Putrid Meat in the Tropics: It Wasn't Just for Inuit

JOHN D. SPETH*
Department of Anthropology, University of Michigan, Ann Arbor, MI 48109-1107, USA; jdspeth@umich.edu

EUGÈNE MORIN
Department of Anthropology, Trent University, Peterborough, Ontario, K9J7B8, CANADA; eugenemorin@trentu.ca

*corresponding author: John D. Speth; *jdspeth@umich.edu*

submitted: 26 April 2022; revised: 13 July 2022; accepted: 14 July 2022

ABSTRACT

It is widely known that traditional northern hunter–gatherers such as the Inuit included putrid meat, fish, and fat in their diet, although the ubiquity and dietary importance of decomposing animal foods seem often to have been underappreciated. There is no evidence that these arctic and subarctic foragers suffered from major outbreaks of botulism (*Clostridium botulinum*), or from the toxic metabolites of other pathogens such as *Listeria monocytogenes* or *Salmonella* spp., until the 1970s and 1980s when Euroamericans introduced more "sanitary" methods for putrefying Native foods. While many scholars are at least generally aware of the importance of putrefied foods among such peoples, most would not expect similar practices to have been commonplace in the tropics, especially in hot, humid environments like the Congo Basin. And yet a deep dive into the ethnohistoric literature of sub-Saharan Africa, and elsewhere in the tropics and sub-tropics, shows that both hunter–gatherers and traditional small-scale rural farmers commonly ate putrefied animal foods, consuming some of it raw, frequently cooking it, but often barely so. Moreover, these ethnohistoric accounts make it clear that Indigenous peoples often preferred it that way. Equally surprising, this preference for putrid meat remained widespread in the tropics well into the first quarter of the 20th century. Combining the insights gained by looking at the consumption of putrid meat in both northern and tropical environments, several interesting implications become evident. First, it is clear that the disgust response with regard to the taste, smell, and sight of rotten meat is not a hardwired human universal, but more likely a learned cultural response, one that is closely linked to European colonization, Westernization, urbanization, and industrialization. Second, the capacity for both northern and tropical peoples to consume putrid meat suggests that their ability to resist the toxic effects of *C. botulinum* and other pathogens most likely stems in large part from the environmental priming of their gut floras and immune systems through early childhood exposure to pathogens rather than from genetic factors. This conclusion fits well with findings from recent microbiome research, including studies of the gut floras of monozygotic twins. Third, putrefaction rapidly, and with little investment of time and energy, provides many of the same benefits that one gets by cooking, because it effectively "pre-digests" meat and fat prior to ingesting them. Finally, we suggest that, by eating meat and fat in a putrefied state, early hominins could have acquired many of the benefits of cooking, but at much lower cost, and quite likely long before they gained control of fire. Until early hominins began acquiring fresh meat in substantial quantities, presumably by hunting, the most important benefits of cooking may have been in the plant food domain.

INTRODUCTION

> *The microbiota of vertebrates rapidly begin to decompose their hosts after death. During the subsequent breakdown of tissue, these microorganisms excrete toxic metabolites, rapidly rendering the carcass a hazardous food source for most carnivorous and omnivorous animals.*(Roggenbuck et al. 2014:1)

The view expressed in the epigraph, written by experts in the study of vultures, is widely shared by scholars across a broad swathe of disciplines and almost certainly by a great many members of the general public. Yet, as we will show in what follows, it is surprisingly off the mark and, when it concerns humans, not only ahistorical, but also strikingly ethnocentric. After all, putrid meat, even meat crawling with maggots, has delighted the palates of circumpolar peoples, young and old, for centuries (see Speth 2017, and references therein; see also Eidlitz 1969; Skåra et al. 2015). Sweeping generalizations by biologists and wildlife specialists are frequently based on this Eurocentric bias, as exemplified by statements such as the following: "because *humans* have a distaste for rotting carcasses..."

(Shivik 2006 :816, emphasis added), or "the obvious reason for the historical lack of scavenging studies is *human* aversion to decomposing matter" (DeVault 2003: 226, emphasis added), or "in warm climates, [a piece of meat] is unacceptable to just about all within a few hours to days, *except those who specialize in eating meat in the later stages of decomposition*" (Janzen 1977: 703, emphasis added). Such statements display a lack of familiarity with the incredible diversity of traditional, non-Western human foods and foodways, many of which included ample and deliberate use of thoroughly putrid meat and fish, not as fallback foods during times of starvation, but as a highly desirable treat. The ethnocentrism displayed in these quotes with respect to food habits and patterns of meat consumption is particularly striking in the fields of evolutionary psychology and biomedical science where experimental observations are often based on subjects drawn from a relatively small subset of populations, many living in industrialized and urbanized nations that have been heavily influenced by Western values and practices and, as a consequence, experience greatly reduced overall exposures to food-borne and other pathogens (Jack et al. 2018).

Perhaps the most extreme example of just how far off the mark such studies can get is provided by Curtis et al.'s (2004) fairly recent look at supposed "human" disgust responses. Their research was based on data collected through a Web-based survey that received a staggering 40,000+ responses. Largely because of the immense sample size and because the respondents lived in many different places on the globe, these authors felt justified in concluding that "*humans* feel disgust for...faeces...rotting meat...[and]... maggots.... Disgust is thought to be universal in humans.... These data provide evidence that the human disgust emotion may be an evolved response to objects in the environment that represent threats of infectious disease" (Curtis et al. 2004: S131, emphasis added; see also Buss 2019: 71; Oaten et al. 2009: 315–317). As we will show in what follows, this survey actually proved nothing of the sort, at least not in so far as it concerned feces, rotting meat, and maggots. Instead, what it showed was just how "Westernized" the respondents were—in part because of the particular substances they expressed aversions to, in part because they were educated enough to participate in the survey, and in part because they were sufficiently wealthy and computer or smart-device savvy to have access to the Internet. If the authors of this survey learned anything useful, it is just how pervasive the forces of modernity and Westernization have become.

If anything, our present-day aversion to the sight, smell, and taste of putrid meat is largely a product of Westernization, one that has become increasingly "universalized" over the last two or three centuries through European conquest, colonialism, missionizing, genocide, destruction of landscapes and environments, imposition of Western educational systems and values, elimination of traditional foods and foodways that Europeans saw as "primitive" or "dirty," Western views of "proper" personal hygiene and sanitation, Western medicines and concepts of health, two World Wars, urbanism, industrialization, incorporation of local communities into global market economies, television, movies, smartphones, and the World Wide Web.

And as microbiology is beginning to show us, "Westernization," by altering and uprooting traditional foods, foodways, value systems, and environments, has brought about significant changes in the nature and composition of our gut floras (Blum et al. 2019; Candela et al. 2012; Conteville et al. 2019; Grieneisen et al. 2019; Gupta et al. 2017; Rampelli et al. 2015; Schnorr 2015, 2018; Schnorr et al. 2016; Wastyk et al. 2021; Yatsunenko et al. 2012), and in our immune responses to ingested pathogens and their potentially harmful metabolites (Alessandri et al. 2022; Apostol et al. 2020; Blumstein et al. 2017; Flies et al. 2015; Hassan and Blanchard 2022; McLaren and Callahan 2020; Murdaca et al. 2021; Ohishi et al. 1979; Pi et al. 2015; Seeber et al. 2020; Theis et al. 2020: 250; Wander et al. 2012). In fact, Westerners have come to see themselves embroiled in a never-ending "war against germs," sometimes gaining ground through heavy use of antibiotics, and then losing ground once more as pathogens become resistant to our "miracle drugs" and new disease-causing variants take center stage (Baldry 1976). The newly emerging focus among microbiologists on the linkages between our gut flora and our immune system is, in many ways, a much-needed reaction to this "war" mentality of past decades, an outgrowth and expansion of the original "hygiene hypothesis." This hypothesis, initially advanced by Strachan (1989), looked at the relationship between early childhood exposure to infectious diseases and the protection such exposure provided later in life against allergies and autoimmune diseases. Current research in microbiology is greatly broadening this focus to include bacterial pathogens, helminths, and a variety of other microorganisms and their deleterious metabolites.

So, coming full circle to where we began this paper, while there is little doubt that vultures, as obligate scavengers of carrion, are well adapted to a lifestyle awash with pathogens, a deep dive into the ethnohistoric accounts of non-Western small-scale traditional societies, regardless of latitude and environment, clearly shows that many human populations, right into the early decades of the 20th century, were not only very capable of safely consuming meat undergoing putrefaction, but often preferred it that way. In fact, contrary to the view of many evolutionary psychologists, the sight, taste, and perhaps smell, of putrid meat are almost certainly not universal hardwired elicitors of disgust, honed by millennia of natural selection to protect us from ingesting harmful pathogens, but instead are to a large extent culturally-contingent responses, very likely learned at an early age as infants first begin to observe the food habits and preferences of their closest and most trusted caregivers (compare the views of Oaten et al. 2009 and Stevenson et al. 2010 with those of Liberman et al. 2016; see also Rottman et al. 2019: 293).

USING ETHNOHISTORIC SOURCES

First, a word about our use of ethnohistoric accounts here and elsewhere (Speth 2017; Morin 2020). Comparative

studies are vital to understanding the amazing range of foods and foodways that humans have developed over the millennia. But comparative studies, be they environmental, cultural, or psychological, are severely handicapped by the tumultuous upheavals and transformations to which our planet and its Indigenous peoples have been subjected in the last few centuries—conquest; colonial rule; the slave trade; massive land clearance; logging; cattle ranching; rubber extraction; gold, copper, and diamond mining; forced relocations; loss of languages; new diseases; new foods and foodways; missionizing; extinction of both human and animal populations; damming of rivers; pollution of land, sky, and water; and climate change. One cannot expect to learn much about the traditional foods and foodways of many of the world's traditional societies after they have been told for centuries by white-skinned, racist, foreigners that what they ate was disgusting, filthy, and backward. So, in order for one to figure out whether a food was considered good or disgusting to the local people, one has to go back as far as possible in the accounts of the colonizers, and in the oral traditions of Indigenous groups, to see what the people were doing and eating before their cultures were irrevocably altered or literally obliterated by the expansion of colonial powers and market economies. There is no doubt that these early accounts literally ooze with bias and racial prejudice. Nothing illustrates this better than the frequency with which the word "disgusting" (in its various forms and its many synonyms) was used by early Europeans, be they English, French, German, Belgian, Spanish, Portuguese, Italian, or Dutch. But for the most part it is much easier to recognize such blatant prejudice and racism than it is to ferret out the far more subtle biases deeply embedded within today's scientific thinking and writing (an example of which we pointed out in the opening paragraphs of this paper). It often takes the passage of many years and the benefit of hindsight in order for us to see our own biases. In short, when used with caution, there is a huge amount of valuable and irreplaceable information tucked away in these early accounts. With that said, let us take a look at what the ethnohistoric record tells us about the consumption of putrid meat in the not-too-distant past.

PUTRIFIED FOODS IN THE CIRCUMPOLAR REGIONS

In two previous papers (Speth 2017, 2019), we synthesized a vast body of ethnographic and ethnohistoric information showing that traditional northern hunting peoples not only ate substantial quantities of putrid meat and fish, maggots and all, but, to the shock and horror of most Westerners, they viewed animal foods in an advanced state of decomposition, not as something foul-smelling, disgusting, and potentially dangerous to eat, but as a genuinely good tasting and desirable food (see also Bogoras 1904: 195–196; Burch 2006: 147; Yamin-Pasternak et al. 2014). When Euroamerican observers expressed their disgust at the stench of an Inuit's putrefying meat, an informant's response was: "We don't eat the smell" (Fienup-Riordan 1988: 11). Interestingly, this same response pops up repeatedly in early explorer and missionary accounts from a region of the world where conventional wisdom would lead us to least expect it—the steamy equatorial rainforests of lowland central Africa (see Cureau 1915: 220–221; Glave 1893: 102–103; Hensey 1924: 194; Nys 1896: 185; Picard 1896: 215–216; Reeve 1921: 72; Vervloet 1909: 400). To many Indigenous peoples the world over, the smell of rotten meat and fish was a sign of good food; it was decidedly not a universal trigger for gag reflexes or worse.

Importantly, despite their heavy reliance on putrid meat and fish, there is no evidence that northern hunting peoples suffered to any serious extent from botulism or the toxic metabolites of other pathogens until the 1970s and 1980s (see Department of Health and Social Services 2017: 7, their Figure 1 for a graphical display of the dramatic increase in probable and confirmed cases of botulism after 1970). That is when well-intentioned Westerners, thinking that Indigenous methods of putrefaction were unsanitary, introduced sterile plastic and glass containers, and in a number of instances shifted the site of putrefaction from what they perceived to be "dirty" pits and caches to "sanitary" sealed structures and containers. However, contrary to what they expected, the results of these supposed "improvements" were often disastrous (Burch 2006: 214; Chiou et al. 2002; Fagan et al. 2011; Shaffer et al. 1990). These Westerners were working with the same underlying assumption that Roggenbuck and colleagues expressed in the epigraph quoted above—that is, decomposing carcasses rapidly become hotbeds of pathogenic activity that are likely to be extremely hazardous sources of food "for most carnivorous and omnivorous animals" (including humans, of course). But northern hunting peoples have been eating such foods with apparent impunity for centuries, perhaps millennia, and often with no prior cooking, as have Icelanders, Scandinavians, and many others (Campbell et al. 2022; Skåra et al. 2015; Speth 2017).

Consider the following eye-opening example from late-19th-century Greenland (see Speth 2017 for many others):

> Ikwa...returned in a jubilant frame of mind, and announced his discovery of a cached seal. He asked Mr. Peary if he might bring the seal to Redcliffe in the boat, saying it was the finest kind of eating for himself and family. We could not understand why this particular seal should be so much nicer than those he had at Redcliffe; but as he seemed very eager to have it, we gave him the desired permission, and off he started, saying that he would be back very soon. About half an hour later the air became filled with the most horrible stench it has ever been my misfortune to endure, and it grew worse and worse until at last we were forced to make an investigation. Going to the corner of the cliff, we came upon the Eskimo carrying upon his back an immense seal, which had every appearance of having been buried at least two years. Great fat maggots dropped from it at every step that Ikwa made, and the odor was really terrible. Mr. Peary told him that it was out of the question to put that thing in the boat; and, indeed, it was doubtful if we would not be obliged to hang the man himself overboard in order to disinfect and purify him. But this child of nature did not see the point, and was very angry at being

> obliged to leave his treasure. After he was through pouting, he told us that the more decayed the seal the finer the eating, and he could not understand why we should object. He thought the odor 'pe-uh-di-och-soah' (very good). (Diebitsch-Peary 1894: 59–60)

Why weren't northern hunters like Ikwa, who clearly delighted in the taste of rotten meat, quickly incapacitated by the toxic byproducts of *Clostridium botulinum*, *Listeria monocytogenes*, *Salmonella* spp., or other presumably harmful or deadly pathogens? That is precisely what one would expect judging from the view expressed in the epigraph and the other quotes given earlier. And, of course, that's likely the thinking that guided the Westerners who sought to improve the Inuit's lot by compelling them to use more "sanitary" means for fermenting their animal foods.

Sadly, some forty years on we still do not fully understand what protected the Inuit from deadly pathogens such as *C. botulinum*, *L. monocytogenes*, *Salmonella*, and others, a capacity even more surprising given the high environmental prevalence of the spores of some of these pathogens, particularly in arctic marine mammals and coastal settings (Campbell et al. 2022: 4; Hauschild and Dodds 1993).

Some might point to the low average annual temperatures in the northern latitudes as the key. However, the neurotoxins of *C. botulinum* are not neutralized or destroyed by extended freezing or repeated cycles of freeze–thaw (Archer 2004: 129; James 1933: 241; Siegel 1993: 339), nor are *Listeria* and *Salmonella* (Archer 2004: 131; Golden et al. 1988: 17, 22–23). Some might also note that the low gastric pH of humans (~1.5) is similar to that of vultures and many other predator–scavengers (typically between 1 and 2), which might have given them a significant degree of protection against the harmful effects of ingested pathogens (see Beasley et al. 2015a: 5–6, 2015b: 115). Interestingly, Graves (2017: 467) has recently questioned the supposed link between low pH and protection against pathogens, noting that "...the stomach and intestines of New World vultures appear to be no more acidic than those reported for domestic fowl and non-scavenging birds that consume large animal prey." In any case, neither cold temperatures nor low gastric pH would explain why botulism and other potentially hazardous pathogens posed little threat to the Inuit until the 1970s, but then suddenly burst upon the scene, just as Westerners altered the way these northern hunter–gatherers putrefied their meat and fish. Stomach pH did not change. And while the temperature regime in sterile containers placed above-ground might have differed somewhat from the ones to which the foods were exposed using the diversity of traditional methods (e.g., below-ground pits, above-ground boxes, rock cairns, submerged in ponds and rivers, sealed in animal stomachs and seal pokes), this hardly seems like an adequate explanation for the sudden outbreaks of botulism. Likewise, the partial loss of traditional knowledge about methods of meat preparation falls short in explaining the marked rise in botulism observed in the last few decades (Shaffer et al. 1990).

We suspect instead that the answer to this conundrum lies largely within the domain of microbiology. While genetics undoubtedly plays a role, a number of recent studies, including some interesting comparisons of the gut floras of monozygotic twins, point to diet and environment as the principal factors of concern (Blum et al. 2019; Gilbert et al. 2018: 393; Grieneisen et al. 2019; Rothschild et al. 2018; Yatsunenko et al. 2012). Unfortunately, despite a veritable explosion of research in this and related fields, we still remain largely in the dark about the nature and composition of the microbiome that developed in traditional northern foods such as seals, walruses, caribou/reindeer, elk, muskoxen, polar bears, moose, arctic hares, and ptarmigans as they underwent putrefaction. Nor do we know how such a microbiome, functioning as an ecosystem that included not just a diverse assemblage of bacteria but also fungi and other microorganisms, might have served to inhibit or block the proliferation of pathogens across various stages of decomposition, particularly as the skin ruptured and exposed the carcass to exogeneous pathogens (Cosetta and Wolfe 2019; David et al. 2014; McFall-Ngai et al. 2013; Pierce et al. 2021). We also know regrettably little about the gut flora of northern hunting peoples, not just those who still subsist at least partly on "country" (i.e., traditional) foods, *but those who still make regular use of country foods prepared in traditional ways and using non-Western canons of hygiene* (see Campbell 2022; Dubois et al. 2017; Girard et al. 2017; Hauptmann et al. 2020a, 2020b).

It is important to point out that replicating "traditional" foodways is far more complicated than one might at first imagine. It is not merely a matter of putrefying a sample of meat under controlled laboratory conditions and then analyzing its microbial content. Indigenous peoples butchered their animals on the ground or on the bare earthen floor of their sod houses. Depending on season and location, many of the family's activities were carried out while sitting or squatting on the ground. Hearths were often shallow, ephemeral affairs, seldom rock lined, and usually also placed directly on the ground. In the Arctic, Indigenous foragers putrefied their meat and fish in below-ground pits, under piles of rocks, in marshes, ponds, caribou stomachs, or sewn seal skins. While indoors, family members worked in close quarters sitting on the ground or on hides taken from animals that had slept on the ground and may have deliberately wallowed in dirt to ward off flies and mosquitos. Like foragers worldwide, they squeezed excrement from the entrails of their kills and then, usually without washing them, stuffed the guts with meat, organs, and blood, fermented them, then froze them, and finally consumed the result (see the general discussion in Buck et al. 2016: 674). Women chewed on animal hides to stretch and soften them. They softened and tanned hides with concoctions of urine and fermented animal brains. Inuit bathed in urine from communal containers, as they had no other form of soap. Lice were plucked from the hair and bodies of family members and eaten (Anderson 1918: 64; Hearne 1795: 325–326; Portlock 1789: 286). Fermented stomach contents and chyme of caribou, ptarmigan, and other animals were delicacies. They ate maggots and warble fly larvae,

commonly uncooked, while feces from various animals (e.g., ptarmigan, caribou) were occasionally eaten as is or mixed with other animal products. Inuit and other groups also sometimes ate natural clays, a practice called geophagy. Dog pups were sometimes fed mouth-to-mouth. Moss substituted for diapers. Babies crawled on dirt floors and animal skins. Serving dishes were often communal and scraped clean but seldom washed. Houses were filled with strips of meat, rendered oil, blubber, and skins in all stages of preparation and decomposition. Meat that was being dried was hung from tree branches or racks and was often swarming with flies, many managing to deposit their eggs in the flesh. Stefansson (1914: 226) observed an Inuit woman who had stepped in dog excrement scrape it off her boots with her ulu knife, casually wipe the blade with a rag, then use the same knife to cut meat and prepare a meal. Perhaps more illustrative is this example taken from (presumably) Father Louis Nicolas in Native eastern North America in the latter half of the 17th century:

> Who would not be horrified to see, in addition to what I just described, pieces of meat laid out on the floor of the cabin, filled with the animal's hair and the hair of dogs that eat their fill of them, and then make their beds upon them? On the other side, a child, who has hands like a Moor because they are covered in grime, crying desperately because he wants something to eat, holding a knife, tries to cut a chunk of meat and throw it on the coals for a moment and then devour it. Another soils himself on his mother's knee, and she wipes him with her hand and continues with her work without bothering to wash her hands. She readies the meat for hanging on poles over the smoke and turns it over from time to time so that the smoke, acting more quickly, can dry it out sooner. To dry the flesh faster, she tramples it under her feet, which are very dirty and full of filth so awful I dare not describe it. And yet, this meat and its juices have to be eaten; that, or die of starvation. (Gagnon et al. 2011: 336, with minor corrections of the translation)

This brief and far from exhaustive overview shows that "traditional" techniques and practices involved constant close contact with numerous and diverse potential sources of contamination by microorganisms that served to enrich and diversify the gut floras of Indigenous northern peoples right from birth onward. Although such complexity will be nearly impossible to replicate experimentally, it is important that it be kept in mind as microbiologists increasingly come to recognize the significant role played by soil and other components of the natural and social environment in structuring human gut floras (e.g., Blum et al. 2019; Grieneisen et al. 2019; Murdaca et al. 2021).

