New Light on Neanderthal Diets

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The human remains at Neumark Nord, a Neanderthal site in Germany, are around 125,000 years old. Those at the Anthropology Research Facility (ARF) — *aka* the Body Farm — in Tennessee, a lot less. What connects them is a remarkable new explanation for the high nitrogen isotope ratios in Neanderthal remains. Normally, such high ratios are the result of eating lots of meat. John Speth thinks there's a better interpretation.

John: Humans are primates, not lions or tigers or wolves. Our livers can only process so much of the amino acids that make up proteins in meat, and particularly the nitrogen. Our bodies have to get rid of that nitrogen. That limit seems to be depends on your body weight. But for humans, typically that limit would be somewhere between 250 and 300g of protein. Now, if you calculate how much meat that is, that's a lot of meat. But if you calculate how many calories that is, it's not very much. Protein typically gives you about four calories per gram. And if you're limited to, let's say take the upper limit 300g of protein, that's only 1200 calories. And for most active hunter gatherers, that's barely half of what you'd need in a day. And if you exceed that, that amount of protein, your liver can't cope with the nitrogen and you develop what early explorers called rabbit starvation.

Jeremy: You're basically being poisoned by too much protein. The symptoms start with uncontrollable diarrhoea and then move on to lethargy and death, often in less than a couple of weeks. Rabbit starvation gets its name from rabbits being famously lean meat with hardly any fat.

John: Let's say you're a hunter and you've run out of plant foods. And it's winter, late winter, spring, early spring, and you're trying to live off of animal foods. If you're limited to only about 1000 to 1200 calories of of muscle, and beyond that, literally, you start becoming incapable of functioning within somewhere between 1 and 2 weeks, you have to

find an alternative. And the two obvious alternatives are carbohydrates, mostly from plants. But if you're in an area and at a time of year when they aren't available, you have to get fat.

Jeremy: And at that point, more meat, more muscle, is no good to you. You throw it to the dogs.

John: And then they would go after whatever fat deposits they could get: the brain, around the internal organs, and the marrow. And then what we call bone grease, the fat or lipids that's in the spongy tissue of bones. That is an extremely valuable source. But it's also very labour intensive.

Jeremy: Which is why you need a fat factory like that site in northern Germany. What John Speth was saying a moment ago is based on solid, modern and historical evidence about how hunting societies avoid rabbit starvation. Neumark-nord, that site, is 125,000 years old. So how do they know it was a factory for extracting bone grease?

John: Well, to be perfectly honest, what we have is everything that fits what you'd expect from bone grease except the smoking gun. And the smoking gun is direct evidence that the bones had been heated in water. And we need scientists, biochemists, molecular biologists, somebody out there to figure out in 100,000 or more year old bone, has this in fact been heated in water? We know that you can boil in bark containers. You can boil in hide containers. The reason that's ... directly that is without using heated stones. The reason that's possible is that you can never get the water hot enough to reach the kindling point of the container itself. So we have a lot of historic evidence of direct boiling in birch bark and in hides. But, so, you know, we have the fragmented bones, we have the concentration in a single area, everything looks like bone boiling except, as I say, a direct biochemical or molecular signature that yes, these bones had actually been heated in water, and that's still missing. And I hope other specialists can in the not too distant future, find us a signature.

Jeremy: Now, the site. You mentioned that it's quite restricted. Tell me a little bit about this site, which is in northern Germany, yeah? Just, what's it like?

John: I've never been to the site. Okay. The paper that came out in Science Advances had quite a few authors, and my contribution was

more of what you might call a library contribution. But I've never ... I was not involved in the excavations, so what I'm describing is basically quite second hand. It's two shallow basins called Neumark-nord one and two that existed during the last interglacial in eastern Germany. The focus of the fat factory paper was on one locus, or one area within one of these basins that had a dense concentration, thousands of highly fragmented bones that represented several different species of animals, generally large animals. And my contribution in that basically was to try to come up with a framework that would explain why fat was so important. And secondly, how could you get so many animals and individuals together in what appeared to be a really short period of time, perhaps a single event, but more likely a series of events within a matter of years or at most a few centuries.

