fire has been going for at least 2,700 years, judging by the fact that Homer recorded its presence.

To call it permanent fire is too exaggerated, perhaps, but it's said that an earthquake was a cause of some release of gas that's been seeping out ever since then and which has been burning all that time. There are several places around the world where you get little patches of permanent fire burning like this. So it doesn't seem unreasonable to imagine that there was some permanent fire in Africa somewhere.

We know that chimpanzees can learn to be happy with fire. Kanzi is a captive bonobo (pygmy chimpanzee) who goes for walks with Sue Savage-Rumbaugh in the forests of Georgia (United States). When she asks him to go get firewood and to use matches to light a fire and then to cook up some sausages, he does so. These things are not that difficult for a species as big-brained as a chimpanzee.

So, it's relatively easy to imagine an australopithecine who keeps coming back, sees these flames roaring out of the ground, and starts playing with them. Then it wouldn't be long before they see what happens to one of the roots they have been eating when it is heated by the fire. That may not be the way it happened, but at least it gives a sense of the possibility of the transition. You don't have to be fully human, I think, to imagine that you could tame fire. So, if indeed you were prehuman and started being able to use fire, then that knowledge could be passed on from generation to generation in the many, many years before these species would have actually been able to make fire.

**ET:** *How do you imagine they were cooking?*

**RW:** The cooking would have been very, very simple. Once you've got a campfire, then it's the way that people cook nowadays. In the bush the main plant food would be roots—African versions of carrots or potatoes often dug from the edge of swamps or lakes. Many would be tough and leathery, pretty nasty in the best of times, but improved enormously by being heated. You'd just rest these on the coals next to the dying flames. After twenty minutes and occasionally turning them, the roots change from something that is extremely fibrous into something that is a lot softer and easier to eat.

Very often the way that people eat meat is they throw a small animal on the flames and that singes the hair off. Then they cut it up. We know that at 1.9 million years they were capable of cutting meat up because there are cut marks [made by stone knives] on fossil animal bones that go back 2.5 million years. So they could have laid strips of meat onto sticks above the fire. Well, maybe it would have taken a little time before that happened. But it doesn't seem very difficult if they had already been cutting up meat for 500,000 years to imagine that they could put small chunks on the embers next to the fire or next to the flames themselves. And all you need to do is heat meat to 170 Fahrenheit, and it reduces enormously the problems that make meat so difficult to eat when it's raw, which is the toughness. Heat coagulates the collagen fibers that make meat tough and turns them brittle. Suddenly, you've got something that you can eat pretty quickly.

**ET:** *How did humans make the transition from cooking over an outdoor fire to hearths and then to earth ovens?*

**RW:** No one knows. I imagine that the way things started is that the first kind of controlled fire would be simply sticks on the flat earth. Then at some point you'd start digging a little pit and you might surround it with some stones that would protect it against the wind a little bit further, and maybe other ways I don't know about making the fire more efficient.

An earth oven is a little hole that has been dug in the ground. Hot stones are put into the hole, and the food that you want to cook is put in with those hot stones. Then you stop the hole with earth, and the heat from the stones combined with the moisture of the earth leads to a sort of steaming effect, and you get a rather nice, gentle, slow cooking. That's practiced nowadays in various parts of the world, such as New Guinea and India.

There are other complicated kinds of hearth arrangements in sites in southern Europe, for instance in France in Pech de l'Azé II, that go back 250,000 to 300,000 years. At

the entrance you have one kind of hearth arrangement, rings of stones where probably there was some kind of lighting arrangement to scare off predators from coming into the cave. And then inside the cave, in addition to something like an earth oven, there was apparently a cooking area more than a yard across, indicated by flat stones whose red and black colors indicate repeated burning.

But to assume that earth ovens start very quickly seems to me to be an unnecessarily optimistic assumption. Earth ovens look like a pretty complicated kind of technical achievement. I had assumed that this was just a signal that cooking had been going on so long at that point that they had been able to devise various rather ingenious ways of making cooked food even nicer.

**ET:** *Did humans start cooking to be able to defrost frozen raw meat?*

**RW:** According to Loring Brace, a physical anthropologist from Michigan who has been the main person suggesting that cooking was important in human evolution, the reason that cooking was adopted was to defrost meat. He said this because the early earth oven sites in southern Europe in the 300,000- to 400,000-year range were made at a time when the glacial ice sheets from the Arctic were covering Europe. So, his notion was that we needed to be able to have fire in order to defrost hunks of frozen meat. But it was defrosting, nothing more than that. I suppose even Brace would allow that, once you start defrosting it, then you would probably go all the way to cooking it, but it was defrosting that he emphasized.