PUTREFIED FOODS BEYOND THE NORTHERN LATITUDES

Even if our readers are willing to grant that northern foragers were able, by whatever means, to safely consume putrid meat, fat, and fish without marked rises of botulism or other food-borne diseases, we suspect that most, including many anthropologists, would still balk at the idea that humans could tolerate such a diet in the sweltering tropics where animal carcasses decompose far more rapidly (Beasley et al. 2015b; DeVault et al. 2003). But that conventional wisdom ignores some important evidence to the contrary. For one thing, almost all mammalian predators in sub-Saharan Africa, even in regions that straddle the equator, engage in some degree of scavenging (Houston 1979: 263; Jones et al. 2016: 468; Kane et al. 2017: 327). Leaving aside the vultures and other avian scavengers, these include lions, leopards, three species of hyenas, three species of jackals, wild dogs, hippos, warthogs, bushpigs, mongooses, genets, civets, bat-eared foxes, honey badgers, and a number of others (e.g., Dudley 2003; Houston 1979: 263; Jones et al. 2016; Wadley 2020). Moreover, in hot African environments, especially in regions close to the equator, decomposition begins very soon after death. Thus, for example, in the sweltering humid zones of the lowland Congo Basin, and in similar tropical environments elsewhere in Africa and beyond, decomposition is usually well underway within, at most, a few hours. Decomposition occurs somewhat more slowly in less humid areas, but still within two to at most three days (see Coad 2007: 79; Ndueze et al. 2013). Since many of these tropical latitude predator–scavengers continue feeding on carcasses beyond that one- or two-day window, conventional wisdom would tell us they are consuming meat that should pose a significant hazard to their well-being. Yet that is clearly not the case.

There is also an amazingly successful and somewhat unexpected newcomer on the block—the feral dog. Hunting in packs, these predator–scavengers are systematically outcompeting vultures, and in some areas even hyenas, for access to carrion (Butler and du Toit 2002; Gompper 2014; Houston 1979; Jones et al. 2016; Pain et al. 2003: 664–667; Vanak et al. 2014). It would seem that "man's best friend" did not have to become an obligate scavenger in order to take advantage of decomposing carrion, even carrion in very advanced stages of putrefaction (e.g., Samson and Ramakrishnan 2017: 23–24, and their Table 1). Like vultures and humans, domestic dogs have the benefit of very low gastric pH, with published figures, though variable, typically falling between 1 and 2 or 2.5 (e.g., De Cuyper et al. 2018: e618, their Figure 2; Dressman 1986; Mahar et al. 2012; Song et al. 2016: 1577). Beasley et al. (2015a: 5–6) give a higher value (4.5), but their figure is at odds with the more common lower values. That dogs can thrive on rotten meat and fish really should not come as much of a surprise. For example, in the far north, putrid flesh, skin, and fat of walruses, seals, caribou, and fish were standard fare for sled dogs (e.g., Bogoras 1904: 123; Stefansson 1920: 540; Urquhart 1935: 195). And dogs have been used for centuries by rural peoples throughout the world, not only as guards to warn against unwanted intruders, but as scavengers to keep communities free of food waste, offal, and excrement.

Thus, scavenging from carrion is by no means the exclusive domain of vultures (or hyenas), even in the equatorial regions of sub-Saharan Africa. While none of the mammalian scavengers, not even hyenas, earn the bulk of their living in this manner (Houston 1979: 263; Jones et al. 2016:

468), and certainly none are obligate scavengers, they all engage in some degree of scavenging. And, more importantly, they often tackle carrion that has been dead and exposed to intense tropical sun, high temperatures, and, in many areas, extreme humidity for days, even weeks (e.g., Crawshay 1904: 267; Handler et al. 2021: 7; Wadley 2020).

In an interesting recent study of scavenging using a motion-activated camera, Wadley (2020: 253–254) found that, in addition to hyenas, other mammalian scavengers made repeated visits to feed on a male kudu carcass over a period of three weeks, *even though the carcass "emitted a powerful scent of decomposition"* (Wadley 2020: 246; see also Handler et al. 2021 and Weihmüller et al. 2021). These persistent feeders included warthogs, bushpigs, and black-backed jackals. Wadley's observations dovetail well with Pereira et al.'s (2014: 50) more sweeping conclusion that: "mammalian carnivores that commonly scavenge seem adapted to deal with the toxins and pathogens that build up in carcasses with putrefaction, including the microparasites that might have caused the death of the animal...."

These observations raise two interesting questions. First, if traditional northern foragers such as the Inuit, prior to the introduction of Western foods and foodways, were capable of coping with the pathogens that they likely encountered when consuming *uncooked* putrid meat (e.g., Campbell et al. 2022), and if many non-human mammalian scavengers in the hot equatorial regions of sub-Saharan Africa also possess this same capability, is it not possible that Indigenous hunter–gatherers and traditional small-scale rural farming–hunting peoples living in these same tropical environments, at least prior to the modern era of globalization and Westernization, might also have possessed similar resistance to the byproducts of putrefaction? And second, if decomposed meat is or was considered desirable, and sometimes highly desirable, by people living at high latitudes, is it not also possible that similar attitudes toward meat prevailed in the tropics despite the hot and often humid conditions? We explore these questions in the remainder of the paper.

Table 1 summarizes data on the consumption of putrid meat garnered from a broad range of ethnohistoric accounts, most from sub-Saharan Africa, the principal focus of this paper, but also several from other tropical regions of the Old World (Australia, Borneo, India, Nepal, New Guinea, Sri Lanka, and Sumatra). Though we did not create a separate entry within Table 1 for temperate or Mediterranean Europe, carrion-eating seems to have been widespread in Serbia and elsewhere in central Europe well into the 20th century among *Roma* or Gypsies (e.g., Petrović 1939). We also gleaned similar data from early New World accounts, and Table 2 provides a number of examples from North, Central, and South America.

The tables list in alphabetical order the countries where the observations were made. In many of the African cases, this determination was a "best" approximation in light of the dramatic redrawing of political boundaries and renaming of ethnic groups and geographical features that have taken place over the past one or two centuries. The tables also note the animal or animals that were consumed when putrid (e.g., whale, hippopotamus, elephant, crocodile, tapir, livestock), although in many cases the observer simply noted that most or all of a group's meat was consumed, even preferred, in a putrid state, in which case the entry simply says "various." The source of the information, including relevant page numbers, is given, followed by a quote taken directly from the cited reference. The cases that we have chosen are those where it seemed reasonably clear that the meat was not just "aged" or "high," but genuinely undergoing significant putrefaction or decomposition. Those that we have chosen are also ones where it seems reasonably clear that the authors had actually witnessed people consuming meat in a putrid state rather than merely expressing Eurocentric prejudices or hearsay. As Shahani (2016) points out, making this distinction is not always an easy task.

A related issue concerns long-term changes in eating etiquette in response to the moralizing behavior of Westerners. We can expect that under pressure to abandon what the white foreigners perceived as "disgusting" practices, Indigenous peoples probably increasingly limited their consumption of putrid meat to private contexts. An excerpt from Native Australia illustrates the point:

> Although meat is sometimes dried over a fire or in the sun, or very crudely salted either in sea-water or in the salt left by the evaporation of sea-water on the rocks, this is rarely an effective preservative, and meat is eaten in a state which appears revolting and even dangerous to the eye of the White man. Today, aborigines will affect to be revolted by meat crawling with maggots, but once one turns one's back, they eat it with relish. (Worseley 1961: 168)

If we are correct in assuming that this type of response was common in order to avoid the scorn of incomers, the result is that the consumption of putrid animals is likely to be underestimated in ethnohistoric accounts, perhaps significantly so. In more recent accounts, especially those written by anthropologists, putrid meat consumption may also be under-reported, in this case in order to avoid the (unintentional) appearance of "dehumanizing" the people and cultures under study.

Unfortunately, the way putrid meat was prepared and consumed was often difficult to establish from the ethnohistoric accounts, in part because the descriptions were overly brief or vague, and in part because the observers, most of whom were men, were either uninterested in how the food was prepared or were deliberately kept away from the women who did most of the food preparation. Most accounts are unclear whether or not the putrid flesh was cooked at all, or smoked, or even dried before being eaten. Many observers do note that meat was dried and/or smoked, presumably to preserve it, but in most cases meat treated in this manner became putrid anyway. In many instances, however, it was already high, if not putrid, before it was smoked. Putrid meat was commonly cooked, but

TABLE 1. NON-ARCTIC OLD WORLD ETHNOHISTORIC ACCOUNTS DOCUMENTING THE CONSUMPTION OF PUTRID MEAT AND FISH.

(When one or more words have been omitted, it is denoted by "..."; When one or more whole sentences have been omitted, it is denoted by "[...]". As a rule, every effort was made to omit only text that did not alter the overall meaning of the passage.)

COUNTRY	ANIMAL(S)	REFERENCE	DESCRIPTION
		AFRICA	
Algeria	Ram	Pearn and Donkin 1934: 403	"After one meal off the ram the carcase began to putrefy, although neither Tuareg nor Arabs appear to mind eating green, rotten meat."
Botswana	Various	Dornan 1925: 115	"The Masarwas [Kalahari San] are not particular as to the state of the food they eat. It may be putrid, but it is all one to them: they devour it and seem to suffer no ill-effects. They crack and swallow the contents of eggs that are...absolutely rotten, with great relish. [...] If they find ostrich eggs on the ground that may have lain there all the season, they are cracked and the contents swallowed. [...] I have accustomed myself to stand fairly strong smells, but I could not understand how human beings could swallow eggs in the state in which these were."
Botswana	Kudu	Foster and Foster 2000 (film)	[min. 42.12] "Hunting is much more difficult than in the past times. Fences cut the land like blades. The herds can't travel their old paths to find food. We see our animals go to waste, and we are sad, and we are angry. The only ones who are happy are the flies and the vultures. We need to find meat. We see vultures feeding. We make them drink wind instead. Take their meat, snatch it from them. The flesh is stinking, three days dead. As children we grew up often eating rotten things, so it doesn't make us sick." [min. 43.27]
Botswana	Various	Stigand 1913: 387–388	"The Masarwa say that the meat remains quite good for a day or two, but if the carcase is left longer it swells very much and the meat goes rapidly bad. One concludes that it must get very bad indeed, since meat of a carcase that has become putrescent in the ordinary way, and which is in such a state of putrefaction as to cause the average European to make a detour in the veldt to avoid it, is most palatable to the Mosarwa, who doubtless looks upon such well-hung game as a dainty dish with plenty of flavour to it […] also the Makuba and the River Masarwa have not the slightest objection to well-hung fish. When you are being punted by them in the swamps they will with loving care recover the decomposed body of a fish floating on the water and preserve it in your canoe...."
Cameroon	Various	Bennett 1899: 81	"So far as I am aware, all fish, flesh and fowl is cooked before being eaten. Flesh is often extremely high, at times positively bad, before it is eaten, but not one morsel is ever wasted."

TABLE 1. NON-ARCTIC OLD WORLD ETHNOHISTORIC ACCOUNTS DOCUMENTING THE CONSUMPTION OF PUTRID MEAT AND FISH (continued).

COUNTRY	ANIMAL(S)	REFERENCE	DESCRIPTION
		AFRICA	
Central African Republic	Various	Cureau 1915: 220–221	"The Negro has so little aversion to tainted meat that one might think he preferred it to fresh. He will pick up and cook carrion which is in an advanced stage of decomposition, whose meat is putrefied, blue with decay, falling apart, and dripping with sanies. [...] When any one reproaches a Negro for his liking for decayed meat, he replies artlessly, 'I don't eat the smell'...."
Chad	Various	Pinto 1881: 370	"J'ai déjà mentionné que les Bihénos [people from the Bihé region] mangent tout ce qui a vécu et qu'ils préfèrent leur viande, s'ils peuvent s'en procurer, à l'état de putréfaction." "I have already had occasion to mention that the Bihenos will eat any mortal thing, and prefer their meat, when they can get it, in a state of putrefaction."
D. R. Congo	Various	Ankei 1990: 150	"A carcass of game found in a trap may have begun decomposing; men remove rotten intestines, dismember, and bring it back home; women burn the surface of decomposing meat; fly maggots fall like torrents; wash and cut into small pieces; remove nails and other inedible parts; boil in palm juice, and never saute in palm oil; put in the meat and boil for 1–2 hours; add salt and chili when the meat softens; simmer; boiled and squeezed pumpkin shoots...may be mixed in to conceal the smell of decomposing meat [...] I tasted this dish made from a carcass that was believed to have died five days before discovery; on the first day it had a very impressive smell even after two hours of cooking; however, it no longer smelt and its skin was soft and good after boiling again on the second day; eight years later, a dish of hare in a Paris restaurant reminded me of this taste."
D. R. Congo	Crocodile	Bailey 1894: 58	"A few miles down the river a most fetid odour was wafted towards us. The boys soon spied out what it came from, and were making for it. As soon, however, as I saw their little game, I ordered them on, and passed the putrid blown-out body of a dead crocodile. The Kroo boys actually wanted to secure some of this rotten flesh. Many times after, when with other tribes in the interior, I remarked their preference for bad meat to fresh."
D. R. Congo	Various	Bailey 1991: 95	"The Efe smoke their meat and, although it begins to take on a noisome odor after only two days, they and the villagers eat it with great delight after it has been sitting for even a week."

TABLE 1. NON-ARCTIC OLD WORLD ETHNOHISTORIC ACCOUNTS DOCUMENTING THE CONSUMPTION OF PUTRID MEAT AND FISH (continued).

COUNTRY	ANIMAL(S)	REFERENCE	DESCRIPTION
		AFRICA	
D. R. Congo	Hippopotamus	Bailey 1894: 237–238	"...my boys saw something floating towards us. [...] [W]e discovered by the smell...that it was a dead hippo. The Bangalas were for towing it at once to a sandbank, there to cut it up. This I would not allow, for the animal was rotten, and the smell enough to suffocate one. The grumbling was great, although I promised to shoot one and give them fresh meat. I said, 'You cannot eat that stinking beef.' They answered, 'We don't eat the stink, but the meat.'"
D. R. Congo	Fish, various	Davis 1941: 259	"Neither is the Congolese over nice about the state of preservation of his animal food. Meat is meat to him and is to be accepted as such wherever found, regardless of kind, consistency, or condition. I was travelling with a group of natives in a canoe going to Mbala from Lotumbe, once, and we came upon a big dead fish floating in the river. They let out a shout of joy and headed for it. The canoe was not mine and I had bummed the ride, so I could not very well remonstrate with them about their find. I got into the bow of the dug-out and held my nose and my tongue. The fish was so rotten that they had to lift it out of the water with a mat to keep it from entirely disintegrating. They took it tenderly aboard and at the first beach we came to they warmed it up a little over a fire and ate it with gusto. Because of climatic conditions meat spoils so rapidly that by the time it has reached the village from the forest it is frequently quite ripe. But nothing ever deters the native from satisfying his desire for it. The odour is never too overpowering; the maggots are never too thick, the state of decomposition is never too complete. Their cast-iron constitutions seem to be able to withstand even the most violent gastronomic insults without being too seriously affected."
D. R. Congo	Hippopotamus	Deken 1900: 131	"La chair d'hippo se corrompt promptement; celle-ci répand déjà telle odeur que le capitaine a défendu d'en rapporter à bord la moindre parcelle qui ne serait pas fumée. Cette mesure est de rigueur en pareille circonstance, car le nègre n'aime rien tant que la viande ultra-faisandée." "Hippo meat quickly spoils; it gives off such a smell that the captain prevents anyone from bringing on board even the smallest part that has not been smoked. This rule is necessary in such circumstances, because the negro loves nothing better than ultra-high meat."

TABLE 1. NON-ARCTIC OLD WORLD ETHNOHISTORIC ACCOUNTS DOCUMENTING THE CONSUMPTION OF PUTRID MEAT AND FISH (continued).

COUNTRY	ANIMAL(S)	REFERENCE	DESCRIPTION
		AFRICA	
D. R. Congo	Wild pig	Dorman 1905: 176–177	"The climate in the Congo is very bad for all kinds of food. Antelope, killed in the early morning, is often rotten by the evening, and thus the difficulty of obtaining fresh food is greatly increased. The rapidity with which flesh decomposes is, perhaps, the reason why the natives prefer it in that condition, for as it is so difficult to obtain meat fresh, they may have acquired the taste for it rotten, just as some civilised people train their palates to prefer game high. It is however, very disgusting to see them eating. One day a carcase of a wild pig in a highly decomposed condition was picked up by one of the paddlers on the Ubangi. This was cut up and shared among the canoes and part of it fell to my crew. Next day a most unpleasant smell accompanied us all the forenoon and no one could detect the cause, in fact, none of the natives noticed it. At lunch time however, the polemen produced a basket full of rotten flesh which they had stored in the front part of the canoe and thus given me the full benefit of it. As they commenced eating it raw, it was rather too much and I promptly ordered them to the other end of the boat where I could neither see nor smell them."
D. R. Congo	Various	Glave 1893: 102–103	"When he [the Congo man] has a quantity of meat he gorges while the savory morsels last, arguing that he may die before to-morrow, and be the loser of a great deal of pleasure. Even if the meat is tainted and the odor of it is so strong as almost to overpower the passer-by, it is not rejected on that account; and any disgust I ever expressed on seeing the natives eat hippopotamus meat, the odor of which would have been intolerable to a civilized man, was met by the retort: 'Bisu ku-ola niama, tu-kuola ncholu té!' (We eat the meat, but we don't eat the smell!)...."
D. R. Congo	Various	Hensey 1924: 194	"Having very few domestic animals, they have to depend largely on wild meat and fish. This means a precarious supply. As preservation of food is difficult in such a climate, their meat is often 'too ripe.' In fact, they will calmly tell you that it is better so—that fresh meat is not nearly so tender nor of such rich flavor. Often my civilized nostrils have been offended by their putrid food, and I have asked them: 'How can you eat such vile-smelling meat?' Almost invariably the reply is: 'White Man, we don't eat the smell, we eat the meat!'"
D. R. Congo	Various	Johnston 1908: 627	"The affection of almost all the Congo races, except those of slightly European culture in the south and west, for putrid meat or fish is remarkable."

TABLE 1. NON-ARCTIC OLD WORLD ETHNOHISTORIC ACCOUNTS DOCUMENTING THE CONSUMPTION OF PUTRID MEAT AND FISH (continued).

COUNTRY	ANIMAL(S)	REFERENCE	DESCRIPTION
		AFRICA	
D. R. Congo	Large rodent	Landor 1907: 80–81	"My men...saw that day a big rodent, a *nduta*, about as big as a cat in its normal condition, but in this case, owing to its decomposed state, swollen to the size of a small pig. They immediately swerved the canoe towards it. When the floating animal came alongside the stench was such that it made me quite ill. I was nearly choked. Unable to speak or breathe, I was trying to signal to my men not to touch it and to get away, but in a moment the putrid beast was hauled on board and, in less time than it takes to write about it, it was eaten. The odour when they dug their knives into it was enough to kill the strongest of men. When I recovered, my admiration for the digestive powers of these people was intense. They were smacking their lips and they said the *nduta* had provided most excellent eating."
D. R. Congo	Antelope, buffalo, elephant	Maes 1909: 608	"Ils ne connaissent ni les repas à des heures régulières ni la délicatesse dans le choix de leurs aliments. Tout convient à leur gourmandise, mais ils adorent la viande. Que ce soit la chair d'antilope, du buffle, de l'éléphant, du rat voir [sic] même du singe; qu'elle soit fraîche et saine ou qu'elle soit dans un état de décomposition au point de répandre une odeur quasi insupportable, pour eux la viande est toujours bonne, et ils se garderont bien de ne pas profiter de toute aubaine que le hasard vient leur offrir." "They don't know meals at regular times or the delicacy in the choice of their food. Everything suits their taste, but they love meat. Whether it is the flesh of an antelope, a buffalo, an elephant, a rat or even a monkey; whether it is fresh and healthy or in a state of decomposition to the point of spreading an almost unbearable odor, for them the meat is always good, and they will be careful to not miss out on any windfall that chance offers them."
D. R. Congo	Various	Nys 1896: 185	“Les indigènes mangent rarement la chair fraîche qu'ils trouvent trop coriace; ils la préfèrent dans un état de décomposition avancée. Quand on leur demande comment ils savent manger la viande, lorsqu'elle répand une odeur infecte à dix mètres à la ronde, ils répondent qu'ils ne mangent pas l'odeur.” “The natives rarely eat fresh meat which they find too tough; they prefer it in an advanced state of decomposition. When asked how they can eat meat whose foul smell can be perceived from ten meters away, they answer that they do not eat the smell."