Jeremy: It's interesting that it seems as if bones were brought to the site. That is, you don't have whole carcasses or evidence of whole carcasses. Is that what you think was going on? That they were butchered somewhere else? Maybe bits of them were eaten, maybe, maybe not. And then they were brought to the site for processing.

John: Well, again, this is a model, all right? Based on looking at five centuries worth of ethnohistoric descriptions of what hunters do and why they do it in mid to northern latitudes, which would be somewhat similar in many ways to the environments that we were dealing with 125,000 years ago. Hunting is very unpredictable. There are periods of boom and there are periods of bust. Humans in the ethnohistoric record over the last 500 years, routinely cached whole carcasses, partial carcasses. And this is without refrigeration, but they had an immune system and a gut flora that had no problems with the meat fermenting or becoming putrid, with it becoming full of maggots. Typical pattern, prime hunting season would be in the summer and fall, and obviously you live off of what you're hunting, but you have access to plant foods and other sorts of resources during those times of year. But whenever you get an excess, you cache it for the tough times, winter and spring. So you have multiple caches in multiple locations, often hanging in trees, under piles of rocks, submerged in ponds. Sometimes they cache whole carcasses, sometimes partial carcasses, sometimes just bones. They just accumulate the bones. And then over the course of the winter, depending on where you're living, you go back and tap these caches. You open them up and you take out what you need. And if they at that point are in need of fat, they would start gathering together bones to open them up for the marrow and

to smash them up and boil them for the grease. And that would help account for the diversity of animals, because they had been killed and cached over many months. These are typical patterns, but very hard to actually see archaeologically.

Jeremy: Well, one of the things that comes across in the paper is that the site is very special among sites because of the way that it was covered over by sediments. Is your sense, from what you know about the ethnographic record, is your sense that this is probably something that's going on with Neanderthal communities kind of everywhere?

John: I think so. You know, I think that the nutritional demands require, especially in mid to northern latitudes, any area that is highly seasonal and that has pretty harsh winters where plant foods may be scarce, and in any area like that you're limited in how much meat you can eat. What's interesting in the ethnohistoric record, and this is so counterintuitive, counterintuitive to the average Westerner, they viewed muscle steaks and roasts as dog food and often threw it away or gave it to the white man. They ate the meat raw or barely cooked. They focused on internal organs, and they focused on fat and muscle. The stuff that we all crave, they often tossed. They left it for the wolves.

Jeremy: If hunters in northern climates, including those Neanderthals 125,000 years ago, if they were throwing those steaks to the dogs, what about the picture of Neanderthals as some sort of hypercarnivore eating nothing but meat? All over Europe, along with Neanderthal remains, there are also a lot of bones from large animals like deer, horses and wild cattle. But the story of hypercarnivores emerges from the bones of the Neanderthals themselves. So where did this idea that we should be eating meat, meat and more meat, like our ancestors, where did that idea come from?

John: Well, it's an interesting question. I think if you talk to archaeologists, they would probably immediately say, no, no, we don't think Neanderthals are hypercarnivores in the sense that they're lions or tigers. In the 1990s, isotope specialists who were interested in the human diet began experimenting with nitrogen isotopes. And nitrogen has two isotopes, two stable isotopes. They're called nitrogen 14 and nitrogen 15. And what they found — there have been many studies of this — what was found was that grass and other plants like that have very little of the heavy isotope. It's very rare in nature to start with,

and it's almost not present at all in grass and so forth. Herbivores eating the grass tend to enrich their collagen in their bone with the heavier isotope, it's slightly enriched. That is, there's more nitrogen 15 in the collagen of the bones of herbivores than you'd find in the grass itself. And then carnivores that eat the herbivores, they're even further enriched, so you find even more nitrogen 15. And in the late 1990s, isotope specialists with an interest in human evolution studied it in Neanderthals and found that not only did Neanderthals have highly enriched collagen, enriched in the nitrogen 15, but they actually were, when you plotted them on a graph against the nitrogen 15 levels in the animals that you found in the same archaeological sites, the Neanderthals plotted out with nitrogen 15 levels up there with the hypercarnivores, with the cave lions, with the wolves, with the hyenas, and so forth.