**ET:** *Why is cooking often considered unimportant in human evolutionary biology?*

**RW:** There are several reasons. One is that there is just an implicit and sometimes explicit assumption that cooking was late. This is a result of the Balkanization of our field, because once you look at the archeological evidence from about 400,000 years ago, it's very difficult to imagine cooking was late. And yet you have a great expert like Katherine Milton, a leader in the field studying primate and human nutrition and the evolution of the digestive system, who says she assumes that cooking happened too late to have had the opportunity to have any biological effect—that would have meant we invented cooking less than 10,000 years ago!

After all, we know that biological effects happen within a few thousand years. The lactose tolerance example is one that speaks directly to the diet. We know from archeological



evidence that people have not been herding cattle and therefore drinking milk of other species for more than about 8,000 years. In the areas where adults do drink milk, they've got a very high, say 95 percent, proportion of genes that make them tolerant of the lactose in the milk. It means there's been very rapid selection for this specific phenomenon. So the question in my mind is, "If cooking was adopted, was it adopted in such a short time that it wouldn't have had a chance to make us dependent upon it in the way that people who now drink milk are able to do so as a result of their biological adaptations?"

So, that's when you go for the really secure archeological evidence: we *know* that 20,000 years ago people were eating things that they could not have eaten unless they were cooked because you can see evidence in the fossilized feces. And if you look at the archeological sites back to 60,000 years ago, you've got people with *huge* piles of thousands of bones, many of which are burned in a pattern that is exactly the same as you find in extremely recent sites from hunter-gatherers in North America just 500 years ago. So, this is strong evidence that people were cooking in an essentially modern manner as far back as 60,000 years ago.

Well, this is enough time for three species to evolve in turn. Evolution is not that slow a process. There would have been plenty of time for cooking to have had major effects on our biology, if in fact it had been adopted as recently as 60,000 years ago. But as we've seen, we've controlled fire for much longer than that.

**ET:** *So there is more evidence of humans cooking earlier than most anthropologists would agree to?*

**RW:** Yes, my strong sense is that people just haven't put the evidence together. In addition to the long history of control of fire and the lack of any recent correlated change in our jaws and teeth, there's the question of whether cooking is an option or a necessity. You often find people accepting the notion that cooking was adopted without having a big effect on us. Okay, theoretically that's true. But in practice it's a tough argument to make.

Cooking would have dramatically changed our ability to take calories from the environment, so it would completely increase the rate at which we can use energy. It would completely change our food distribution and therefore change our social system.

So it just revolutionizes our relationship to the natural world. Simply to say, "Oh, by the way, we started cooking at some point," and then not say it didn't do anything to our bodies and social relationships is to ignore a very important

question. How could we start cooking and not be changed by it? I think there's a clear answer. We couldn't do it. Any animal that learns to cook becomes a new kind of animal. So cooking didn't start during one of these phases when humans were just doing the same thing and not changing their frame. It started *way* back and it changed everything.

**ET:** *How did cooking affect the social structure?*

**RW:** I think the social structure is a *really* interesting question because this is in many ways the biggest gap in the way anybody has thought about cooking so far. Everyone's aware that cooking would have improved the quality of the food, so it's not that big a deal to think about it affecting our energy and our teeth and so on. But there's been amazingly little thought given to this question of what cooking did to social structure.

My colleagues and I made the following argument in a paper that we wrote in 1999 that cooking lay at the base of human evolution: The huge problem that cooking presents is that it changes a species from feeding as it picks the food to forcing a species to keep its food for some time, which will be at least twenty minutes to probably several hours during the period when it is gathering it and going to cook it. That means for a period of time there is individual ownership, and once you have ownership, then there is the possibility of competition over those owned goods.

In other words, just as with any other animal where somebody gets a piece of food that is relatively valuable, others will try to pinch it. Female lions bring down the antelope; the male lion comes and takes it away. The low-ranking male chimp kills a monkey; the high-ranking chimp comes and takes it away. The female baboon digs for some roots; the male baboon watches, and just as she reaches to get the results of her labor, he says, "I'll take over, thank you." And in a similar way it seems impossible to imagine that when our ancestors first started cooking there wasn't pressure by which the hungry high-ranking individuals would not have taken advantage of the low-ranking individuals who had done all the hard work to get some meat or dig up the roots and get it cooked. And that problem seems to me to be really severe. We need to think about how we solved it.