TABLE 1. NON-ARCTIC OLD WORLD ETHNOHISTORIC ACCOUNTS DOCUMENTING THE CONSUMPTION OF PUTRID MEAT AND FISH (continued).

COUNTRY	ANIMAL(S)	REFERENCE	DESCRIPTION
		AFRICA	
D. R. Congo	Buffalo	Papy 1949: 126	"Les Batéké sont friands de viande. [...] Un interdit d'origine rituelle ne leur permet pas de consommer de la chair d'éléphant. Mais le buffle qui commence à pourrir, cru ou cuit, est un mets de choix; on fait boucaner sa viande, pour la conserver quelque temps, à la fumée d'un feu allumé dans un trou." "The Batéké are fond of meat. [...] A ritual prohibition does not allow them to eat elephant meat. But buffalo that begins to rot, raw or cooked, is a delicacy; the meat is smoked, to preserve it for a while, using smoke from a fire lit in a pit."
D. R. Congo	Hippopotamus	Picard 1896: 215–216	"Le boy noir qu'un Congolais imprudent ramène, a les yeux inquiets de l'animal à qui le vague instinct révèle qu'il va à l'abattoir. […] Regrette-t'il sa chikwangue, pain de manioc, son batakoro, morue sèche, son lozo, riz manipulé en boulettes grosses comme des oeufs, avalées d'un seul coup, la viande faisandée de l'hippopotame, délice de putréfaction dont ses congénères disent à qui les interroge sur ce goût pour les pourritures: Est-ce que nous mangeons l'odeur?" "The black boy, whom a reckless Congolese brings back [in a boat to Europe], has the anxious eyes of the animal whose instinct tells him that he is going to the slaughterhouse. […] Does he miss his chikwangue, cassava bread, his batakoro, dry cod, his lozo, rice formed into dumplings the size of eggs, swallowed whole, the high meat of the hippopotamus, a delicacy of putrefaction that his fellows tell anyone who asks them about this taste for rotten foods: Do we eat the smell?"
D. R. Congo	Elephant	Putnam 1948: 331–332	"They will follow the elephant two or three days, until he finally lies down and dies.... Sometimes he has been dead for some time when they reach him, and he may be blown up like a balloon and rotten. Still they will eat him, for rotten meat, if thoroughly boiled, is edible. [...] When a group of pygmies reaches a blown-up elephant...a free-for-all takes place; the men cut the sides open, pull out the entrails, and climb inside to hack away at the meat. [...] The women take the pieces of meat which their men hand to them, and boil them. [...] Everyone eats as much of the boiled meat as he is able, and they spread out the rest on drying racks; when it has dried they will take it into the village to the Negroes, who keep it and eat it gradually, for the combination of boiling and drying serves as a means of preserving it, the only food preservation the pygmies practice...."

TABLE 1. NON-ARCTIC OLD WORLD ETHNOHISTORIC ACCOUNTS DOCUMENTING THE CONSUMPTION OF PUTRID MEAT AND FISH (continued).

COUNTRY	ANIMAL(S)	REFERENCE	DESCRIPTION
		AFRICA	
D. R. Congo	Various	Reeve 1921: 72	"The animals...killed include elephants, hippopotami, buffaloes, large and small antelopes, and wild hogs. The meat is cut up into large hunks and dried—that is, the outside of the hunks is dried, while the inside is often left raw. Of course this soon rots and fills up with worms, but this does not effect its desirability as food so far as the native is concerned. Worms, rotted meat, and all are put into the pot and cooked. When the white man remonstrates against their eating such stuff, pointing to the worms as evidence of its unfitness for food, the native replies: 'The worms, why, they are meat too.' Then the white man says: 'How can you eat anything that smells so badly?' [...] And again the black man replies: 'We eat the meat; we don't eat the smell.'"
D. R. Congo	Various	Sato 1983: 42	"It is not uncommon that the meat with a considerably foul smell is consumed without discard. Game, that has been dead more than 3 days and in which worms have bred, may be considered edible if when the hunter beats the body he hears dry and clear sounds. Cooking of rotten meat begins with boiling it in water. After boiling, dead worms are removed and the meat is washed with water. The washed meat is cooked according to the procedure for boiling fresh meat."
D. R. Congo	Elephant, buffalo, boar	Stuhlmann 1894: 455–456	"Ausser mit den Waffen erlangen die Pygmäen ihre Jagdbeute durch Wildfallen, in deren Aufstellung sie ausserordentlich geschickt sind. Sehr häufig werden Fallgruben gemacht, oder es wird ein Klotz mit oder ohne daran befestigter Lanzenspitze, in der Höhe aufgehängt, der auf das Opfer herabfällt, sobald es einen über den Weg gespannten Strick berührt. Elephanten, Büffel und Schweine bilden das hauptsächlichste Wild. Wenn sie ein grosses Thier erlegt haben, siedeln sich die Leute in der Nähe, wo es gefallen, so lange an, bis es verzehrt ist. Starke Zersetzung des Fleisches verhindert nicht dessen Genuss." "In addition to weapons, the pygmies obtain their prey through game traps, which they are extremely skilled at setting up. Very often pitfalls are made, or a log, with or without the tip of a lance attached to it, is hung up high, which falls on the victim as soon as it touches a rope stretched across the path. Elephants, buffalo and pigs make up the main game. When they have killed a large animal, people settle near where it has fallen, until it is eaten. Severe decomposition of the meat does not prevent its consumption."

TABLE 1. NON-ARCTIC OLD WORLD ETHNOHISTORIC ACCOUNTS DOCUMENTING THE CONSUMPTION OF PUTRID MEAT AND FISH (continued).

COUNTRY	ANIMAL(S)	REFERENCE	DESCRIPTION
		AFRICA	
D. R. Congo	Various	Torday and Joyce 1922: 176	"Quoique l'on [the Bankutu] mange la viande faisandée, on la préfère généralement fraîche. On n'en perd rien, même si elle est littéralement décomposée. On connaît bien le procédé de conservation de la viande par fumigation, mais cette méthode est loin d'être aussi employée que chez les Basongo Meno. Quelques personnes font bouillir cette viande fumée avant de la manger, mais d'autres la font simplement chauffer sur le feu." "Although they [the Bankutu] eat high meat, they generally prefer it fresh. Nothing is lost, even if it is literally decomposed. The process of preserving meat by smoking is known, but this method is far from being as widely used as among the Basongo Meno. Some people boil this smoked meat before eating it, but others simply heat it over the fire."
D. R. Congo	Hippopotamus	Vervloet 1909: 400	"Toute fraîche, la viande d'hippo (surtout celle des jeunes animaux) est très acceptable. Mais, sous la température tropicale qui règne dans la région, cette viande se corrompt très rapidement et dégage alors une odeur nauséabonde. Ceci du reste, n'empêche pas les indigènes de continuer à s'en régaler durant plusieurs jours, répondant si on leur exprime un certain étonnement de cette singulière aberration du goût 'nous mangeons la viande mais pas l'odeur'"! "When fresh, hippo meat (especially that of young animals) is very acceptable. But, under the tropical temperature that reigns in the region, this meat spoils very quickly and then gives off a nauseating odor. This does not prevent the natives from continuing to feast on it for several days, responding if one expresses a certain astonishment to them at this singular aberration of taste 'we eat the meat but not the smell'"!
Egypt	Sheep	Cailliaud 1826: 125	"Les Arabes de Barqah avaient apporté un grand nombre de moutons écorchés et séchés au soleil. En traversant la place, nous fûmes infectés par l'odeur fétide des viandes pourries, qu'ils transportaient avec eux depuis quinze jours." "The Arabs from Barqah had brought a large number of skinned sheep that had been sun-dried. While crossing the plaza, we were infected by the horrible stench of the rotten meat that they had transported with them for fifteen days."

TABLE 1. NON-ARCTIC OLD WORLD ETHNOHISTORIC ACCOUNTS DOCUMENTING THE CONSUMPTION OF PUTRID MEAT AND FISH (continued).

COUNTRY	ANIMAL(S)	REFERENCE	DESCRIPTION
		AFRICA	
Egypt	Shark	Sonnini 1799: 247	"The shark is eatable, it is true, but I believe was never reckoned a food of exquisite flavour, except, when half putrid, by some of the negroes."
Ethiopia	Elephant	Austin 1902: 149–150	"Shortly before arriving at this point we had been overpowered by a most sickening odour; we hastened on, and it still hung heavy on the air, though we should have been out of range of it. [...] Mabruk Effendi was called up, to make a searching inquiry into its whereabouts and origin. He soon ascertained that three or four of the Jehadia had concealed something tasty in the skin bags, slung over their shoulders, which proved to be green, rotten, elephant meat, ten days old at least. This length of time means little in England, a good deal in Africa. They had obtained this treasure when they came on the carcass in the bush, had annexed chunks of the foul stuff, and then rejoined the donkeys and drove them gaily along. A traction-engine would have shied if that awful smell had been attached to it; but these jackals enjoyed it apparently, and were looking forward to a hearty meal on arrival in camp. They were much perturbed when sternly ordered to throw away their skin bags, meat and all, but nothing short of this would have removed traces of what these had contained."
Ethiopia	Cattle	Gwynn 1911: 122	"Travelling was unpleasantly hot at this lower level, and the stench of dead cattle, the victims of a severe visitation of rinderpest, did not improve matters. The rinderpest had been particularly bad on the Boran highlands, and the country was full of Abyssinians attracted by the opportunity of gorging themselves with meat. The natives were only too glad to dispose of their moribund animals. Much of the meat was dried and carried away, but the whole idea is rather horrible...."
Ghana	Field-rat	Cardinall 1920: 82	"I have seen sights fit to turn one's stomach; but these people are indifferent. There is a field-rat which is greatly desired. They are taken at the time of burning grass, when clumps are left after the fire has first gone through. The animals are pounded up in their skins and no effort is made to disembowel them. When the pounded animal is putrescent it is eaten."
Ghana	Cattle	Fortes and Fortes 1936: 250–251	"The Tallensi are not particularly discriminating in their choice of meat. Domestic animals dying of disease are eaten to the last shred. At the height of the ritual season cows are often slaughtered and left to lie in the broiling sun for two days before time is found to skin them. The meat, already putrescent, is nevertheless enjoyed despite its stench."

TABLE 1. NON-ARCTIC OLD WORLD ETHNOHISTORIC ACCOUNTS DOCUMENTING THE CONSUMPTION OF PUTRID MEAT AND FISH (continued).

COUNTRY	ANIMAL(S)	REFERENCE	DESCRIPTION
		AFRICA	
Ghana	Various	Purchas 1625: 935	"They use altogether raw and strange kind of meates…. […] Dogs, Cats, and filthy stinking Elephants, and Buffoloes flesh, wherein there is a thousand Maggets, and many times stinkes like carrion, in such sort that you cannot indure the smel thereof…. […] …they eat raw Dogs guts, and never…roast them, which we our selves saw…."
Guinea-Bissau	Various	Carreira 1969: 58	"Another of the customs harmful to the life of a child is the precociousness with which it is made to eat food inappropriate for its age and physical condition, such as 'fundo,' sorghum, rice (cooked), small portions of decomposed meat or fish, and so forth. When the children are able to sit up or crawl, the mothers leave them on the floor, paying no attention to them as they carry out their chores. The children then unconsciously eat dirt, grains of rice, and corn dropped from the mortar or storage jars, and everything else within their reach. This too is one of the more probable causes of the great incidence of enteritis and other intestinal diseases registered at the Health clinics and posts."
Kenya	Various	Chanler 1896: 374	"Later...from them [Dorobo] I gathered some idea of their mode of life. In the rainy season...[they] watch for vultures. When they see these birds circling about and finally descending to the earth, word is sent to the village, and all sally forth in search of food. They will eat anything in the shape of meat, be its state of putrefaction what it may; and I was told that they frequently battled with hyenas and vultures for the remains of the carcass of some beast, slain by a lion or other animal, long after an ordinary human being would be willing to approach within 100 yards of it."

TABLE 1. NON-ARCTIC OLD WORLD ETHNOHISTORIC ACCOUNTS DOCUMENTING THE CONSUMPTION OF PUTRID MEAT AND FISH (continued).

COUNTRY	ANIMAL(S)	REFERENCE	DESCRIPTION
		AFRICA	
Kenya	Hippopotamus	Jackson 1930: 225–226	"The most remarkable thing about the ravenous desire of the Kavirondo for meat was the fact that they rarely touched it, as they were not sufficiently well off in stock; yet they gorged masses of the most horrible putrefaction without ill effects. Even more remarkable than their general immunity from stomach trouble, was the digestive powers of small boys. In order to hasten the extraction of the hippo tusks, the skulls were buried just outside the camp, but before burying they were stripped of nearly every scrap of meat. But even the little that was left...appeared to be a sinful waste in the eyes of small boys who came forward and volunteered to reduce the remnant still further [...] As each fragment of meat or gristle was removed it was eaten [...] It was a revelation to watch those nimble-fingered little savages with the improvised cane-scalpels remove every scrap of adhesive matter from even such a confined space as an eye-socket. In the meantime the scraps of meat and fragments of gristle began to have an amazing effect on the stomachs of the industrious operators as they began to swell and went on swelling until they became to the touch literally as tight as drums. [...] Yet next morning they appeared in a normal deflated condition and quite ready to start afresh."
Kenya	Elephant	Neumann 1898: 230–231	"It is extraordinary what miserable places these Ndorobo camps are.... Baithai and his companions and their women came in just after we got there, the women laden with rotting elephant bones and putrid meat. It seemed he had found a small elephant dead, undoubtedly the one I had shot...."
Kenya	Various	Powell-Cotton 1904: 63	"In the afternoon, we were rather amused to see the porters, who had been set to work to boil, in our tin bath, the heads of the beasts we had killed, busily employed eating the brains and the little pieces of flesh and gristle which still adhered to the bone. As many of the skulls had been shot for some days, they must have held almost as many maggots as brains, but this did not seem to put the porters off in the least…."

TABLE 1. NON-ARCTIC OLD WORLD ETHNOHISTORIC ACCOUNTS DOCUMENTING THE CONSUMPTION OF PUTRID MEAT AND FISH (continued).

COUNTRY	ANIMAL(S)	REFERENCE	DESCRIPTION
		AFRICA	
Liberia	Elephant	Soubrier 1936: 168	[After two days] "Le carnage a repris autour de l'éléphant qui dégage une odeur épouvantable de charogne. Les vers y fourmillent. Avant d'envoyer les morceaux sur le feu, on fait tomber, du bout de la machette, des grappes d'asticots. Les flammes détruisent le reste. Les hommes pataugent jusqu'aux mollets dans la pourriture et la boue, au milieu des mouches. La carcasse a gonflé. Des chairs verdâtres ou violacées pendent le long des côtes, tendues comme des arbalètes. Le crâne est livré aux mouches, qui se chargent de le nettoyer. On l'a recouvert de feuillages pour leur faciliter la tâche et empêcher que le soleil ne durcisse les lambeaux de viande qui adhèrent encore. Dans quelques jours, les pointes se détacheront d'elles-mêmes. Pour sortir les viscères, il faut éventrer la carcasse. Au premier coup de machette, le ventre éclate comme un ballon; au deuxième, un énorme jet de matières putrides s'échappe, inondant les hommes; et les rires, les cris reprennent de plus belle. Une masse d'intestins, brillants et irisés, a glissé mollement sur le sol. L'atmosphère devient irrespirable." [After two days] "The carnage continues around the elephant, which gives off the terrible stench of carrion. Maggots swarm there. Before putting the pieces on the fire, clusters of maggots are knocked off with the tip of the machete. The flames destroy the rest. The men wade up to their calves in the rot and mud, amid the flies. The carcass is bloated. Greenish or purplish flesh clings to the ribs, stretched taut like crossbows. The skull is left to the flies, which take care of cleaning it. We covered it with foliage to make it easier for them, and to prevent the sun from hardening the shreds of meat that still adhere. In a few days, the tusks will come off on their own. To remove the viscera, the carcass must be disembowelled. At the first blow of the machete, the belly bursts like a balloon; on the second, an enormous jet of putrid matter escapes, flooding the people; and the laughter, the screams, start again. A mass of intestines, shiny and iridescent, slid limply to the ground. The air becomes unbreathable."
Malawi	Various	Stannus 1910: 323	"The fried fish eaten is often partly decomposed, and meat which is very high, even with maggots, is cooked and eaten, maggots and all."

TABLE 1. NON-ARCTIC OLD WORLD ETHNOHISTORIC ACCOUNTS DOCUMENTING THE CONSUMPTION OF PUTRID MEAT AND FISH (continued).

COUNTRY	ANIMAL(S)	REFERENCE	DESCRIPTION
		AFRICA	
Mozambique	Whale	Owen 1833: 274	"We found on the shore the putrid carcase of a whale, the smell of which had brought gangs of natives from the neighbourhood within olfactory range, to regale upon the delicious morsel; and day and night the fires informed us of the continuance of the feast, whilst the perfume gave us constant evidence of its disgusting nature."
Namibia	Various	Andersson 1875: 233	"With the exception of the hyena...they eschew not the flesh of any other animal, whether tame or wild. [...] What is more than strange, however, is that both flesh and fish, even when in a high state of putrefaction, are eaten by them with great gusto, and singularly enough, no evil consequences would appear to follow the banquet."
Nigeria	Elephant	Christy 1924: 147–148	"...a number of vultures were circling about...in the direction of the place where we had first come upon the elephants. [...] The Bassakomo living in the hills...had heard our shots, and somehow discovered a dead elephant, even while we had been searching for it. When we arrived on the spot they were hard at work chopping it up, and had already made one journey to their village with meat.... I had never then witnessed the chopping-up of a big carcass by a hoard of savages.... [T]he natives...seemed to revel in the gory, maggotty [sic], stinking surroundings. The...appalling smell and the dense cloud of flies, all helped to accentuate the demoniacal character of the scene. [...] Although the meat was now three days old and abominable, each of my party loaded up as much as he could carry.... My camp that night was almost unendurable...."
Nigeria	Various	Tremearne 1912: 242	"...Hausawa [Hausa] will eat flesh absolutely rotten, often not even troubling to cook it."
Senegal	Various	Anonymous 1841: 114	"The Jaloofs...are equally scrupulous in avoiding to eat 'of anything that dieth of itself'.... The necessity of such a law is, however, pointed out by the practice of the Timanees, Bullonis, and other pagan Africans, who eat without scruple the flesh of animals without regard to the manner in which they died, and even when far gone in putrefaction. Indeed they prefer it after decomposition has commenced...."
Senegal	Hippopotamus	Gray 1825: 266	"I have seen a dead hippopotamus floating down the river, and poisoning the air with its putrid vapours, drawn to shore by them, and such was their love of meat, that they nearly came to blows about its division."
South Africa	Various	Campbell 1822: 186	"I heard of no animal which they did not eat with a relish, even in a state of absolute putridity."

TABLE 1. NON-ARCTIC OLD WORLD ETHNOHISTORIC ACCOUNTS DOCUMENTING THE CONSUMPTION OF PUTRID MEAT AND FISH (continued).

COUNTRY	ANIMAL(S)	REFERENCE	DESCRIPTION
		AFRICA	
South Africa	Various	Colenso 1865: cclxi	"There is a word, *ubomi*, which is used for "meat, rather high," in fact, in an incipient state of putrefaction, which is regarded by the wild Zulus as rather a dainty. Hence, to be "eating *ubomi*" has come to be used among them as an expression for a state of great enjoyment, of supreme felicity."
South Africa	Various	Farini 1886: 438	"we...passed the night at an old Boer's werf, where there were two families of Berg Bushmen encamped.... [...] One of them was on his knees, in the sand, licking up the marrow that fell from some bones which an elder Bushman was knocking on a stone. The stench from it was so great we were obliged to walk away, when the old Boer said that the bones were those of a horse of his that had died from disease, and that the Bushmen ate all kinds of putrid, diseased meat, seemingly without any injury to themselves."
South Africa	Seals	Foster 1905 [1608]: 15	"And having brought our boates laden with these seales, we cutt the fatt from them for oyle, and the rest was throwne a good distance from the tents because of noysomnes; upon which fish the Saldanians fed very hartilie on, after it had lyen in a heape 15 daies, that noe Christian could abide to come within a myle of itt. Not withstandinge the loathsomnes of the smell, these people would eate of it as if it had bene better meate, and would not take of that which laye upon the topp, which were the sweetest, but would search under for those which were most rotten, and laye it on the coales without any ceremonyes of washinge; and beeinge a little scorched with the fire, would eate it with a good stomacke…."
South Africa	Horse	Moffat 1842: 367–368	"...a dead horse was found that had belonged to one of the Griquas.... Next morning the women fell on the swollen and half putrid carcase, and began...to tear it limb from limb [...] every particle of skin, meat, bone, the entrails, and their contents, were carried off. Mr. H...[found] it absolutely impossible to induce them to leave the spot till every particle was devoured, and in the evening they actually danced and sang with joy! This will appear the more astonishing, as the women were allowed a regular supply of rations...."
South Africa	Whale	Paterson 1789: 116	"When it happens that a Grampus [whale] is cast ashore, they remove their huts to the place, and subsist upon it as long as any part of it remains; and in this manner it sometimes affords them sustenance for half a year, though in a great measure decayed and putrified [sic] by the sun."