Jeremy: The problem, as John Speth explained up front, is that humans are primates, not carnivores. So unlike cave lions and hyenas, we're limited in how much muscle meat our bodies can process.

John: It always bothered me to see these Neanderthals plotting out not only with the hypercarnivores, but often with nitrogen 15 levels that were more enriched than the hypercarnivores. In other words, they were sort of ... They looked isotopically like hyper-hypercarnivores in a way. And that made no sense to me.

Jeremy: John Speth's underlying unease with modern Western views of Palaeolithic diets, along with his interest in ethnographic accounts of modern hunters in northern latitudes, led him to write a paper on the nutritional value of putrid meat. We talked about that a few years ago, and I'll put a link in the show notes. Debunking the idea of Neanderthals as hypercarnivores came out of that study.

John: At the very end of that paper, I speculated that because the process of decay of animal carcasses leads to giving off all sorts of lovely smelling gases with lovely names like, well, one is ammonia, which has nitrogen in it, and putrescine and cadaverine, and these all contain nitrogen. And if they're going off as gases, I surmised that presumably they would be taking off the lighter isotope and leaving behind putrid meat that would be somewhat enriched in the heavier isotope. So I gave it ... I was at a meeting in San Diego, California, and I gave a talk there, and there was a young woman there named Melanie Beasley who had just finished her PhD and studying isotopes, and her

field of specialty was biological anthropology and with a great deal of interest in forensics. And she attended my talk and she had already, I think, had lined up a postdoctoral position at what is often called the Body Farm in Tennessee, which is a forensic unit that specialises in studying the decay of human bodies. People donate their bodies to science, and the science that is being done is by letting the bodies decompose under a great variety of conditions, and the information from that is used to estimate things like the postmortem interval, that is, how long is a body been dead.

And Melanie, after my talk came up and said, you know, I can test this using ... It's admittedly not using red deer or horses, but its muscle, and muscle is muscle. And we have all of these bodies that are being allowed to decompose under controlled conditions. We know what the conditions are. Why don't I do some isotope studies on the muscle? And then we talked some more and she said, why don't we also look at the maggots? Because nobody had ever looked at the maggots. And what she ended up finding was that, yes, the meat was somewhat enriched. The putrid meat, the putrid muscle, if you like, from these cadavers, was enriched in nitrogen 15. But not a great deal. Probably not enough to account for the enrichment that we see in Neanderthals. But the maggots turned in — and this was a total shocker for Melanie and for me — the maggots were off the charts and we don't fully understand yet why.

Jeremy: It's interesting because although people knew that many cultures are a lot less squeamish about maggots than we are, they didn't think to apply that to Neanderthal bones, I suppose because they had no idea maggots could be so enriched in nitrogen 15.

John: Yeah. It was it was something different. I mean, it doesn't prove that we're right, but it will get people thinking in new directions. And that's sort of what we want. And it opens lots of research doors, and we can think of a million things that we would like to be able to answer now. How much of these maggots do you need to eat to get how much enrichment? I suspect that humans are eating them whether they're alive or dead. They're in the meat. They don't pick them out, And they seem to be ubiquitous where you don't have refrigeration and where you cache meat. And in fact, we found ethnographic descriptions or ethnohistoric descriptions that even when you put ... hang meat and other body parts from an animal out to dry in the sun, even if you build a fire underneath with lots of

smoke, the flies get at it. And these early descriptions say the maggots were raining on the ground, literally, and the indigenous people would come and scoop them up and make a meal out of them. But we don't, you know, we have no quantitative data yet, and we need we need experiments. And there are many different species of fly larvae, and they have many different seasonal needs. So it's complicated. And we view our work as sort of step one, but it gets us away from the hypercarnivore argument.

Jeremy: The most interesting takeaway I got from talking to John Speth is that the real palaeo diet, not the one you read about everywhere, meshes exactly with the best modern advice.

John: The palaeo diet — I mean, for for real, hunter gatherers — was probably phenomenally diverse and complex, and it certainly was a great deal more than a slab of steak on a, on a plate.

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