**ET:** *How do you suppose humans solved this problem?*

**RW:** The human species is the only one, in all of the animals we know, in which there is a thing we call "sexual division of labor." I think it is a slight misnomer because it underestimates the extent to which there is a bias in favor of

the male. It implies that the male and female are equal, doing equally well under the sexual division of labor. But women are always the ones that get to do the least favorite tasks, and women are the ones who predictably have to take responsibility for producing a meal in the evening.

Men are free to do what they want. A man can go off every day and hunt for three weeks and never get anything, and still he's going to get food, given to him by his wife in the form of a cooked meal when he returns in the evening. But if a woman goes off and tries to dig for food and never gets anything, she's in big trouble. A man knows that he can rely on a woman to produce food for him; a woman has nobody to rely on, she has to do it for herself.

So a woman is more like a chimpanzee, as it were: she is producing for herself, and then she has the problem of somebody who's taking some food away from her. A man is an entirely new species of animal, because a man is relying on others to feed him every evening. Now it's true that he will often produce foods that he will give to his wife, and the relationship can be beneficial. But some men don't. Some men are lousy producers, and they are still able to take advantage of the system. The problem is not so much why did men and women divide and then cooperate. We should be asking this question instead: "Why is it that men are able to get away without having to be responsible for their own food supply?"

**ET:** *Why aren't men responsible for their own food supply?*

**RW:** I put these two observations together: On the one hand, there's the fact that you know that there's going to be pressure to steal the food of low-ranking individuals. On the other hand, there's the fact that only in our species is there a sex that doesn't have to collect their own food every day. Among hunters and gatherers, men are able to get away with not feeding themselves. The solution is that males have developed a relationship with females in which they protect a female's food supply from everybody else in the community. And in exchange, she feeds him.

The way I imagine it working in the past was something like this. Around the ancient campfire you have females getting their own food. Then you find males who are coming back in the evening, having been unsuccessful in hunting or getting any other food. Maybe they were off chasing other women instead of trying to find honey. So now they've got nothing to eat, and they bully a female into giving them some of her food.

And that kind of social pressure creates a situation in which it pays every female to develop a friendly relationship

with a male who will protect her from being bullied by a whole herd of males. Better to have one male to protect your food supply and predictably feed him, if he can keep everybody else off, than be a lone female who is exposed to the possibility of theft from many other individuals. The male is an effective protector of her food supply because he's part of a system of respect among males. In a sense, he pays other males to stay away because he's part of a food-getting system in which whenever he does get food, he shares it on a predictably culturally agreed equal basis with other males. So, all the males are in an arrangement whereby they agree not to interfere with each other, and the female is in a relationship with the male whereby he agrees to keep all the other males off. It seems to make sense.

**ET:** *How has cooking affected human life history—how fast we grow, for instance?*

**RW:** These are areas that still haven't been well explored. But of course one of the most dramatic things about human life history is the fact that we have children that are dependent. This is different from chimpanzees, for instance, where the infants are weaned at about the three- to five-year stage and then they're independent. The only way chimpanzees feed each other is through nursing.

Whereas with humans, the child is being fed until it's an early adolescent. Children make some contribution to the domestic work and food gathering and so on, but nevertheless, the net flow of energy is definitely from the parent to the child, not just until weaning but all the time until at least 10 to 12 years old. So, childhood (a period of economic dependency beyond weaning) is normally regarded as a special human feature.

And childhood is made possible by cooking, because a species that cooks can easily overproduce. A chimpanzee that spends six hours collecting and chewing her own food doesn't have time to collect extra food to give to her children. But a foraging woman can collect and cook enough food to feed her family. Instead of spending six hours a day eating, she spends only about one hour eating. That leaves enough time to gather and cook for others.

Then, earlier in the life span, for at least 20,000 years, babies have been given cooked mush so they can abandon nursing very early. The result is that the mother has less energetic strain on her body, so she's able to have a relatively quick interbirth interval of three to four years, whereas in chimpanzees it's more like five to six years. That is presumably because even though the women still have children with them, they're able to feed them by

cooking and still get enough food themselves to return to a high rate of ovulation.

So, cooking gives us big families—dependent children, produced relatively quickly.

**ET:** *What effect does cooking have on the human mortality rate?*

**RW:** Well, it's very interesting that humans have a very low rate of mortality. If you compare humans and chimps, at every age humans are dying more slowly than chimpanzees. This is not because of predation, because most of the chimp populations have not been subject to predation. It's just something inherent about their bodies. The implication is that the immune system or other systems of defense are less effective in chimps than they are in humans. I don't want to suggest that this is well known, but I think it's an interesting speculation. Part of what's happening as humans are able to acquire more energy as a result of cooking and eating superior food may be that they're able to divert a proportion of that energy into the kinds of defenses that enable us to live a long time.