TABLE 1. NON-ARCTIC OLD WORLD ETHNOHISTORIC ACCOUNTS DOCUMENTING THE CONSUMPTION OF PUTRID MEAT AND FISH (continued).

COUNTRY	ANIMAL(S)	REFERENCE	DESCRIPTION
		AFRICA	
South Africa	Various	Percival 1804: 85	"...with the Hottentot: his only motive for the chase is to prevent himself from starving; nor does he ever undertake it except when impelled by the imperious calls of hunger. Instead of salt to correct the putrid qualities of their meat, for it is in that state they prefer it, the Hottentots use the juice of limes, or of certain acrid plants, and also ashes of green wood."
South Africa	Cattle	Shooter 1857: 29	"With so great a passion for beef, we cannot feel surprised that they should eat animals which have died from disease. Nor does it much signify how long they may have been dead, provided they are not absolutely putrid. The man just mentioned told me that he would eat a cow which had been lying in the bush three days; but he did not think that the beef would be palatable on the fourth"
South Africa	Various	Sparrman 1785: 12–13	"At this Zwart-kops river...we found two farmers had got in before us, who were come thither in order to get salt and hunt. Indeed, they had already shot several heads of game, which they had hung up in large slips and shreds on the bushes, waggons, and fences, in order to dry it in the sun.... From this flesh there was diffused round about the spot not only a crude and rank smell, but likewise a putrid stench from such parts of it as had arrived at the state of putrefaction; and the farmers wives and children, together with the Hottentots who had accompanied them, with a view to assist them, as well as for their own pleasure, were employed in feasting upon it...."
South Africa	Gemsbok	Steedman 1835: 21	"Some Bushmen...[a]fter witnessing...my operations in preparing, as a zoological specimen, the skin of the gems-bok, which I had shot on the previous day, they evinced the greatest eagerness to possess themselves of the flesh. No objection being made to their removing the fragments, which they regarded as a valuable prize, although by this time almost in a state of putrefaction, they speedily constructed a raft for conveying their treasure to the other side of the river."
South Africa	Fish	Terry 1655: 18–19	"I once tooke notice of a Couple of them, who had found on the neighbouring shore a large piece of a dead fish the Sea had cast up, which did most sufficiently stink, they presently made a little fire with dry Cow-dung, and with this they warm'd it, and then they eat it, with as much seeming appetite, as an hungry man with us, would feed upon a very choyce and savoury dish, which makes me almost to believe, that those wretched creatures have but three senses, wanting the benefit both of smelling and tasting."

TABLE 1. NON-ARCTIC OLD WORLD ETHNOHISTORIC ACCOUNTS DOCUMENTING THE CONSUMPTION OF PUTRID MEAT AND FISH (continued).

COUNTRY	ANIMAL(S)	REFERENCE	DESCRIPTION
		AFRICA	
South Africa	Various	Wood 1874: 255–256	"There is an excuse for this extraordinary exhibition of gluttony, namely, that the hot climate causes meat to putrefy so rapidly that it must be eaten at once if it is eaten at all. Even as it is, the Hottentots are often obliged to eat meat that is more than tainted, and from which even the greatest admirer of high game would recoil with horror. They do not, however, seem to trouble themselves about such trifles, and devour the tainted meat as eagerly as if it were perfectly fresh."
Southern Africa	Various	Ankermann 1906: 579	"Le nègre n'est pas du tout difficile dans le choix de sa nourriture; il se contente souvent de choses pour lesquelles nous aurions une invincible répugnance. Il ne voit aucun inconvénient à manger de la viande à demi-pourrie, où fourmillent les vers; c'est pourquoi aussi il se nourrit d'animaux que nous dédaignons, tels que chenilles, sauterelles, termites, qui, grillés, constituent pour lui un mets délicat." "The negro has no difficulty in choosing his food; he is often content with things for which we would have utter disgust. He sees no problem in eating half-rotten meat, swarming with maggots; this is also why he feeds on animals which we disdain, such as caterpillars, grasshoppers, termites, which, grilled, for him are a delicacy."
South Sudan(?)	Wild boar (warthog?)	Baker 1868: 101	"While we were thus engaged some natives appeared carrying with them the head of a wild boar in a horrible state of decomposition, and alive with maggots. On arrival at the drinking-place they immediately lighted a fire, and proceeded to cook their savoury pork by placing it in the flames. The skull becoming too hot for the inmates, crowds of maggots rushed pele-mele from the ears and nostrils like people escaping from the doors of a theatre on fire. The natives merely tapped the skull with a stick to assist in their exit, and proceeded with their cooking until completed; after which they ate the whole, and sucked the bones. However putrid meat may be, it does not appear to affect the health of these people."

TABLE 1. NON-ARCTIC OLD WORLD ETHNOHISTORIC ACCOUNTS DOCUMENTING THE CONSUMPTION OF PUTRID MEAT AND FISH (continued).

COUNTRY	ANIMAL(S)	REFERENCE	DESCRIPTION
		AFRICA	
South Sudan	Elephant	Calmeyn 1912: 51, 507	"L'aspect du campement des Shillouks est ignoble, l'odeur de la viande pourrie épouvantable." "The appearance of the Shilluks' camp is wretched, the smell of rotten meat atrocious." "On vend de tout au marché, mais le quartier de la viande d'éléphant pourrie et du poisson mal fumé et avancé est le plus achalandé." “Everything can be bought at the market, but the area with the rotten elephant meat and the poorly smoked and high fish is the most visited.”
South Sudan	Livestock	Junker 1890: 310–311	"...we noticed in the distance vultures and kites wheeling in wide circles, but always returning to a certain point, where our people concluded a buffalo or some other large animal had fallen. Later some of them went in search of the quarry, and in a few hours brought back the upper half of an antelope already in a putrid state. In fact it was so “high” that the horns...were easily removed from the sockets, where the worms were at work. Yet the carcase, brain, and all, was eagerly devoured by our hungry people."
South Sudan	Livestock	Peney 1859: 333	"...les Nègres fort avares de leurs troupeaux, ne sacrifient jamais une bête à leur appétit, et ne se régalent de viande que lorsqu'un accident, une maladie ou les progrès de l'âge ont occasionné le trépas de la bête. Ajoutons encore que la chair de ces animaux crevés, se décomposent rapidement par l'effet de la chaleur et de l'humidité qui règnent dans ces contrées, les Nègres, quand il leur arrive de manger de la viande, ne la mangent généralement que pourrie. Et cependant ce genre d'alimentation, qui semblerait convenir davantage à l'estomac d'une hyène qu'à celui d'une créature humaine, n'indispose nullement le Nègre." “...the Negroes who are very miserly about their herds, never kill an animal to eat it, and consume the meat only when an accident, a disease, or old age has caused the death of the beast. Let's add that the flesh of dead animals rots quickly as a result of the heat and humidity that prevails in this country; the Negroes, when they do eat meat, only eat it rotten. Yet, this type of consumption, which seems to better fit the stomach of a hyena than that of a human being, does not seem to indispose them at all."

TABLE 1. NON-ARCTIC OLD WORLD ETHNOHISTORIC ACCOUNTS DOCUMENTING THE CONSUMPTION OF PUTRID MEAT AND FISH (continued).

COUNTRY	ANIMAL(S)	REFERENCE	DESCRIPTION
		AFRICA	
South Sudan	Various	Schweinfurth 1874: 274	"With the exception of human flesh and the flesh of dogs, the Bongo seem to consider all animal substance fit for eating, in whatever condition it may be found. The putrefying remnant of a lion's feast, which lies in the obscurity of a forest and is only revealed by the kites and vultures circling in the air above, is to them a welcome discovery. That meat is “high” is a guarantee for its being tender, and they deem it in that condition not only more strengthening than when it is fresh, but likewise more easy of digestion."
Sudan	Various	El-Tounsy 1845: 147	"Ces hommes n'ont aucun goût de propreté; il n'y a ni variété ni art dans la préparation de leur nourriture; ils mangent indistinctement tout ce qui se présente à eux avec l'apparence d'aliments. Que ce soit amer ou gâté, ils ne font aucun choix; parfois même ils préfèrent à tout [sic] les aliments amers ou la viande presque pourrie, et s'en font un régal." "These men have no taste for cleanliness; there is neither variety nor art in the preparation of their food; they indiscriminately eat anything that comes their way with the appearance of food. Whether bitter or spoiled, they make no choice; sometimes they even prefer bitter food or meat that is almost rotten, and treat themselves to it."
Tanzania	Rhinoceros, various	Bagshawe 1925: 121	“The Kangeju will eat, with the exception of the hyaena, everything that walks, crawls or swims. They are gruesome scavengers, and I have known them to gorge themselves, with evident relish and no apparent ill results, upon the carcass of a rhinoceros which was polluting the atmosphere for half a mile. Fish, snakes, lizards, the foulest of carrion birds, eggs, ants and other insects are common articles of diet.”
Tanzania	Various	Marlowe 2010: 141	"Hadza often scavenge meat from the kills made by lions, leopards, and hyenas, and this sometimes gets them injured by one of these predators. The scavenged (and sometimes very rotten) meat also gives them stomachaches, even after they cook it, but not often enough to keep them from eating it."

TABLE 1. NON-ARCTIC OLD WORLD ETHNOHISTORIC ACCOUNTS DOCUMENTING THE CONSUMPTION OF PUTRID MEAT AND FISH (continued).

COUNTRY	ANIMAL(S)	REFERENCE	DESCRIPTION
		AFRICA	
Tanzania	Rhinoceros	Schöller 1901: 163	"Die Eingeborenen stellen dem Rhinozeros in Fallgruben nach, und wir fanden unmittelbar neben unserm Lagerplatze ein altes Weibchen, welches kaum einige Tage vorher in einer jener Fallgruben verendet war. Das Fleisch wies bereits einen fortgeschrittenen Grad von Verwesung auf; trotzdem vermochten die Wanyamwesiträger es nicht über das Herz zu bringen, dasselbe der Vernichtung anheimfallen zu lassen. Sie trennten recht ansehnliche Stücke aus dem Rücken heraus und verspeisten dieselben." "The natives hunted the Rhinoceros with pit traps, and we found an old female next to our camp, who had died in one of those pits a few days before. The meat had already reached an advanced state of decay; nevertheless, the Wanyamwesia bearers did not have the heart to let it go to waste. They cut quite sizeable pieces out of the back and ate them."
Zambia	Various	Béguin 1903: 26	"On ne se fait pas une idée de ce qu'ils sont capables de manger; ce sont des viandes vertes, exhalant une forte odeur de décomposition ou remplies de vers; fréquemment, ils disputent aux vautours des animaux en train de pourrir dans la plaine; ils recueillent avec joie les poissons qui filent au courant de l'eau et dont les chairs ne tiennent souvent plus ensemble, tellement elles sont à un degré avancé de décomposition. Des Européens mourraient sans doute à ce régime, les noirs n'ont pas l'air d'en souffrir...." "It is hard to imagine what they are capable of eating; this is green meat, emitting a strong odor of decay or filled with maggots; frequently they compete with vultures for access to animals rotting in the plains; they happily pick up fish that drift by in the current and whose flesh often no longer holds together because it is in such an advanced stage of decomposition. Europeans would no doubt die under this regime, the blacks do not seem to suffer from it...."
Zambia	Various	Burton 1873: 86	"All the Caffres of these lands and, as far as I see, of Inner Africa generally, prize the flesh, and the more tainted it is the better they like it."

TABLE 1. NON-ARCTIC OLD WORLD ETHNOHISTORIC ACCOUNTS DOCUMENTING THE CONSUMPTION OF PUTRID MEAT AND FISH (continued).

COUNTRY	ANIMAL(S)	REFERENCE	DESCRIPTION
		AFRICA	
Zambia	Elephant	Giraud 1890: 395	"The remains of a young elephant, which was found dead three days ago, have just been carried into the village. [...] the division of the quarry began with a savagery impossible to describe. [...] This flesh exhales a sickening odor, and the whole village will be infected by the stench for a long time to come...."
Zanzibar	Shark	Becker 1887: 15	"C'est surtout dans les quartiers où sont emmagasinées les provisions de requin séché, que l'atmosphère est intolérable. Le Zan-Sybarite—pardon du calembour—consomme dans un état très avancé de putrefaction ce dernier produit.... Le requin constitue le mets favori des indigènes. Plus il est faisandé et plus il leur semble exquis!" "It is especially in the quarters where the provisions of dried shark are stored that the atmosphere is intolerable. The Zan-Sybarite—pardon the pun—consumes this last product in a very advanced state of putrefaction.... Shark is the favorite dish of the natives. The more putrid it is, the more exquisite it seems to them!"
Zimbabwe	Elephant	Holub 1881: 212	"...a little further up the valley some of our people discovered a dead elephant. Their attention was caught by a disgusting smell, which they thought they recognized; and pushing into the bushes they found the carcase of a huge male elephant, dead from gun-shot wounds. [...] [T]he servants...cut off the feet, intending to carry them off as a dainty for their next meal, but the stench of them was so intolerable that we soon made them throw their tit-bit away."
Zimbabwe	Elephant	Selous 1881: 436	...we found some natives who had come to cut up the elephant left in the thick bush, and which, except that its tusks had been chopped out, and its trunk cut off, had not been disturbed by us. This carcass we had passed almost daily during the last week, and on the preceding evening the hyaenas must have torn it open for the first time, as the stench was sickening, at a distance of at least half-a-mile below the wind; and now these men were going to cut up and eat the putrid, stinking meat, which had lain eight days and nights festering beneath the fierce rays of a tropical sun! Truly some tribes of Kafirs and Bushmen are fouler feeders than either vultures or hyaenas. This is not an isolated case, as they are constantly in the habit of eating putrid meat, and there is little doubt that they like it just as well as, if not better than, good, sweet flesh; curiously, too, it does not seem to do them any harm."

TABLE 1. NON-ARCTIC OLD WORLD ETHNOHISTORIC ACCOUNTS DOCUMENTING THE CONSUMPTION OF PUTRID MEAT AND FISH (continued).

COUNTRY	ANIMAL(S)	REFERENCE	DESCRIPTION
ASIA, INDONESIA, NEW GUINEA, AND AUSTRALIA			
Australia	Crocodile, turtle	Dahl 1926: 43, 71, 303, respectively	"Dead crocodiles, which sank in too deep water for the natives to reach them by diving, were always lost to us. They rose when they were half putrid, and the blacks invariably ate them." "We had, however, no time to wait for it to rise. Two months later I met Tommy's old uncle—previously mentioned—who told me that some days after our departure he had found the giant stranded at the end of the pool and had for days feasted on the putrid carcase. "One day, as I walked along the shore, I became aware of a strong putrid stench. Just round a point I met two old women groaning under heavy loads of rotten turtle meat. Further along on the beach I found the remains of the turtle, an enormous Loggerhead turtle, the carapace thickly covered by barnacles or acorn shells. The carcase had obviously been drifting in the sea for a long time, as it was in an advanced stage of decay. Close by a dead camp fire testified to the fact that the first happy discoverers had immediately feasted on the putrid meat. The blacks about the station fed on this rotten turtle for two or three days and one could smell them at a considerable distance!"
Australia	Various	Eyre 1845: 255	"If food, at all tainted, is offered to a native by Europeans, it is generally rejected with disgust. In their natural state, however, they frequently eat either fish or animals almost in a state of putridity."
Australia	Whale	Grey 1841: 277–278	"[He]...cuts his way through the [whale] blubber into the flesh..., of this he selects the nicest morsels, and either broils them on the fire, or cooks them as kabobs.... By-and bye other natives come gaily trooping in from all quarters: by night they dance and sing, and by day they eat and sleep, and for days this revelry continues unchecked, until they at last fairly eat their way into the whale, and you see them climbing in and about the stinking carcase, choosing tit-bits. [...] ...they remain by the carcase for many days...gorged to repletion with putrid meat.... There is no sight...more revolting than to see a young and gracefully formed native girl stepping out of the carcase of a putrid whale. When they at last quit their feast, they carry off as much as they can stagger under, to eat upon the way, and to take as a rarity to their distant friends."

TABLE 1. NON-ARCTIC OLD WORLD ETHNOHISTORIC ACCOUNTS DOCUMENTING THE CONSUMPTION OF PUTRID MEAT AND FISH (continued).

COUNTRY	ANIMAL(S)	REFERENCE	DESCRIPTION
ASIA, INDONESIA, NEW GUINEA, AND AUSTRALIA			
Australia	Various	Harney 1951: 245	"A good rule when dealing with any unknown native food is to prepare it in this manner. Even putrid meat placed in running water by Aborigines for a few days before cooking becomes quite edible."
Australia	Turtle	King 1827: 46	"The chief...expressed the greatest astonishment at every thing he noticed about us. He ridiculed our repugnance to partake of a piece of the raw gut of a turtle which he offered to us, and to expose our folly, ate a piece, which he appeared to think a dainty, although it was quite fetid from putrefaction."
Australia	Whale	Tench 1793: 54	"September, 1790. On the 7th instant, captain Nepean, of the New South Wales corps, and Mr. White, accompanied by little Nanbaree, and a party of men, went in a boat to Manly Cove, intending to land there, and walk on to Broken Bay. On drawing near the shore, a dead whale, in the most disgusting state of putrefaction, was seen lying on the beach, and at least two hundred Indians surrounding it, broiling the flesh on different fires, and feasting on it with the most extravagant marks of greediness and rapture."
Australia	Various	Worseley 1961: 168	"Although meat is sometimes dried over a fire or in the sun, or very crudely salted either in sea-water or in the salt left by the evaporation of sea-water on the rocks, this is rarely an effective preservative, and meat is eaten in a state which appears revolting and even dangerous to the eye of the White man. Today, aborigines will affect to be revolted by meat crawling with maggots, but once one turns one's back, they eat it with relish."
Borneo	Monkey, tree rat	Hoe 2019: 156	"Often accompanying this brew would be bamboo platters of foul-smelling rotten meat known as *jarat* (often monkey or tree rat, a delicacy to the natives). The meat would be stuffed into sections of bamboo and then buried to speed up the decomposition. This was viewed as a special gift to be offered to visitors. The SAS [British Army Special Air Service] trick was to take a minimal mouthful of the stinking mess and get to the *tapai* as quickly as possible to cleanse the palate and hope that stomachs and bowels would remain under control at least until they left the longhouse."
Borneo	Pig	Lumholtz 1920: 217	"The meat of pig is often eaten when ten days old, and is preferred to that which is fresh. In this they [Punan and Bukat] share the taste of the Dayak tribes I have met, with the exception of the Long-Glats [Bahau]. I have known the odour from putrefying pork to be quite overpowering in a kampong [village or cluster of houses], and still this meat is eaten without any ill effect."

TABLE 1. NON-ARCTIC OLD WORLD ETHNOHISTORIC ACCOUNTS DOCUMENTING THE CONSUMPTION OF PUTRID MEAT AND FISH (continued).

COUNTRY	ANIMAL(S)	REFERENCE	DESCRIPTION
ASIA, INDONESIA, NEW GUINEA, AND AUSTRALIA			
Borneo	Various	Roth 1896: 383	"They are not very particular about the cleanliness of their persons, and think nothing of eating meat which is so putrid that a rotten egg is absolutely fresh compared to it...."
India	Various	Bhuttacharjee 1869: 13–14	"If we accept...that...decomposed food...can give rise to diarrhoea and dysentery, then...providence is especially kind to these men; for...there are few animals in nature which a Naga does not eat with relish; and it is said by them that decomposed fish and meat taste better than fresh ones. A Naga does not care whether...the food he takes is fresh or decomposed.... If we analyse the usual constituents of his diet...more than half of it is decomposed. [...] The meat he takes is usually...a decomposed article, because...they consume the remnant of some monkey or elephant or deer killed three or four days or months before."
India	Deer, pig	Soppitt 1887: 10	"Let, however, a porcupine or ant-eater cross his [Rangkhol Tribe] path, and with one war-whoop he puts himself on the track, and the stoical reserve hitherto maintained is abandoned. Even the body of a deer or pig found in the jungles, alive with maggots, is not despised, maggots being considered rather a delicacy than otherwise by all the tribes."
Nepal	Rhinoceros	Müller-Böker 1999: 152	"It is an extreme case of good luck to get hold of the flesh, blood and skin, or even the urine and dung, of a rhinoceros. The meat of a rhino, no matter how rotten and decayed it may be, is held to be a 'delicacy'...."
New Guinea	Pig	Dornstreich 1973: 252	"Footnote 1: On one occasion we arrived at a cane-loop trap set at a sago tree which had caught a pig some five to six days earlier. The smell of this animal was pungent. Although the Gadio had told me that any animal dead for more than four days was considered too rotten to eat, this pig vas cooked on the spot. Most of the meat turned liquid in the baking and little but skin, bone, fat-soaked ferns and some rather bluish flesh remained. This was carried off and distributed to some people back at the hamlet who presumably ate it."
New Guinea	Pig	Meggitt 1958: 297–298	"One man aged at least sixty walked 56 miles in two days and counted the journey well worth while because he received half a leg of pork. [...] A half-side can change hands six times in four or five days, travelling fifty miles or more before it stinks abominably and nobody else will accept it. The unfortunate possessor then shares it with his immediate relatives. If it is really foul, men wash it carefully and submerge it in a stream during carving so that the company will not vomit. If it is too rotten to eat, they save the fat for decorations and throw away the meat. But men are loath to lose even rotten meat, and every year a number of people die as a result."

TABLE 1. NON-ARCTIC OLD WORLD ETHNOHISTORIC ACCOUNTS DOCUMENTING THE CONSUMPTION OF PUTRID MEAT AND FISH (continued).

COUNTRY	ANIMAL(S)	REFERENCE	DESCRIPTION
ASIA, INDONESIA, NEW GUINEA, AND AUSTRALIA			
New Guinea		Pierre Pétrequin, personal communication, 26 February 2022	"Nouvelle-Guinée: viande rance, avariée, pourrie, infestée de vers. Un prémice: pas de mode de conservation de la viande au-delà de quelques jours, par enfumage froid ou tiède au-dessus du foyer. Sous climat tropical, la viande 'fraîche et non traitée' peut commencer à s'altérer quelques heures après l'abattage. Même avec l'enfumage (seulement durant la nuit en cas de déplacement entre deux villages ou durant des expéditions pour la chasse, le sel ou l'extraction des roches pour les lames polies), la viande commence à s'altérer dès 48 heures, prend un goût et une odeur très forts au cours du troisième jour, devient immangeable le quatrième jour pour un occidental [...] mais est encore désirable pour nos amis papous (les hommes seulement). Je n'ai jamais observé de consommation de viande au-delà du 5e jour, sauf probablement l'oiseau dont je parlerai plus loin [...] Dani de la Baliem centrale, passage du col du Wusak. Un oiseau crevé, de la taille d'une pie, ramassé sur l'alpage le long du chemin. Les trois hommes qui nous accompagnaient ont posé le cadavre directement sur le petit feu du bivouac nocturne (abri de chasse couvert d'écorce), ont dégusté les petits vers au fur et à mesure qu'ils sortaient du plumage roussi et se sont finalement partagé l'oiseau qu'ils ont mangé en affichant leur plaisir gustatif." "New Guinea: rancid meat, high meat, rotten meat, infested by maggots. The premise: there are no methods that can preserve meat beyond a few days, which occurs by cold or lukewarm smoking over a fire. In tropical climates, the 'fresh and untreated meat' may become altered only a few hours after slaughter. Despite smoking (only during the night when moving between two villages or during expeditions aimed at hunting, salt procurement or the extraction of stones for polished blades), meat becomes high within 48 hours, takes on a very strong taste and smell on the third day, becomes unpalatable for a Westerner on the fourth [...] but is still desirable by our Papua friends. I have never observed consumption beyond the fifth day with the exception of a bird, which I will talk about shortly [...] Dani, Central Baliem, crossing of the Wusak pass. A dead bird, the size of a magpie, found in the mountain pasture along the way. The three men who were accompanying us put the animal directly on top of the little fire of the night shelter (hunting shelter covered with bark), and were eating the little maggots as they were coming out of the singed plumage and at last shared the bird which they ate with gusto."

TABLE 1. NON-ARCTIC OLD WORLD ETHNOHISTORIC ACCOUNTS DOCUMENTING THE CONSUMPTION OF PUTRID MEAT AND FISH (continued).

COUNTRY	ANIMAL(S)	REFERENCE	DESCRIPTION
ASIA, INDONESIA, NEW GUINEA, AND AUSTRALIA			
New Zealand	Fish	Nicholas 1817: 266–267	"But notwithstanding we felt absolutely hungry, the food that was before us was too strong for our stomachs. The fern-root we could only taste, and though we tried to partake of the dried fish, we were soon obliged to give it up, from the quantity of disgusting maggots we perceived in every part of it. Not so our New Zealand companions;—they considered it a delicious treat, and were not a little surprised that we could not relish such fine...food...as well as themselves."
New Zealand	Shark	Polack 1838: 101–107	"On approaching towards the mountain, my olfactory nerves had been for some time discomposed; I now found the cause to proceed from the dead body of a shark, which had been cast on the beach full a month previously; and stormy tides had washed it high and dry on the beach. This offensive object was in the last state of putridity and decomposition; and on Támároa approaching it, myriads of gad-flies issued from the body, which was about seven feet in length. My companion eyed it much, I rather thought wistfully, and observed, that the mango, or shark, was a rich treat to the New Zealanders. I assented, when it was to be had in a fresh state, but not in the disgusting condition of the fish before us. [...] We now retraced our steps [to return to Tangiari], passing again the offensive shark, which appeared to attract the attention of my comrade very much. Many pieces of whalebone lay strewed about the beach, bleaching in the sun. [...] I arose the ensuing morning at five o'clock, and was surprised to find the two young women only outside the sheds; I called to the lads, who entreated for a respite of a further half hour; I granted the request; but, perceiving the young females laughing, I felt assured there was some secret hidden from me. It was with much difficulty I could get an explanation, when they informed me the boys had been absent all night, after I had retired to rest, and had hastened to the sea-shore, regardless of the distance, to devour the putrid shark; and, having filled themselves to repletion, they had slept a short time near the scene of their barbarous tastes, and had returned to Tangiari an hour before daybreak. As early as they arose, I spoke to them with angry feelings; I could not sufficiently censure their bestiality."

TABLE 1. NON-ARCTIC OLD WORLD ETHNOHISTORIC ACCOUNTS DOCUMENTING THE CONSUMPTION OF PUTRID MEAT AND FISH (continued).

COUNTRY	ANIMAL(S)	REFERENCE	DESCRIPTION
ASIA, INDONESIA, NEW GUINEA, AND AUSTRALIA			
Sri Lanka	Deer	Deschamps 1891: 310	"Les Singhalais de ces régions ont la même coutume de préparer les viandes sauvages en les faisant sécher d'abord au-dessus d'un feu où elles se fument, puis finir au soleil. Un des coolies porteurs de mes bagages me donna même bien de l'ennui avec quelques quartiers de daim dont il achevait la préparation en les laissant sécher sur son dos; ils exhalaient une odeur révoltante de viande pourrie." "The Sinhalese of these regions have the same custom of preparing wild meats by drying them first over a fire where they are being smoked, then finishing them in the sun. One of the coolies carrying my baggage even gave me some trouble with pieces of deer, which he finished preparing by letting them dry on his back; they were exhaling a revolting odor of rotten meat."
Sumatra	Various	Forbes 1885: 242	"Their [Kubus] food, which consists for the most part of wild fruits or small animals, which they prefer, I am told, in a semi-putrid condition, they eat as they come by it, with little or no cooking."

observers offer few details on how it was cooked (boiled separately, stewed, roasted, baked), for how long, and how thoroughly. Our guess is that much of the time, putrid meat was, in fact, cooked—often by quick, light roasting over an open flame or on hot coals while participants were still gathered at a large carcass such as a hippo or elephant, and more extensively in stews once the butchered portions were brought back home. When roasted, it often involved fairly large chunks or pieces, entire anatomical units (e.g., hindquarters, heads), and even whole carcasses of small- to medium-sized animals. As a result, commonly only the outermost part of the meat actually got cooked, sometimes just enough to singe off the fur, leaving much of the interior meat raw or nearly so. In several cases the accounts explicitly note that people ate pieces of skin, meat, and fat *while they were still raw*—and seemingly regardless of whether these "tid-bits" were fresh or putrid (a distinction that seldom appears to have mattered). And there are suggestions that on occasion they also ate internal organs such as the liver and parts of the entrails without prior cooking (e.g., Dorman 1905: 176–177; Faulkner 1868: 214; Harris 1839: 170; Jackson 1930: 225–226; King 1827: 46; Landor 1907: 80–81; Tremearne 1912: 242). Unfortunately, we have no clear idea how often that was done. Sometimes putrid meat was deliberately rinsed or washed in a stream or pond prior to cooking but, again, it remains unclear how common that practice was and what effect that would have on the bacterial load of the meat (e.g., Harney 1951: 245; Posey 1990: 48–49; Sato 1983: 42). Cooking on or under hot ashes was fairly common, but baking using heated rocks was unusual except in Australia.

The lack of clarity with regard to preparation is unfortunate because heat, even from very brief and comparatively light cooking, would not only have significantly reduced overall bacterial growth (Smith et al. 2015: 65), but it would have contributed to inactivate the toxic metabolites of *C. botulinum*. Knowledge of the pH of the rotten meat would also be useful information as it is another factor that affects the stability of the neurotoxins. The toxins are most stable at pH's between about 4.0 and 5.0, while at both lower and higher pH's they break down fairly readily, almost invariably in less than 8 minutes, but often in as few as 1 to 3 minutes, and at temperatures of only 80–85 ºC (Leevongcharoen et al. 2018; Licciardello et al. 1967; Losikoff 1978; Siegel 1993).

Another aspect of the debate on pathogen exposure concerns whether contact with the skin is critical. In the human cases documented here and in other scavenging species, this does not seem to be problematic. For instance, participants in the butchery of very large decomposing carcasses such as hippos, elephants, and whales almost invariably became covered with the contents of the rotting viscera, other body fluids, and fat (e.g., Soubrier 1936: 168), and they sometimes literally climbed into the putrid mass and emerged covered from head to foot in gore. One such case is described in amazing detail by Grey (1841: 276–278), who observed Australian foragers butchering and consuming a huge dead whale that had drifted ashore:

> A whale is the greatest delicacy that a native can partake of, and whilst standing beside the giant frame of one of these monsters of the deep, he can only be compared to a mouse standing before a huge plum-cake; in either case the mass of the food compared to that of the consumer is enormous. [...] [H]e falls to work with his wives, and kindles large fires to give notice of the joyful event. This duty being performed, he rubs himself all over with the blubber, then anoints his favourite wives, and thus prepared, cuts his way through the blubber into the flesh or beef, the grain of which is about as firm as a goose-quill, of this he selects the nicest morsels, and either broils them on the fire, or cooks them as kabobs, by cutting them into small pieces, and spitting them on a pointed stick. By-and bye other natives come gaily trooping in from all quarters: by night they dance and sing, and by day they eat and sleep, and for days this revelry continues unchecked, until they at last fairly eat their way into the whale, and you see them climbing in and about the stinking carcase, choosing tit-bits. In general the natives are very particular about not eating meat that is fly-blown or tainted, but when a whale is in question, this nicety of appetite vanishes. I attribute this to their disliking in the first instance to leave the carcase, and then gradually getting accustomed to its smell; but whatever may be the reason, they remain by the carcase for many days, rubbed from head to foot with stinking blubber, gorged to repletion with putrid meat.... [...] There is no sight in the world more revolting than to see a young and gracefully formed native girl stepping out of the carcase of a putrid whale. When they at last quit their feast, they carry off as much as they can stagger under, to eat upon the way, and to take as a rarity to their distant friends.

Another example comes from the Ituri Forest in what is today the Democratic Republic of the Congo, where Pygmies feasted upon the decomposing carcass of an elephant. The feast began with a small ceremony in which the highly bloated carcass was deliberately burst as though it were an overly inflated balloon. To accomplish this, a man repeatedly cut off thin slices of skin from a small area over the animal's belly until what remained was barely able to sustain the pressure beneath. Then a child, usually a young relative of the hunter, was selected to literally bite through the skin and release the gassy mess within. The ensuing explosion inevitably covered the child and others nearby with stinking putrid gore. Once this little ritual was complete, the joyous participants climbed into the elephant's body cavity to disembowel it and remove the meat and fat, all the while working from the inside out. The ritual and subsequent feast involving an elephant that had been dead for five days were captured on film by the Denis–Roosevelt Expedition to the Belgian Congo (1934–1935) and released in 1938 as part of a movie entitled *Dark Rapture* (*Magie africaine*). A description of the feast and accompanying photo can be seen in the June 20, 1938 edition of *Life Magazine* (Denis and Roosevelt 1938: 51; see also Putnam 1948: 331–332).

In many parts of Africa it was common practice for participants to deliberately smear their face and torso with the fat from large hunted or scavenged carcasses, in the latter case even thoroughly putrid ones. Hippo fat was especially esteemed for this purpose, but fat from many other animals was used this way as well (e.g., eland). Roggenbuck

TABLE 2. NON-ARCTIC NEW WORLD ETHNOHISTORIC ACCOUNTS DOCUMENTING THE CONSUMPTION OF PUTRID MEAT AND FISH. (*When one or more words have been omitted, it is denoted by "..."; When one or more whole sentences have been omitted, it is denoted by "[...]". As a rule, every effort was made to omit only text that did not alter the overall meaning of the passage.*)

COUNTRY	ANIMAL(S)	REFERENCE	DESCRIPTION
		NORTH AMERICA	
Mexico (Baja)	Various	Baegert 1952: 66–67	"They will devour...rotten meat or fish, green with decay, smelling abominably and alive with maggots...."
Mexico (Sonora)	Various	Moser 1988: 486–487	"Their favorite dishes are donkey, mule, and sea turtle, and of course, the more decomposed they are, the better. They also eat *buro*, a kind of antelope [mule deer] that lives in abundance on the island, which is delicious, but which the Seris, to be able to eat it, let it stand until it rots."
Mexico (Sonora)	Various	Pfefferkorn 1949: 198	"Often I observed with astonishment an animal feast among the wild Papagos. Frequently these people were forced to go afield for their nourishment because of the shortage of provisions, and sometimes they visited me. They remained quietly and peacefully in the mission for three or four weeks but as soon as they learned that there was a dead horse, burro, or other animal anywhere, they hurried to the spot, tore it up like hungry wolves, and ate it greedily, intestines and all. The Sonoran is little concerned with whether the meat is fresh or half-rotten, stinking, and full of maggots; he takes everything without repugnance."
USA (MT)	Various	Coues 1897: 356–357	"Some of them [Gros Ventre] invited us to their huts to eat...but we found it impossible to taste their dried meat; it was so nearly putrid that the pieces would scarcely hold together. This, however, is entirely to their liking; they seldom use meat till it is rotten; they keep it in their huts, unexposed to the air, till it is almost impossible for a stranger to remain indoors on account of the stench arising from putrefaction."
USA (NM)	Various	Henderson and Harrington 1914: 58	"...from the fact that Indians of various tribes have frequently been known to show a preference for raw entrails of large game animals and seem really fond of meat that has become somewhat tainted, one can not always feel certain that the use as food of things which are revolting to other people may not be due to choice."
USA (NM)	Various	Letherman 1856: 290	"It would be hard to say what they [Navajo] would not eat. The majority seem to live on what they can get—deer, antelope, sheep, horses, mules, rabbits, prairie-dogs; and we have seen some eat meat in such a state of putridity that the sight was disgusting in the extreme."

TABLE 2. NON-ARCTIC NEW WORLD ETHNOHISTORIC ACCOUNTS DOCUMENTING THE CONSUMPTION OF PUTRID MEAT AND FISH (*continued*).

COUNTRY	ANIMAL(S)	REFERENCE	DESCRIPTION
		NORTH AMERICA	
USA (NY)	Bear	Pilkington 1980: 30–31	"My Elder Brother [Iroquois] had been out about a week ago, to set...a tree trap to...catch a bear; but...did not go out seasonably to see if his trap had...caught any thing, & when he came to his trap found a large bear caught...& appeared to have been dead some days, & the weather was very sultry & warm for the season. However he...packed home a quarter of it. While my Sister & kind Landlady was cutting it up, I observed some white & living animal fall on the floor. I thought I heard her whisper to her husband & tell him she was afraid their brother whiteman would not eat of it. However...a number of large pekes of the once dead bear, now almost come to life again were...put into the kettle. While she carried the chunks of meat from the block where they had been cut up, I observed a number of these white insects to fall to the ground from the chunks of meat & scamper about like lusty fellows. [...] In the...evening a large bowl containing 3 or 4 quarts & a chunk of meat on a bark...with half a spoonful of salt on one side. I looked upon it. The soup white & frothy. I viewed the meat. The cravings of my appetite & the disgustful and forbidding cast of the dish prepared for my refreshment forced tears from my eyes. [...] I strove to conceal my feelings from the family, of course. I...shut my eyes, & by an effort made out to swallow a pint or more. [...] I then...made out to swallow more than I at first expected by seasoning it plentifully with salt. But I was soon obliged to hasten out & unload my self by emitting a great part of my supper & felt very faint afterwards for a short time."
USA (PA)	Elk	Walton 1790: 103–104	"The prospect appeared very gloomy to our captive, to be thus distressed with hunger, and to be from home near one hundred miles with the whole family: but this situation, though so alarming to him, did not appear to reach their [Iroquois captors's] stoic insensibility. In this extremity one of the Indians killed a fine elk, which was a long wished-for and delightful supply; but as the weather was very warm, and they had no salt, it soon became putrid, and filled with maggots, which they, not withstanding, eat without reserve."

TABLE 2. NON-ARCTIC NEW WORLD ETHNOHISTORIC ACCOUNTS DOCUMENTING THE CONSUMPTION OF PUTRID MEAT AND FISH (continued).

COUNTRY	ANIMAL(S)	REFERENCE	DESCRIPTION
		NORTH AMERICA	
USA (SD)	Bison	Audubon 1897: 496–497	"When the Buffaloes have leaped or tumbled down from either side of the stream [Missouri River], they swim with case across, but on reaching these walls, as it were, the poor animals try in vain to climb them, and becoming exhausted by falling back some dozens of times, give up the ghost, and float down the turbid stream.... The most extraordinary part of the history of these drowned Buffaloes is, that the different tribes of Indians on the shores, are ever on the lookout for them, and no matter how putrid their flesh may be, provided the hump proves at all fat, they swim to them, drag them on shore, and cut them to pieces; after which they cook and eat this loathsome and abominable flesh, even to the marrow found in the bones. In some instances this has been done when the whole of the hair had fallen off, from the rottenness of the Buffalo."
USA (SD)	Bison	MacKenzie 1889: 337	"Buffaloes and other animals are in immense numbers destroyed every winter by the Mississouri Indians. In stormy weather, whole droves run from the mountains and plains to seek shelter in the woods which form the margin of the Mississouri; many of them, attempting to cross when the ice is weak, sink and are drowned, and, in the spring, both sides of the river are in several places covered with rotten carcases and skeletons of buffaloes, elks, &c. These dead animals, which often float down the current among the ice for hundred of miles, are preferred by the Natives to any other kind of food. When the skin is raised you will see the flesh of a greenish hue and ready to become alive at the least exposure to the sun, and so ripe and tender that very little boiling is required. The stench is absolutely intolerable, yet the soup made from it, which becomes bottle green, is reckoned delicious. So fond are the Mandanes of putrid meat that they bury animals whole in the winter for the consumption of the spring."
USA (TX)	Fish	Newcomb 1961: 41	"Those bands situated near the large streams shot fish with bows and arrows, sometimes at night with the aid of torches to attract them, and they were also seined from shallow streams. Fish were sometimes dried and ground into flour, the grinding process being applied to virtually every edible substance the Coahuiltecans had. Fish were sometimes roasted without cleaning, and set aside for eight days, by which time the larvae of flies and other insects had developed in the rotting flesh. The larvae were then consumed as an epicure's delight, as also, apparently, was the remaining flesh."

TABLE 2. NON-ARCTIC NEW WORLD ETHNOHISTORIC ACCOUNTS DOCUMENTING THE CONSUMPTION OF PUTRID MEAT AND FISH (continued).