**ET:** *If cooking evolved as a women's task primarily, why are the majority of professional chefs men?*

**RW:** I'm sure cooking is biological in many senses, such as the fact that we have adapted to need cooked food. But it's clearly not biological in the sense of being a cooking instinct. It's not that women automatically just moved to a fire and said, "I want to cook, I've just got this inner feeling that makes me want to cook." Actually, it's the opposite probably; most women would probably *prefer* to have the man cook.

We know perfectly well that men can cook in all sorts of circumstances. If there are ceremonial foods, they cook; if there are communal foods to be prepared, they cook; if they are bachelors who have some kind of rule that means they can't have contact with women for years at a time, in some societies, even in hunter-gatherer societies, they cook. If it pays in terms of profession, again then they cook. I think the existence of professional chefs just reminds us that the reason that women cook is essentially because of the unfairness of the sexual division of labor. It's not because cooking comes in an automatic package with childcare and nursing. It's because the social arrangement fits women and men best, but it particularly fits men.

**ET:** *Is it possible for humans today to live on raw food alone?*

**RW:** Many people would still dispute whether there really is an answer. I've become convinced that all of the little subtle references that you get about the notion that people can live by raw food alone are in fact fictional conjectures. When I talk about subtle references, I'm thinking about *The Lord of the Flies*, where William Golding's boatload full of boys are on an island and are surviving quite happily by finding and eating raw fruit. It is as if, through that sort of cultural reference, we get the idea that this isn't a problem. "Yeah, sure, we can eat raw food if we want." But I have found no cases at all of people surviving on raw food in an ordinary world. Even the most prolonged cases of eating raw food are extremely unusual. One example is the Tartar or Mongol warriors of Genghis Khan who could live for up to ten or eleven days at a time by drinking just the blood of their horses before they stopped and with great gratitude had a cooked meal.

**ET:** *Why can't humans live on only raw food now?*

**RW:** Well, actually, people in industrial society who choose to eat raw food can survive pretty well. But even so, we're so badly adapted to eating raw food that if you study these urban people who by choice live on it, you find that many of them end up underweight. There's a German study by Corinna Koebnick and colleagues from 1999 in which 25 percent of the women were chronically undernourished as a result of living on raw food. These are women who live under the very best conditions: they don't have to take much exercise compared to the very hard physical work of being a forager; they're eating foods that have been domestically selected for thousands of years and are therefore relatively low in fiber and high in soluble carbohydrates, so it's high-energy food; the foods have even been extensively processed, such as by sprouting, drying, and pressing; and they're eating food that is available at high quality all year, in contrast to the inevitable food-poor seasons in the wild where people always starve and lose weight even under the conditions of cooking.

That alone makes it very difficult to see how people could survive on raw food in the wild, where people would have hard physical labor and their foods would be tough, high fiber, and low energy. But then you add the fact that in the Koebnick study 50 percent of the women who were eating 100 percent raw food were completely amenorrheic. They had no reproductive activity at all. Another high proportion, perhaps 25 percent or more, would have been severely subfecund; so this means that even under ideal conditions a raw-food diet is not producing sufficient surplus



energy to be able to maintain an effective reproductive system. So that says to me that humans are just not adapted to eating raw food. What exactly that means in terms of our failure to be adapted is not clear, but it probably means that our guts are now too small to allow us to survive on raw food, and too high a proportion of the gut is devoted to absorption rather than fermentation. The most important conclusion, however, is that we know remarkably little about the constraints on our digestive system.

**ET:** *Are there problems with humans today eating too much or only meat?*

**RW:** Nowadays, people can eat a tremendous amount of meat because there's a lot of fat to go with it. But if you're eating meat from the wild, which has very little fat and is mostly protein, then there is a problem with getting rid of the urea that is produced by digestion of excess protein.

Urea poisoning can result. So too much meat can definitely be bad for you.

Of course, people in rich countries eat too much of everything. Indeed, the irony is that although cooked food has been so important for human evolution, raw food might be one of the healthiest diets for today. A raw-food diet is possible in rich countries today because of our low level of physical activity, the high agricultural quality of foods that go into a modern raw-food diet, and the extensive processing that makes raw foods palatable and easily digested. Even so, it takes a tremendous amount of determination to stick to a raw-food diet, because you'll feel hungry so much of the time. If you can do it, however, you'll bring your caloric intake nicely down, and maybe you'll have the philosophical satisfaction of imagining what the lives of our prehuman ancestors were like in those distant days before cooking was invented. ◉