COUNTRY	ANIMAL(S)	REFERENCE	DESCRIPTION
		CENTRAL AMERICA	
Guatemala	Deer	Gage 1677: 321	"The richer sort of people fare better, for if there be Fish or Flesh to be had, they will have it, and eat most greedily of it, and will not spare their Fowls and Turkeys from their own Bellies. These also now and then get a wild Deer, shooting it with their Bows and Arrows. And when they have kill'd it, they let it lie in the Wood in some Hole or Bottom cover'd with Leaves for about a Week, till it stink and begin to be full of Worms, then they bring it home, cut it out into Joints, and parboil it with a herb which groweth there somewhat like unto our Tanzy, which they say sweetens it again, and makes the Flesh eat tender, and as white as a piece of Turkey. Thus parboil'd, they hang up the Joints in the Smoak for a while, and then boil it again, when they eat it, which is commonly dressed with red Indian Pepper, and this is the Venison of America, whereof I have sometimes eaten, and found it white and short, but never durst be too bold with it, not that I found any evil Taste in it, but that the apprehension of the Worms and Maggots which formerly had been in it, troubled much my stomach."
		SOUTH AMERICA	
Brazil	Various	Maybury-Lewis 1974: 41	"If meat has to be kept for any length of time, then it is roasted on the embers of the fire. This roasting is done long and thoroughly, for the meat is well protected by a covering of ash and earth. When the cooking is completed the roast meat can be kept for a week, or even more, without becoming inedible. Admittedly, by the end of a few days after roasting there are maggotts in the centre of the meat, but the Shavante [Xavante] do not mind this or the accompanying stench, and simply cut the good meat off the rotten part and eat it. I found that, once I had overcome my initial repugnance, I could also eat this meat without any ill effects."

TABLE 2. NON-ARCTIC NEW WORLD ETHNOHISTORIC ACCOUNTS DOCUMENTING THE CONSUMPTION OF PUTRID MEAT AND FISH (continued).

COUNTRY	ANIMAL(S)	REFERENCE	DESCRIPTION
		SOUTH AMERICA	
Brazil	Tapir	Posey 1990: 48–49	"Several Indians from a neighboring cabin happened by, saw the meat being thrown away, looked at me strangely, ask[ed] for the meat—which I gladly gave [them]—and meandered off looking quite pleased. I was not quite sure why. The next day, my hosts arrived from their prolonged journey. They were hungry for tapir meat and immediately ask[ed] about the prepared tapir. I said: 'Well, it was full of maggots and I threw it out'. 'What!!!' the head of the household exclaimed angerly. He then threatened to throw me out of the cabin. Some maggots, it seems, as they grow exude enzymes which help break down the more gristly parts of the meat. They look awful, but do a great service. One has only to remove the maggots with a good washing to find a very nice tender piece of meat that is much more edible than before the processing. The meat is then hung up to dry in the sun and it becomes traditional 'charque.' But who would want to live with people who eat such horrible things?"
Colombia	Various	Rivero 1883: 54	"Muy al contrario de este gentío es la nación Tuneba: no se ha conocido gente más bruta ni más inmunda [...] no hay plato más regalado para ellos que un pedazo de carne podrida, y mientras más hedionda más se saborean con ella." "Very different from these people is the Tuneba nation: no people are known to be as brutal or filthy as them [...] There is no dish more delicious to them than a piece of rotten meat, and the more it stinks, the more they savor it."
Colombia and Venezuela	Tapir	Beckerman and Lizzaralde 2013: 111	"Game can be preserved by nightly smoking for a couple of days longer than fish, perhaps nearly a week. Eventually, it too becomes either stiff and dry or rotten. Sometimes dry smoked meat is boiled to soften it, but rotten meat is often just eaten as is—frequently with consequences that include late-night dashes out of the longhouse."

TABLE 2. NON-ARCTIC NEW WORLD ETHNOHISTORIC ACCOUNTS DOCUMENTING THE CONSUMPTION OF PUTRID MEAT AND FISH (continued).

COUNTRY	ANIMAL(S)	REFERENCE	DESCRIPTION
SOUTH AMERICA			
Peru	Various	Bergman 1974: 222	"When a reasonable number of animals has been taken, usually an average of one important animal per man, it is time to go home, the quantity of game being more important than the hour of the day. None of the animals are cleaned in the field, and if it is hot they may arrive bloated and stinking. Tapir or deer are often salted and dried, with some meat made into sausage as they cannot be consumed immediately in entirety."
Peru	Tapir	Clark 1961: 80	"Once we saw several savages standing in the river. [...] As we drifted closer, we saw that a large eight-foot-long bloated animal was caught under the limbs, and it was this carrion they were after. [...] One of them began talking sulkily, saying that four days before, this beast had been speared while swimming across the river. It had sunk, but they knew that its body would come to the surface.... They had searched the river banks for miles, and had just located it. Though rotten with gas, the tapir was being cut up. This putrid meat was divided among the band of Indians, who began eating huge mouthfuls on the spot."

et al. (2014) note that vultures have to stick their head into the body cavity of the carcasses upon which they are feeding, which may increase their risk of exposure to deadly pathogens. Surely climbing into the decaying carcass of a bloated whale, hippo, or elephant, especially one that had been dead for several days and decomposing in the hot, humid tropics, and then deliberately smearing oneself with its fat, would constitute a similar risk. Yet, we encountered no convincing evidence to suggest that *C. botulinum* or other similar pathogens posed a major threat associated with exposure through the skin surface. When evidence of digestive stress did occur, it was almost invariably attributed to gluttony, calibrated according to 19th-century European standards of etiquette and decorum. Tragically, Europeans, biased by their own cultural conceptions, found such spectacles so utterly disgusting that many drew the illogical if not irrational conclusion that those who indulged in such "gore" must surely also be cannibals (e.g., Waller 1874: 92–93). Once dehumanized in this manner, all too many Europeans and Americans had no qualms about selling such supposedly less-than-human "cannibals" into slavery.

OBSERVATIONS AND SYNTHESIS

Looking at Tables 1 and 2, a number of trends emerge from the ethnohistoric and other literature we have consulted, and these are summarized here in the form of a list.

1. Eating putrid meat, even when it stank and was crawling with maggots, was widespread throughout the temperate and tropical latitudes of both the Old and New World, including the dense equatorial forests of what today is the Democratic Republic of the Congo and surrounding areas of Cameroon, Central African Republic, Uganda, South Sudan, Mozambique, and elsewhere. The practice was also common in the semi-arid woodland and grassland regions of eastern and southern Africa. Looking farther afield, similar attitudes toward putrid meat are found in many areas of south and southeast Asia, Melanesia, and Australia, as well as in Amazonia.
2. Putrid meat was widely viewed by non-Westerners, especially those subsisting as hunter–gatherers or living in small-scale rural farming–hunting communities, as a desirable food, sometimes explicitly preferred over fresh meat, as was clearly the case throughout much of sub-Saharan Africa.
3. There is no evidence, at least in so far as we have been able to determine from these ethnohistoric accounts, to suggest that the meat was viewed as dangerous to those who consumed it. When problems arose, it was generally recognized by European observers as a direct result of gorging excessive, often staggering, amounts of meat, not as an indication of disease. There were, of course, societies in which putrid meat was considered unhealthy, even tabooed, but many had no qualms whatever about consuming animal foods in a highly decomposed state.
4. Several observers explicitly noted that Indigenous people were fully cognizant of the disgust engendered in Europeans and Americans by the sight and smell of putrid meat. As a consequence, when in the presence of foreigners, they often feigned similar disgust, but when in private they had no qualms about consuming meat that was in an advanced state of decomposition.
5. Whether the consumption of putrid meat was sporadic or habitual in the neotropics is less certain. It definitely occurred, and not merely as a response to starvation, but we were unable to get a clear sense of just how often. This is also the case in Australia where accounts are far less numerous than in tropical Africa and most often concern marine animals such as beached whales and sea turtles. However, early ethnographic reports are often spotty for these regions and we cannot exclude the possibility that early missionary and colonizing activities had already altered the Natives' use of decomposing meat, at least in public settings, by the time many of these groups were documented by foreigners. In the case of Latin America, we were also limited by our lack of fluency in both Spanish and Portuguese. Thus, someone more familiar with these languages might find additional information, particularly in the many 16th–18th century accounts that have not been translated into English.
6. While putrid meat was presumably often cooked, either by stewing or light roasting, few deliberate attempts were made to assure that it was thoroughly cooked. Moreover, in the case of roasting, when the portions placed on the fire were large, as was often the case, typically only the exterior became lightly cooked while the interior remained nearly if not entirely raw. Before being eaten, putrid meat was sometimes washed in a nearby river or pond, sometimes dried, and sometimes smoked. Raw skin, meat, organs, and fat, despite being putrid, were occasionally eaten on the spot while butchering a carcass or while transporting meat and fat back home (e.g., Jackson 1930: 225–226). Although admittedly far from certain, our impression from these accounts is that cooking of putrid meat was done more for reasons of taste, texture, and tenderness, and as a reflection of cultural norms of proper meal preparation and consumption, rather than out of any real concern for food safety. However, in certain areas, it does seem that putrid meat was cooked because it was considered less fit for eating.
7. While we remain less than certain about how often traditional peoples in the tropics ate putrid meat and fish in an entirely raw state without any prior washing, drying, smoking, or cooking, there is no doubt that they routinely drank pathogen-laced ("putrid") water from highly contaminated waterholes, wells, ponds, and rivers without first boiling it or treating it in any other fashion. These water sources were often heavily polluted with animal manure, urine, and human waste, and not uncommonly afloat with rotting animal carcasses and the discarded offal from animals butchered close to the water's edge. The following example from late 19th-century southern Africa is not

unusual:

> We ourselves were dying of thirst, but the water was so terrible that even the "boys" had not the courage to touch it. Imagine a mass of blackish mud, upon the top of which was a stagnant ooze of liquid animal manure. Covered with this layer of filth, it gave forth a putrid odour which completely impregnated you if you touched it. [...] Near the well we found half a dozen Bushmen...[who] every day of their life...partook of this kind of water; they consumed it without the slightest sign of disgust. (Decle 1898:47–48)

8. Hippos and other large game (e.g., elephants) were sometimes captured in pitfall traps and were often in an advanced stage of decomposition when they were recovered. Hippos were also attacked during the day while in the water. In such cases, when an animal was fatally wounded it usually sank and did not resurface for several hours (e.g., Andersson 1857: 425; Ansorge 1899: 252–253). While still submerged it often drifted quite some distance downstream before it resurfaced and became visible again, and by the time it was finally located and hauled out of the river it had become quite putrid. However, as many accounts make abundantly clear, decomposition seems in no way to have detracted from its value as a source of meat and especially of fat. No matter how decayed, the hunters smeared themselves from head to toe with its fat and consumed substantial quantities of fat on the spot, sometimes cooked, apparently sometimes raw.
9. In coastal areas, the consumption of beached, often putrid, carcasses of whales, penguins, sharks, sea turtles, and other marine species was widespread, if not universal.
10. Many accounts of putrid meat consumption relate to the use of large game. Foragers and small-scale horticulturalists, even those generally reluctant to eat decomposing flesh, ate it nonetheless because they recognized it as a scarce and valuable resource.
11. In many larger villages and towns throughout Africa and much of the Middle East, meat offered for sale in local markets often became tainted and sometimes quite putrid, in large part because of the incessant heat, swarms of flies, and lack of refrigeration. Nineteenth-century European observers frequently described the odor in these markets as "utterly disgusting" and sometimes deliberately avoided them to escape the smell.
12. Indigenous people do not seem to have been overly concerned with the smell of putrid meat, and maggots were regarded as either unimportant or as a source of food in their own right. In both the arctic and the tropics, people recognized that maggots ate the same meat they did, and hence the maggots qualified as an added form of edible "meat."
13. Although our species does not show the genetic and morphological adaptations seen in obligate scavengers such as vultures and nocturnal raptors, the ethnohistoric literature suggests that humans who are extensively exposed already in utero and during infancy to a wide range of pathogens can tolerate those associated with putrid meat in a manner that is not significantly different from that of facultative scavengers such as hyenas, dogs, or pigs. The widespread practice of alloparenting and allonursing documented among hunter–gatherers, and especially among those living in the tropics, as well as among many small-scale rural farming–hunting groups, may prove to be an important mechanism by which an infant's immune system becomes primed right from the start to cope with the local array of pathogens that the child will continue to encounter throughout its lifetime (e.g., Atyeo and Alter 2021; Henry and Morelli 2022; Hewlett and Winn 2014; Lyons et al. 2020; Martin and Sela 2013; Pannaraj et al. 2017; Stinson et al. 2021; Tronick et al. 1987).

THOUGHTS ABOUT THE DISGUST RESPONSE

Neither putrid meat, nor maggots, nor the smell of decomposing animal flesh can be viewed as universal core elicitors of the disgust response. Instead, they are almost certainly learned cultural aversions, and for the most part largely Western and "Westernized" ones at that. A look at the ethnohistoric record shows that other so-called core elicitors are almost certainly equally cultural in origin. One such example is urine (Bourke 1888, 1891; Speth 2017). Traditional Inuit kept special receptacles in their dwellings in which they collected household urine for use as a substitute for soap in personal bathing (Mirsky 1937: 58); and some African groups used the urine from cattle in a similar fashion (Grant 1864: 51; Petherick 1861: 391–392). Many African pastoralists mixed cattle urine with milk in order to sour it and many drank it as a form of medicine (e.g., Baker 1867: 231; Chaillé-Long 1876: 70; Elemam 2009: 1–2, 24; Oswald 1915: 35). Urine was also widely used by the Inuit and other hunting peoples for tanning hides (e.g., Beyries 2002; Hatt and Taylor 1969).

Similar arguments can be made about feces. For example, Baegert, a Jesuit priest who served from 1751 to 1768 as a missionary among the hunter–gatherers of Baja California, commented upon the Natives' habit of collecting their own feces in order to retrieve and consume the abundant tiny seeds that had passed undigested through their system after ingesting large quantities of pitahaya (cactus) fruit (the so-called "second harvest"; Baegert 1952: 68; for the original German text, see Baegert 1773: 119–120). Well before Baegert, another Jesuit, Adamo Gilg, who lived among Seri hunter–gatherers in northern Mexico (Sonora) during the second half of the seventeenth century, similarly alludes to the consumption of human feces in an account in which he also describes their intake of carrion of "wild beasts which have been torn by lions or birds of prey" (Di Peso et al. 1965: 55). Interestingly, archaeologists excavating dry caves in the Great Basin of the western United States have encountered numerous prehistoric pits filled

with human feces that they have routinely interpreted as "latrines." Thomas (1985: 380–382) has questioned this interpretation, pointing out that in at least some cases such deliberate fecal accumulations occur together with caches of equipment that had clearly been stored in the caves for future use. To Thomas, the placement of the latrines side-by-side with other cached material suggests that the feces had also been stored there, presumably as food reserves—in short, additional examples of Baegert's "second harvest." Indigenous peoples at times also ate animal feces, and not just in a context of hunger or starvation. One such example is found in the account of an early Dutch visitor to the Cape Colony in South Africa who witnessed Khoekhoe people consuming animal dung (Fryke and Schewitzer 1700: 211–212). Eidlitz (1969: 88) provides another example, this one from the circumpolar region, in which the hunters consumed ptarmigan excrement chewed together with walrus meat. The ethnohistoric record contains many other such examples (e.g., Domenech 1860: 311; Guinnard 1861: 149; Harmon 1820: 425; Mas 1843: 23; Theal 1900: 418), including one collected in the early 1500's (Cabeza de Vaca 1922: 89–90). Even today, cow dung and urine are being consumed in India as a cure for COVID–19 (see Daria and Islam 2021: 1950).

These and many other examples show that putrid meat, urine, and human and animal feces are not universal core elicitors of disgust. Again, it would appear that one's reaction to these substances is a cultural feature molded by early childhood learning and social experience, not a biological response hardwired in us by millennia of natural selection. It is in fact ironic that Western value systems tend to view feces, whether human or animal, as something utterly disgusting and untouchable, while at the same time microbiologists and medical professionals, who are very much products of the same cultural milieu, are increasingly coming to appreciate the benefits of fecal transplants as a way of restoring compromised or impoverished gut floras (Rossen et al. 2015; Vrieze et al. 2013).

THE WESTERN TRADITION: PURITY, PUTRIDITY, MIASMA, AND SIN

While contemporary Western science generally believes these substances and odors to be universally shared elicitors of disgust, our deep dive into the ethnohistoric record shows that, as recently as the early decades of the 20th century, the populations of many traditional small-scale non-Western societies, seemingly regardless of latitude or environment, displayed no such aversions and, in the case of putrid animal foods, often actually preferred them that way. In short, many Western scientists, while believing they are objectively viewing human universals, are actually seeing the world through the biased filter of their own culture.

So, if these disgust responses and aversions are not universals, but reactions and behaviors closely linked to Western culture, where in fact do they come from? Needless-to-say, a thorough discussion of such a vast and complex topic is far beyond the scope of this paper, not to mention necessitating a breadth of scholarship for which neither of us are adequately equipped. Thus, what follows is a brief (and admittedly cherry-picked) discussion of what we perceive as a few of the key cultural and historical threads that, when woven together, ultimately formed the fabric of contemporary Western attitudes toward decay, excrement, and stench.

One thing does seem certain. These peculiarly Western views have deep roots in antiquity, extending back more than 4,000 years, placing them squarely within the Bronze Age, if not earlier (Greenberg 2019). Moreover, they seem firmly anchored within the ancient cultures of the eastern Mediterranean, and are most clearly evident in the Near East, Egypt, and Greece.

Ancient Egyptian medical documents, particularly the Edwin Smith (ca. 1600 BC) and Ebers (ca. 1550 BC) papyri, make it clear that Egyptian physicians were well aware of a dangerous substance or "principle" seated in the intestines, and especially in the colon, that was associated with rot and evil smells (Botero and Pérez 2012: 7; Breasted 1930; Ebers 1889; Majno 1975: 129–130, 1991: 937). In fact, "expelling the stench of disease was…an act of *ma'at* [maintaining the world of peace, justice, order, and truth], which belonged to the daily task of [Egyptian] physicians…" (Goldsmith 2021: 653). Moreover, this dangerous principle could spread through the air and via the blood stream to other parts of the body and cause further decay and death. The hieroglyphic spelling of this substance was WHDW (thought to have been pronounced "ukhedu"), to which was added a silent determinative that denoted something disgusting. The scribes used the same determinative for other substances they also perceived as disgusting, such as urine, excrement, and vomit.

One can already see in these three-to-four-thousand-year-old Egyptian texts the roots of the Greek concepts of *sepsis*—the putrefaction associated with infection—and *miasma*—the belief that sepsis could be brought on by invisible particles or *miasmata*, as well as by foul smells or stench ("night air"), both arising spontaneously from rotting substances such as decaying animal and vegetal matter. It is important to point out that the concept of miasma in Greek thought and usage generally conveyed the sense of something impure, not just dirty; dangerous in the spiritual or religious sense, not just physically dangerous; and contagious (e.g., Parker 1983: 3–4). The sepsis-miasma view of infection and disease gained widespread prominence through the writings and teachings of Hippocrates (ca. 460–370 BC) and Aristotle (384–322 BC), and through the continuing influence of their students and successors. While swamps and marshes were believed to be particularly dangerous sources of miasmata, so too were human corpses and animal carcasses, excrement, menstrual blood, seminal fluid, and other physically and spiritually impure or potentially evil substances and effluvia.

> For when the morning breezes blow toward the town at sunrise, if they bring with them mists from marshes

> and, mingled with the mist, the poisonous breath of the creatures of the marshes to be wafted into the bodies of the inhabitants, they will make the site unhealthy. (Vitruvius [20s BC] 1914: 32; see also Nichols 2017: xiii)

During the Middle Ages and early modern period, medical thinking remained steadfastly wedded to the belief that miasmata and stench were the principal causes of contagious diseases, but physicians and theologians alike also saw sickness as evidence of humankind's spiritual impurity and depravity in the eyes of God. Even as recently as the middle decades of the 19th century, Florence Nightingale, the founder of modern nursing, continued to adhere to the miasma theory, while also firmly believing that a patient's health and freedom from disease were closely linked to their spiritual purity and morality (see McDonald 2004: 23).

> In Florence Nightingale's cosmology physical and moral purity were a single and absolute value. Disease was Nature's sanction against moral failure and the world was so ordered that one's own body was a constant source of pollution unless rigorous cleanliness was pursued. Consequently, hygiene represented a religious observance for Florence Nightingale and her religion was at the same time rendered a very worldly one. Her own very deep religiosity contained little room for otherworldliness. For her the ultimate moral imperative was to understand God's ordering of the world in the laws of Nature. (Holton 1984: 61; see also Nightingale 1861: 7, capitalization in original)

Many of the 18th- and 19th-century explorer accounts we cite in this paper allude to the contagious "putrid fevers" spread by the vaporous mists rising from low-lying tropical swamps and marshes, but also to the suffocating infectious stench of putrefying animal carcasses, human and animal excrement, and rotting vegetal matter these explorers encountered in the Indigenous communities they visited.

Thus, firmly entrenched beliefs in the infectious potency and evil nature of miasmata and foul smells remained ascendant for more than two millennia, persisting almost to the close of the 19th century. Only then did science and the medical profession finally abandon the miasma theory and adopt the germ theory of disease (Botero and Pérez 2012: 4–5; Galanaki 2014; Hamlin 1985; Littré 1839–1861; Majno 1991: 938, 942; Martinez et al. 2014: 390).

Another very important thread woven right from the outset into the fabric of Western culture—one which provided a deeply religious core to views about carrion—can already be seen in the ancient texts of the Hebrew Bible and Old Testament, and continued, albeit in a variety of modified forms, into the Common Era through the scriptures and practices of the three great Abrahamic religions that emerged from that original base—Judaism, Christianity, and Islam (see discussions in Armanios and Ergene 2018; Freidenreich 2011, 2015; Tieman and Hassan 2015). Codified in these foundational Biblical texts are specific rules or commandments, accepted as divine in origin, for the proper handling of foods so that the faithful can achieve a state of holiness and purity in the eyes of God. Particularly important among these are rules about the proper way to slaughter an animal, a highly formal and ritualized procedure that involves slitting the animal's throat in a prescribed manner and carefully draining its ("life") blood:

> *Deuteronomy 14:21 (KJV):* Ye shall not eat of any thing that dieth of itself: thou shalt give it unto the stranger that is in thy gates, that he may eat it; or thou mayest sell it unto an alien: for thou art an holy people unto the LORD thy God. Thou shalt not seethe a kid in his mother's milk.

> *Ezekiel 4:14 (KJV):* Then said I, Ah Lord GOD! behold, my soul hath not been polluted: for from my youth up even till now have I not eaten of that which dieth of itself, or is torn in pieces; neither came there abominable flesh into my mouth.

> *Leviticus 17:10–14* (*KJV):* 10 And whatsoever man there be of the house of Israel, or of the strangers that sojourn among you, that eateth any manner of blood; I will even set my face against that soul that eateth blood, and will cut him off from among his people. 11 For the life of the flesh is in the blood: and I have given it to you upon the altar to make an atonement for your souls: for it is the blood that maketh an atonement for the soul. *12* Therefore I said unto the children of Israel, No soul of you shall eat blood, neither shall any stranger that sojourneth among you eat blood. *13* And whatsoever man there be of the children of Israel, or of the strangers that sojourn among you, which hunteth and catcheth any beast or fowl that may be eaten; he shall even pour out the blood thereof, and cover it with dust. *14* For it is the life of all flesh; the blood of it is for the life thereof: therefore I said unto the children of Israel, Ye shall eat the blood of no manner of flesh: for the life of all flesh is the blood thereof: whosoever eateth it shall be cut off.

These prescriptions and proscriptions persisted in the New Testament, as exemplified by Acts 15: 28–29. While there is debate about when Acts was actually written, most would place the date within the first century CE and very likely sometime shortly before 70 CE (see Bernier 2022; Robinson 1976).

> *Acts 15: 28–29 (KJV): 28* For it seemed good to the Holy Ghost, and to us, to lay upon you no greater burden than these necessary things; *29* That ye abstain from meats offered to idols, and from blood, *and from things strangled*, and from fornication: from which if ye keep yourselves, ye shall do well. Fare ye well. (italics added)

Islamic tradition also preserved very similar rules about the proper way to slaughter an animal, and clear strictures regarding carrion (Aubaile-Sallenave 2005: 128):

> Forbidden to you is that which dies of itself, and blood, and flesh of swine, and that on which any other name than that of Allah has been invoked, and the *strangled* (animal) and that beaten to death, and that killed by a fall and that killed by being smitten with the horn, and that

> which wild beast have eaten, except what you slaughter, and what is sacrificed on stones set up (for idols) and that you divide by the arrows; that is a transgression. (Surah al-Ma'idah or 5th chapter of the Qur'an)(italics added)

According to Freidenreich (2011: 132), the word "strangled" in these Biblical and Qur'anic passages refers to meat obtained from any animal that died without the blood first being properly drained from its body. Carrion, therefore, falls into the "strangled" category, *but not for the reason most present-day Westerners might immediately assume*. The issue is not whether the meat was tainted and hence unhealthy or potentially hazardous, but whether it was obtained from an animal that had been slaughtered according to divine commandments. Thus, many keepers of the faith would find completely fresh meat from improperly slaughtered animals unacceptable, even anathema, and would likely reject it, except perhaps under the most dire circumstances of starvation. As Grivetti (1978: 174) put it: "To reject carrion for human consumption is ethnocentric. Biblical and Koranic codes regarding carrion and other forbidden meats are not based on public health considerations but on reasons of religious contamination...or ethnic identity..." (see also Blidstein 2017; Grivetti and Pangborn 1974). One must be careful not to conflate the desire for achieving a state of holiness and purity in the eyes of God with concerns about food safety and pathogens. This distinction is not trivial, as the following ethnohistoric example clearly illustrates:

> It had been the intention to keep the ram for a long time, but it became so restless that Ferreg and Maatallah, who shared in the purchase, suggested killing it immediately. We left them to carry out the unpleasant Muslim rites, and went on ahead, and halted at some pasturage. [...] After one meal off the ram the carcase began to putrefy, although neither Tuareg nor Arabs appear to mind eating green, rotten meat. (Pearn and Donkin 1934: 403–403)

Unlike Judaism and Islam, the Latin or Roman Catholic Church and later Protestant sects of Christianity, despite the divine commandments of the Old Testament and similar rules in Acts in the New Testament, ultimately abandoned most of these highly formal strictures regarding the ritual treatment of meat (although many Christians still abstain from eating meat during Lent and when fasting). Nevertheless, emerging Christian thought and practice maintained deeply religious views about decay, stench, disease, spiritual purity, and sin.

The tenacity of the ancient Greek idea that miasmata and stench spontaneously generated from rot were major causes of ill-health and death was not due merely to the lack of a germ theory of disease. Religious ideas harkening back to the Book of Genesis, and probably ancient Egypt as well, became intimately woven into the fabric of medical explanation (e.g., Harvey 2006: 207, 210; Sennefelt 2021: 96). Christians of course believed that God was divine and, being such, God's Creation had to have been perfect. Therefore, disease, death, filth, putrefaction, and stench could not have been products of divine Creation. Instead, they were seen as evidence of human depravity and sinfulness, or even as God's continuing punishment for Adam and Eve's original sin in the Garden of Eden. One sees countless expressions of such deeply religious views in the writings of some of the earliest Christians, and they occur repeatedly in various guises throughout the ensuing centuries (e.g., Harrison 2007: 26–27).

> Religiously motivated cleanliness was perhaps the strongest formal tradition for body care in late medieval and early modern Europe. Depictions of the human body as spiritually and literally corrupt and in need of cleansing had deep roots in Greek, Roman, Jewish, and Muslim traditions. Ritual hand washing and bathing before prayer reflected long-standing folk and religious beliefs in water's power to purify an unclean body. Immersing the body in water, moreover, occurred mainly at life's dramatic transitions: at birth, before marriage, and at death. Biblical metaphors drawn from both the Old and New Testaments built on this foundation to equate sin with loathsome filth. [...] Catholicism supplied most early modern Europeans with a framework for understanding cleanliness as spiritual purity and filth as sin. Images of heaven and hell offered vivid testimony to the environments appropriate for the sanctified Christian and the lost souls of the damned; heaven's sweet scent contrasted to the foul stench of hell. (Brown 2009: 15)

> [The Calvinist] view of Providence was generally adopted by most English Protestants, despite disputes about the scope of human will, so it was necessary to combat the tendency to blame circumstances for misfortunes. [...] For God there were no accidents; sickness did not come by chance but was sent as a fatherly correction by God either to punish human wickedness or as a trial of faith. One should give thanks as much for afflictions as for blessings, all God's works being good. (Harley 1993: 101)

Moreover, if God created heaven and earth, and Creation was perfect, then God must also have blessed the earth with a perfect climate and environment. Not surprisingly that place just happened to be Europe (northern Europe for those who wanted to be more precise). From that blatantly ethnocentric and racist vantage point, those environments on the globe most alien to Europeans—the hot, steamy, miasmata-spewing tropical forests of sub-Saharan Africa and south and southeast Asia—were seen as hotbeds of putrid fevers and human spiritual depravity (Markley 2010: 108).

> That the Clouds should be so carried about by the Winds as to be almost equally dispersed and distributed, no part of the Earth wanting convenient Showers, unless when it pleaseth God for the punishment of a Nation to withhold Rain by a special interposition of his Providence.... [...] This Distribution of the Clouds and Rain is to me (I say) a great Argument of Providence and divine Disposition; for else I do not see but why there might be in some Lands, continual successive Droughts for many Years, till they were quite depopulated; in others as last-

> ing Rains, till they were overflown and drowned; and these, if the Clouds moved casually, often happening.... (Ray 1691: 64–65)

Traces of this same link between filth and sin or unholiness persists even today in an oft used cliché—"cleanliness is next to godliness." John Wesley may have been the first to use the expression, as it shows up in 1786 in two of his best known sermons (nos. 88 and 98, "On Dress," and "On Visiting the Sick," respectively):

> Together with the more important lessons, which you endeavour to teach all the poor whom you visit, it would be a deed of charity to teach them two things more, which they are generally little acquainted with,—industry and cleanliness. It was said by a pious man, "Cleanliness is next to godliness." Indeed the want of it is a scandal to all religion; causing the way of truth to be evil spoken of. And without industry, we are neither fit for this world, nor for the world to come. (Wesley 1872: 123)

What we have presented in this section is just the barest outline of the formation of a very complex and long-lived socioreligious tradition whose origin lies deep within the ancient cultures of the eastern Mediterranean. Nevertheless, this brief sketch illustrates an important point about Western aversions toward carrion, filth, and stench; namely, that these aversions emerged in a deeply religious context in which rot and foul smells were seen as signs of humanity's base iniquity. They cannot be understood solely or even primarily as responses that evolved under natural selection to reduce human exposure to pathogens. In both Judaic and Islamic traditions, meat was deemed unacceptable, no matter how fresh, if it was acquired from animals slaughtered without the proper religious rituals and observances. This is hardly what one would expect if pathogen avoidance were the driving force behind these practices. While later Christian sects jettisoned most of these strictures, in substantial measure to distance themselves from Jews and Muslims, they nonetheless continued to see decay and foul odors as signs of humankind's fall from Grace. These deep-seated cultural values and traditions, though now less overtly religious, persist even to the present day, perhaps best epitomized by our intense revulsion at the sight and smell of decomposing flesh and bodily effluvia, but equally by our Herculean efforts to sanitize, freshen, and deodorize our bodies, our clothing, our food, and practically everything else around us.

DISCUSSION AND CONCLUSIONS

One thing seems eminently clear, both from the information presented in this paper and from our earlier look at traditional circumpolar diets (Speth 2017): namely, that until quite recently Indigenous peoples in many parts of the world—in stark contrast to Western views—saw putrefied meat, fat, and fish, not as disgusting and potentially dangerous substances to be assiduously avoided, but as desirable, often even preferred foods. The intense aversion to such foods in today's world seems to be a comparatively recent development, heavily influenced by the spread of Western ideals and values. Moreover, it seems that this aversion to rot has become increasingly universalized over the last several centuries, and particularly since the end of the 19th century, through the combined effects of colonialism, urbanization, industrialization, Western attitudes toward "proper" sanitation, and the development of global market economies. Revulsion triggered by the sight and smell of putrid meat is even beginning to take on the attributes of a hardwired disgust response, although this may be more a reflection of gut floras adjusting to contemporary foods, foodways, medicines, and sanitary practices than an innate response embedded in our genes through unknown millennia of natural selection.

The putrefaction of meat, fat, and fish offers foragers and other Indigenous peoples a number of distinct advantages. For one thing, it accomplishes outside of the body much of what would normally happen to these foods inside the body if ingested in their fresh state (Kozlov and Zdor 2003). Moreover, in the tropics putrefaction happens very rapidly and with almost no investment of time or energy by the consumer. In other words, in many respects putrefaction, through the combined postmortem proteolytic effects of endogenous enzymes in the carcass and the products of both endogenous and exogenous bacterial action, becomes a powerful and very low-cost way of "pre-digesting" meat and fish, softening the flesh significantly, and breaking down the proteins into peptides and amino acids (Amato et al. 2021; Fadda et al. 2002; Forbes et al. 2017; Ordóñez and de la Hoz 2007; Petäjä-Kanninen and Puolanne 2007). The same endogenous and exogenous processes also contribute to the breakdown or lipolysis of fats in the food, liberating a range of nutritionally beneficial free fatty acids (Forbes et al. 2017; Vasundhara et al. 1983). In essence, putrefaction produces many of the same benefits that cooking does but at far less cost.

If the ability of humans to consume decomposing carrion without adverse health consequences was widely shared prior to the modern era by foraging populations as far removed from each other as the arctic and the lowland African rainforests, then it could be an ability of considerable antiquity. An interesting question then is how far back in time does it actually go? If one assumes, as many do, that cooking is necessary in order to kill or inhibit the growth of pathogens such as *C. botulinum*, *L. monocytogenes*, and *Salmonella*, or to deactivate their toxic metabolites (e.g., Ragir et al. 2000; Smith et al. 2015), then the potential time-depth is dependent on when humans gained regular control of fire. This is an issue that has received a great deal of attention, yet one that remains far from resolved and quite contentious. Most, though by no means all, agree that hominins had gained effective control of fire, and hence cooking, sometime during the Middle Pleistocene, perhaps by 300–400 ka. Many, however, argue for an earlier date, pushing it back to at least 1.0 mya, and some to as much as 1.8–2.0 mya (see differing opinions in Alperson-Afil et al. 2017; Dibble et al. 2018; Fernández-Jalvo et al. 2018; Gowlett

2016; Hlubik et al. 2017; MacDonald 2017; MacDonald et al. 2021; McCauley et al. 2020; Peris et al. 2012; Pop et al. 2016; Sandgathe et al. 2011; Shimelmitz et al. 2014; Thompson et al. 2021; Wrangham 2009).

We offer a somewhat different take on this issue, one that departs from conventional wisdom. Though anything but certain, in our view there is a very real possibility that cooking, even in the equatorial latitudes, may not have been necessary in order to render putrid meat safe as a food for hunting–scavenging hominins. There are several reasons that lead us to this suggestion.

First, the sight, smell, and taste of putrid meat were not universal elicitors of disgust, as is widely assumed in Western popular and scientific thinking; instead, they were commonly taken as signals of acceptable, even desirable food.

Second, for centuries circumpolar peoples have routinely consumed thoroughly putrefied meat with no major adverse effects, and they found it to be as desirable in summer as in winter. Thus, exposure to summer sun and heat did not necessarily make decomposing animal foods any less attractive. *And regardless of season, they often ate such meat without cooking it*. In winter, northern peoples deliberately froze much of the raw putrid meat before they ate it, letting it thaw slightly first in order to achieve a desirable texture (Spray 2002: 39). However, freezing and partial thawing neither kill nor deactivate the pathogens nor their toxic metabolites (Archer 2004: 129, 131; Golden et al. 1988: 17, 22–23; James 1933: 241; Siegel 1993: 339). Instead, what freezing and partial thawing very likely accomplished, when done in conjunction with putrefaction, was to make the meat easier to chew, ingest, and metabolize, not to mention conserve precious fuel, but it probably did little to eliminate pathogens or their byproducts.

And third, since both circumpolar peoples and modern Westerners have comparably low gastric pH values (between 1 and 2), that factor alone cannot account for the protection that traditional Indigenous northern peoples obviously possessed when it came to consuming putrid carrion. And since they regularly consumed meat in this state without cooking, and freezing would not have offered them much if any protection, the source of that protection must lie elsewhere, perhaps in their gut flora or in their genes (or some combination of the two). Studies of monozygotic twins, as well as comparisons of the immune resistance of carrion-eating animals like hyenas living in the wild versus those kept in zoos, suggest that early life experience and labile gut floras, in conjunction with the low pH of our stomach, may in fact be the most critical factors.

In conclusion, we suspect that many Indigenous populations throughout the world were able to consume putrid meat, fat, and fish with little or no concern about botulism or other pathogens, and they may have been able to do so regardless of whether the food was cooked or raw, and regardless of whether the cooking was thorough or superficial and barely enough to singe off the fur and warm the exterior portion of the meat. That ability is now being steadily eroded as Western ideals of foods, foodways, and sanitation are becoming increasingly globalized.

For scholars interested in human origins and evolution, this conclusion, if correct, implies that early hominins could have scavenged meat (and fat) from putrid carcasses and consumed it safely without having to cook it first. Putrefaction, by softening and "pre-digesting" the meat, would in fact have offered them many of the same benefits that they would have obtained by cooking it, but at less cost. We suspect that the value of cooking meat would have increased once hominins began to acquire greater proportions of *fresh meat* from animals they had killed themselves. Whatever the case, we hasten to point out that we do not envision our suggestions here as counterarguments to Wrangham's (2009) "cooking hypothesis" (see also Carmody et al. 2011). In our view, and in the opinion of many other scholars, meat—whether hunted or scavenged—probably provided only a small and unreliable component of early hominin diet, with the bulk of both energy and macronutrients coming from plant foods (Barr et al. 2022; O'Connell et al. 2002). It is conceivable, therefore, that cooking's most important nutritional contribution to early hominin diet and subsistence lay in the botanical domain, especially by making tubers and other starchy and oily plant foods more readily accessible, chewable, and digestible (e.g., Groopman et al. 2015; Schnorr et al. 2016; Wrangham 2009). And, of course, at some as yet unknown point in the human story the use of fire added all sorts of social and symbolic dimensions to human foodways and ways of life.

This is an exciting time in the study of human origins and evolution. Many of the questions we are now asking are amazingly broad and truly interdisciplinary. To resolve issues such as the ones we raise in the present paper, we need input from a remarkably diverse array of scholars, not just archaeologists and paleoanthropologists, but also ethnologists, wildlife biologists, microbiologists, food scientists and nutritionists, public health specialists, geneticists, historians, and many others. But there is also a lesson that we believe can be learned from studies such as the present one. It can be very misleading to assume that the peoples one studies today, even if one's sample is huge and deliberately cross-cultural, are necessarily representative of *humanity* across all time and space. If the sample has been drawn from populations whose foodways and health systems have been impacted by the "modern" world, the results of such studies may tell us a great deal about ourselves, but lead us astray if we project such information uncritically into the past, even into a past as recent as the late-19th century.

ACKNOWLEDGMENTS

This paper was initially presented at the 91st annual meeting of the American Association of Biological Anthropologists (AABA) on March 25, 2022, in Denver, Colorado. Working together on the manuscript was a real treat. When we began, conventional wisdom told us that the last place on earth where we would find evidence for heavy reliance on putrid meat would be in the tropics, especially in areas like the hot humid rainforests of the Congo Basin. But

find it we did, and lots of it. Once we knew the project was not a dead end, it became a bit like a treasure hunt. We began systematically searching the ethnohistoric literature for first-hand descriptions of Indigenous people in Africa and elsewhere eating putrid meat. Almost daily via email we would share our latest findings, and gradually, step-by-step, we were able to put together a coherent picture of the cultural values given by Indigenous peoples to putrid meat and fish, how (if at all) such decomposing foods were prepared, what health consequences there might be as a result of eating such foods, and so forth. And as we assembled the basic data, their implications for many broader issues and questions became increasingly evident. For example, it became clear that aversion to putrid meat was not a hardwired pan-human disgust response, but largely a modern "Western" or "Westernization" phenomenon that has become increasingly globalized by colonialism, industrialization, urbanization, and Euromericans' unceasing "war against germs." It also became obvious that one did not need to be a vulture or hyena to consume carrion, a conclusion with implications for archaeologists interested in early hominin scavenging. Putrefaction "pre-digests" meat, much like cooking does, but it would have been a low-cost means of food preparation available to our ancestors long before they gained control of fire. This entire project is a product of the digital age. We can only stand in awe of scholars who, even just a few years ago, attempted to cull data from the ethnohistoric literature as we did, but without the aid of the computer, Internet, pdfs, and optical character recognition (OCR). We literally went through thousands of books and articles to find what we were after. And we were able to do this while hardly ever leaving the comfort of our office or setting foot in a brick-and-mortar library. Just a few decades ago scholars would have had to spend hundreds of hours, or more, squirreled away in a dusty library carrel or rare book room thumbing through piles of ancient tomes and periodicals to find what we were able to get our hands on, and keyword search, in a matter of seconds via the Internet. And where scans were old, and searching for specific terms was not at first possible, OCR worked its magic and we were back in business. It therefore seems appropriate, if perhaps a bit unorthodox, to acknowledge, not the usual internal and external funding agencies (none were required), but the real heroes of this project—Google Scholar, Internet Archive (Archive.org), HathiTrust Digital Library, JSTOR, ProQuest Dissertations and Theses, Gallica, Project Muse, the digital library catalogs of the University of Michigan and Trent University, Academia.edu, ResearchGate, the pdfs obtained directly from authors or through digital interlibrary loan (ILL), and many others. And we have just scratched the surface, focusing mainly on works in English and French, and far more heavily on North America and sub-Saharan Africa than elsewhere. There is still so much to be examined in German, Italian, Dutch, Swedish, Portuguese, Afrikaans, and many languages elsewhere across the globe. The ethnohistoric record is so much more than just a massive collection of antiquated trivia recorded by explorers blinded by their own cultural biases, prejudices, and often arrogant racism. Buried within is a treasure trove of insights into many of today's cutting-edge questions and issues in archaeology, anthropology, health and nutrition sciences, microbiology, evolutionary psychology, and many other areas of research and study. We hope others will see the value of these documents and pick up where we left off. Finally, in closing, we want to acknowledge our two anonymous reviewers for their insightful and very helpful comments on the manuscript. We had to do some deep thinking to address some of their comments, but we know the paper is stronger and clearer as a result. Finally, one of us (JDS) completed many of the final revisions to the manuscript during a brief but wonderful stint as a Resident Scholar at the University of Arizona School of Anthropology's "University Indian Ruin" (UIR) in June 2022. Many thanks to the School of Anthropology and to Diane Austin, Director, for making this wonderful opportunity possible.

REFERENCES

Alessandri, G., Rizzo, S.M., Ossiprandi, M.C., Sinderen, D.V., Ventura, M. 2022. Creating an atlas to visualize the biodiversity of the mammalian gut microbiota. *Current Opinion in Biotechnology* 7, 28–33.

Alperson-Afil, N., Richter, D., Goren-Inbar, N. 2017. Evaluating the intensity of fire at the Acheulian site of Gesher Benot Ya'aqov—spatial and thermoluminescence analyses. *PLoS One* 12, e0188091 and 13, e0190804.

Amato, K.R., Mallott, E.K., Maia, P.D.A., Sardaro, M.L.S. 2021. Predigestion as an evolutionary impetus for human use of fermented food. *Current Anthropology* 62, S207–S219.

Anderson, R.M. 1918. Eskimo food—how it tastes to a white man. *Ottawa Naturalist* 32, 59–65.

Andersson, C.J. 1857. *Lake Ngami; or, Explorations and Discoveries During Four Years' Wanderings in the Wilds of South Western Africa*. Dix, Edwards and Company, New York.

Andersson, C.J. 1875. *Notes of Travel in South Africa*. Hurst and Blackett, London.

Ankei, T. 1990. *Cookbook of the Songola: An Anthropological Study on the Technology of Food Preparation Among a Bantu-Speaking People of the Zaïre Forest*. African Study Monographs Supplementary Issue 13, 1–174.

Ankermann, B. 1906. L'ethnographie actuelle de l'Afrique méridionale. *Anthropos* 1, 552–591.

Anonymous. 1841. *The Christian Traveller: Western Africa. Being an Account of the Country and its Products; of the People and their Condition; and of the Measures Taken for their Religious and Social Benefit*. Charles Knight, London.

Ansorge, W.J. 1899. *Under the African Sun: A Description of the Native Races in Uganda, Sporting Adventures and Other Experiences*. William Heinemann, London.

Apostol, A.C., Jensen, K.D.C., Beaudin, A.E. 2020. Training the fetal immune system through maternal inflammation—a layered hygiene hypothesis. *Frontiers in Immunology* 11, 1–14 (https://core.ac.uk/download/pdf/39201466.pdf).

Archer, D.L. 2004. Freezing: an underutilized food safety technology? *International Journal of Food Microbiology* 90, 127–138.

Armanios, F., Ergene, B.A. 2018. *Halal Food: A History*. Oxford University Press, New York.

Atyeo, C., Alter, G. 2021. The multifaceted roles of breast milk antibodies. *Cell* 184, 1486–1499.

Aubaile-Sallenave, F., 2005. Meat among Mediterranean Muslims: beliefs and praxis. *Estudios del Hombre* 19, 127–153.

Audubon, J.J. 1897. The Missouri River journals, 1843. In Audubon, M.R. (Ed.), *Audubon and his Journals, with Zoological and Other Notes by Elliott Coues*, Vol. 1. Charles Scribner's Sons, New York, pp. 447–532.

Austin, H.H. 1902. *Among Swamps and Giants in Equatorial Africa: An Account of Surveys and Adventures in the Southern Sudan and British East Africa*. C. Arthur Pearson, London.

Baegert, J.J. 1773. *Nachrichten von der Amerikanischen Halbinsel Californien: Mit einem Zweyfachen Anhang Falscher Nachrichten*. Gedruckt in der Churfürstl. Hof- und Academie-Buchdruckerey, Mannheim.

Baegert, J.J. 1952. *Observations in Lower California*. University of California Press, Berkeley.

Bagshawe, F.J. 1925. The peoples of the Happy Valley (East Africa): the aboriginal races of Kondoa Irangi, Part II. The Kangeju. *Journal of the Royal African Society* 24, 117–130.

Bailey, H. (Bula N'zau). 1894. *Travel and Adventures in the Congo Free State and Its Big Game Shooting*. Chapman and Hall, London.

Bailey, R.C. 1991. *The Behavioral Ecology of Efe Pygmy Men in the Ituri Forest, Zaire*. Anthropological Paper 86. University of Michigan Museum of Anthropology, Ann Arbor.

Baker, S.W. 1867. The races of the Nile basin. *Transactions of the Ethnological Society of London* 5, 228–238.

Baker, S.W. 1868. *The Albert N'yanza Great Basin of the Nile, and Explorations of the Nile Sources*. J. B. Lippincott, Philadelphia.

Baldry, P.E. 1965. *The Battle Against Bacteria: A History of the Development of Antibacterial Drugs, for the General Reader*. Cambridge University Press, Cambridge.

Barr, W.A., Pobiner, B., Rowan, J., Dud, A., Faith, J.T. 2022. No sustained increase in zooarchaeological evidence for carnivory after the appearance of *Homo erectus*. *Proceedings of the National Academy of Sciences, USA* 119, e2115540119.

Beasley, D.E., Koltz, A.M., Lambert, J.E., Fierer, N., Dunn, R.R. 2015a. The evolution of stomach acidity and its relevance to the human microbiome. *PLoS One* 10, e0134116.

Beasley, J.C., Olson, Z.H., DeVault, T.L. 2015b. Ecological role of vertebrate scavengers. In Benbow, M.E., Tomberlin, J.K., Tarone, A.M. (Eds.), *Carrion Ecology, Evolution, and their Applications*. CRC Press, Boca Raton, FL, pp. 107–127.

Becker, J. 1887. *La Vie en Afrique ou Trois Ans dans l'Afrique Centrale*, Tome 1. J. Lebègue, Paris.

Beckerman, S., Lizzaralde, R. 2013. *The Ecology of the Bari: Rainforest Horticulturalists of South America*. University of Texas Press, Austin.

Béguin, E. 1903. *Les Ma-Rotsé: Étude Géographique et Ethnographique du Haut-Zambèze*. Guilloud-Howard, Lausanne.

Bennett, A.L. 1899. Ethnographical notes on the Fang. *Journal of the Anthropological Institute of Great Britain and Ireland* 29, 66–98.

Bergman, R.W. 1974. *Shipibo subsistence in the Upper Amazon rainforest*. Ph.D. Dissertation. University of Wisconsin.

Bernier, J. 2022. *Rethinking the Dates of the New Testament: The Evidence for Early Composition*. Baker Academic, Grand Rapids, MI.

Beyries, S. 2002. Le travail du cuir chez les Tchouktches et les Athapaskans: implications ethno-archéologiques. In Audoin-Rouzeau, F., Beyries, S. (Eds.), *Le Travail du Cuir de la Préhistoire à Nos Jours*. Actes des XXIIe Rencontres Internationales d'Archéologie et d'Histoire d'Antibes, 18–20 Octobre 2001. Éditions APDCA (Association pour la Promotion et la Diffusion des Connaissances Archéologiques), Antibes, France, pp. 143–157.

Bhuttacharjee, H.C. 1869. Prevailing diseases in the Angami Naga Hills. *Indian Medical Gazette* 4, 13–14.

Blidstein, M. 2017. *Purity, Community, and Ritual in Early Christian Literature*. Oxford University Press, Oxford.

Blum, W.E.H., Zechmeister-Boltenstern, S., Keiblinger, K.M. 2019. Does soil contribute to the human gut microbiome? *Microorganisms* 7 (9), 287.

Blumstein, D.T., Rangchi, T.N., Briggs, T., De Andrade, F.S., Natterson-Horowitz, B. 2017. A systematic review of carrion eaters' adaptations to avoid sickness. *Journal of Wildlife Diseases* 53, 577–581.

Bodley, J.H. 2015. *Victims of Progress*, 6th ed. Rowman and Littlefield, Lanham, MD.

Bogoras, W. 1904. The Chukchee—material culture. In Boas, F. (Ed.), *The Jesup North Pacific Expedition*. G. E. Stechert, New York, pp. 1–276.

Botero, J.S.H., Pérez, M.C.F. 2012. The history of sepsis from ancient Egypt to the XIX century. In Azevedo, L. (Ed.), *Sepsis: An Ongoing and Significant Challenge*. IntechOpen, London, pp. 3–32. (available from: https://www.intechopen.com/books/2583).

Bourke, J.G. 1888. *Compilation of Notes and Memoranda Bearing Upon the Use of Human Ordure and Human Urine in Rites of a Religious or Semi-Religious Character Among Various Nations*. U.S. War Department, Washington, DC.

Bourke, J.G. 1891. *Scatalogic Rites of All Nations: A Dissertation Upon the Employment of Excrementitious Remedial Agents in Religion, Therapeutics, Divination, Witchcraft, Love-Philters, etc., in All Parts of the Globe: Based Upon Original Notes and Personal Observation, and Upon Compilation from One Thousand Authorities*. W. H. Lowdermilk, Washington, DC.

Breasted, J.H. 1930. *The Edwin Smith Surgical Papyrus: Published in Facsimile and Hieroglyphic Transliteration with*

Translation and Commentary, Vol. 1. University of Chicago Press, Chicago.
Brown, K.M. 2009. *Foul Bodies: Cleanliness in Early America*. Yale University Press, New Haven.
Buck, L.T., Berbesque, J.C., Wood, B.M., Stringer, C.B. 2016. Tropical forager gastrophagy and its implications for extinct hominin diets. *Journal of Archaeological Science: Reports* 5, 672–679.
Burch, E.S. 2006. *Social Life in Northwest Alaska: The Structure of Iñupiaq Eskimo Nations*. University of Alaska Press, Fairbanks.
Burton, R.F. 1873. *The Lands of Cazembe: Lacerda's Journey to Cazembe in 1798*. John Murray, London.
Buss, D.M. 2019. *Evolutionary Psychology: The New Science of the Mind*, 6th Ed. Routledge, New York.
Butler, J.R.A., du Toit, J.T. 2002. Diet of free-ranging domestic dogs (*Canis familiaris*) in rural Zimbabwe: implications for wild scavengers on the periphery of wildlife reserves. *Animal Conservation* 5, 29–37.
Cabeza de Vaca, A.N. 1922. *The Journey of Alvar Nuñez Cabeza de Vaca and his Companions from Florida to the Pacific, 1528–1536* (Translated by Fanny Bandelier). Allerton, New York.
Cailliaud, F. 1826. *Voyage à Méroé, au Fleuve Blanc au-delà de Fazoql, dans le Midi du Royaume de Sennâr, à Syouah, et dans Cinq Autres Oasis: Fait dans les Années 1819, 1820, 1821 et 1822*, Tome 1. Imprimerie Royale, Paris.
Calmeyn, M. 1912. *Au Congo Belge: Chasses à l'Eléphant, les Indigènes*. L'Administration en vente chez les Principaux Libraires, Bruxelles.
Campbell, J. 1822. *Travels in South Africa, Undertaken at the Request of the London Missionary Society; Being a Narrative of a Second Journey in the Interior of that Country*, Vol. 1. Francis Westley, London.
Campbell, R., Hauptmann, A., Campbell, K., Fox, S., Marco, M.L. 2022. Better understanding of food and human microbiomes through collaborative research on Inuit fermented foods. *Microbiome Research Reports* 1, 5 (https://www.oaepublish.com/mrr/article/view/4568).
Candela, M., Biagi, E., Maccaferri, S., Turroni, S., Brigidi, P. 2012. Intestinal microbiota is a plastic factor responding to environmental changes. *Trends in Microbiology* 20, 385–391.
Cardinall, A.W. 1920. *The Natives of the Northern Territories of the Gold Coast: Their Customs, Religion and Folklore*. George Routledge and Sons, London.
Carmody, R.N., Weintraub, G.S., Wrangham, R.W. 2011. Energetic consequences of thermal and nonthermal food processing. *Proceedings of the National Academy of Sciences USA* 108, 19199–19203.
Carreira, A. 1969. Mandyoko-Brams and Balantes of Portuguese Guinea. *Translations on Africa* 762, 36–62.
Chaillé-Long, C. 1876. *Central Africa: Naked Truths of Naked People. An Account of Expeditions to the Lake Victoria Nyanza and the Makraka Niam-Niam, West of the Bahr-el-Abiad (White Nile)*. Sampson Low, Marston, Searle, and Rivington, London.
Chanler, W.A. 1896. *Through Jungle and Desert: Travels in Eastern Africa*. Macmillan, London.
Chiou, L.A., Hennessy, T.W., Horn, A., Carter, G., Butler, J.C. 2002. Botulism among Alaska natives in the Bristol Bay area of southwest Alaska: a survey of knowledge, attitudes, and practices related to fermented foods known to cause botulism. *International Journal of Circumpolar Health* 61, 50–60.
Christy, C. 1924. *Big Game and Pygmies: Experiences of a Naturalist in Central African Forests in Quest of the Okapi*. Macmillan, London.
Clark, L. 1961. *The Rivers Ran East*. Funk and Wagnalls, New York.
Coad, L. 2007. *Bushmeat hunting in Gabon: Socio-economics and Hunter Behaviour*. Ph.D. Dissertation. University of Cambridge.
Coates, K.S. 2004. *A Global History of Indigenous Peoples: Struggle and Survival*. Palgrave Macmillan, Basingstoke, England.
Colenso, J.W. 1865. On the efforts of missionaries among savages. *Journal of the Anthropological Society of London* 3, clxiii–clxxxiii.
Conteville, L.C., Oliveira-Ferreira, J., Vicente, A.C.P. 2019. Gut microbiome biomarkers and functional diversity within an Amazonian semi-nomadic hunter-gatherer group. *Frontiers in Microbiology* 10, 1–10 (https://www.frontiersin.org/articles/10.3389/fmicb.2019.01743/full).
Cosetta, C.M., Wolfe, B.E. 2019. Causes and consequences of biotic interactions within microbiomes. *Current Opinion in Microbiology* 50, 35–41.
Coues, E. 1897. *New Light on the Early History of the Greater Northwest: The Manuscript Journals of Alexander Henry, Fur Trader of the Northwest Company and of David Thompson, Official Geographer and Explorer of the Same Company, 1799–1814. Exploration and Adventure Among the Indians on the Red, Saskatchewan, Missouri, and Columbia Rivers*, Vol. 2. Francis P. Harper, New York.
Crawshay, R. 1904. Some observations on the field natural history of the lion. *Proceedings of the Zoological Society of London* 74, 264–268.
Cureau, A.L. 1915. *Savage Man in Central Africa: A Study of Primitive Races in the French Congo*. T. Fisher Unwin, London.
Curtis, V., Aunger, R., Rabie, T. 2004. Evidence that disgust evolved to protect from risk of disease. *Proceedings of the Royal Society of London, Series B. Biological Sciences* 271B, S131–S133.
Dahl, K. 1926. In *Savage Australia: An Account of a Hunting and Collecting Expedition to Arnhem Land and Dampier Land*. Philip Allan, London.
Daria, S., Islam, M.R. 2021. The use of cow dung and urine to cure COVID-19 in India: a public health concern. *International Journal of Health Planning and Management* 36, 1950–1952.
David, L.A., Maurice, C.F., Carmody, R.N., Gootenberg, D.B., Button, J.E., Wolfe, B.E., Ling, A.V., Devlin, A.S., Varma, Y., Fischbach, M.A., Biddinger, S.B., Dutton, R.J., Turnbaugh, P.J. 2014. Diet rapidly and reproducibly alters the human gut microbiome. *Nature* 505, 559–

563.
Davis, W.E. 1941. *Congo Doctor*. Robert Hale, London.
Decle, L. 1898. *Three Years in Savage Africa*. Methuen, London.
De Cuyper, A., Hesta, M., Tibosch, S., Wanke, C., Clauss, M., Janssens, G.P.J. 2018. How does dietary particle size affect carnivore gastrointestinal transit: a dog model. *Journal of Animal Physiology and Animal Nutrition* 102, e615–e622.
Deken, C.D. 1900. *Deux Ans au Congo*. Clément Thibaut, Anvers.
Denis, A., Denis, L.R. 1938. The photographic essay: the Belgian Congo: the Denis–Roosevelt Expedition films its giants and pygmies, its customs and ceremonies, its animals and atmosphere (Belgian Congo Denis–Roosevelt Expedition films tribes in Africa's darkest corner). *Life Magazine* 4, 40–53.
Department of Health and Social Services. 2017. *Botulism in Alaska*. State of Alaska, Department of Health and Social Services (DHSS), Division of Public Health, Section of Epidemiology, Anchorage, AK. (http://dhss.alaska.gov/dph/Epi/id/SiteAssests/Pages/botulism/monograph.pdf).
Deschamps, É. 1891. Les Veddas de Ceylan et leurs rapports avec les peuples environnants, les Rhodias et les Singhalais. *L'Anthropologie* 2, 297–337.
DeVault, T.L., Rhodes, O.E., Shivik, J.A. 2003. Scavenging by vertebrates: behavioral, ecological, and evolutionary perspectives on an important energy transfer pathway in terrestrial ecosystems. *Oikos* 102, 225–234.
Di Peso, C.C., Matson, D.S., Gilg, A. 1965. The Seri Indians in 1692 as described by Adamo Gilg, S. J. *Arizona and the West* 7, 33–56.
Dibble, H.L., Sandgathe, D., Goldberg, P., McPherron, S., Aldeias, V. 2018. Were western European Neandertals able to make fire? *Journal of Paleolithic Archaeology* 1, 54–79.
Diebitsch-Peary, J. 1894. *My Arctic Journal: A Year Among Ice-Fields and Eskimos. With an Account of the Great White Journey Across Greenland by Robert E. Peary*. Longmans, Green, and Company, London.
Domenech, E. 1860. *Seven Years Residence in the Great Deserts of North America*, Vol. 2. Longman, Green, Longman, and Roberts, London.
Dorman, M.R.P. 1905. *A Journal of a Tour in the Congo Free State*. J. Lebègue, Brussels.
Dornan, S.S. 1925. *Pygmies and Bushmen of the Kalahari: An Account of the Hunting Tribes Inhabiting the Great Arid Plateau of the Kalahari Desert, their Precarious Manner of Living, their Habits, Customs and Beliefs, with Some Reference to Bushman Art, Both Early and of Recent Date, and to the Neighbouring African Tribes*. Seeley Service and Company, London.
Dornstreich, M.D. 1973. *An Ecological Study of Gadio Enga (New Guinea) Subsistence*. Ph.D. Dissertation. Columbia University.
Dressman, J.B. 1986. Comparison of canine and human gastrointestinal physiology. *Pharmaceutical Research* 3, 123–131.
Dubois, G., Girard, C., Lapointe, F.-J., Shapiro, B.J. 2017. The Inuit gut microbiome is dynamic over time and shaped by traditional foods. *Microbiome* 5, 151.
Dudley, J.P. 2003. Record of carnivory, scavenging and predation for *Hippopotamus amphibius* in Hwange National Park, Zimbabwe. *Mammalia* 60, 486–488.
Ebers, G. 1889. *Papyrus Ebers: Die Maasse und das Kapitel über die Augenkrankheiten. Abhandlungen der Philologisch–Historischen Klasse der Königl*. Sächsischen Gesellschaft der Wissenschaften Band 11, No 2–3. S. Hirzel, Leipzig.
Eidlitz, K., 1969. *Food and Emergency Food in the Circumpolar Area*. Almqvist and Wiksells Boktryckert AB, Uppsala.
El-Tounsy, M.E.-O. 1845. *Voyage au Darfour*. Benjamin Duprat, Paris.
Elemam, A.E.M. 2009. *Microbiology and Chemical Composition of Fermented Cow Urine (Okah)*. M.S. Thesis. University of Khartoum.
Eyre, E.J. 1845. *Journals of Expeditions of Discovery into Central Australia, and Overland from Adelaide to King George's Sound, in the Years 1840–1; Sent by the Colonists of South Australia, with the Sanction and Support of the Government: Including an Account of the Manners and Customs of the Aborigines and the State of their Relations with Europeans*, Vol. 2. T. and W. Boone, London.
Fadda, S., Oliver, G., Vignolo, G. 2002. Protein degradation by *Lactobacillus plantarum* and *Lactobacillus casei* in a sausage model system. *Journal of Food Science* 67, 1179–1183.
Fagan, R.P., McLaughlin, J.B., Castrodale, L.J., Gessner, B.D., Jenkerson, S.A., Funk, E.A., Hennessy, T.W., Middaugh, J.P., Butler, J.C. 2011. Endemic foodborne botulism among Alaska native persons—Alaska, 1947–2007. *Clinical Infectious Diseases* 52, 585–592.
Farini, G.A. 1886. *Through the Kalahari Desert: A Narrative of a Journey with Gun and Camera, and Note-Book to Lake N'Gami and Back*. Scribner and Welford, New York.
Faulkner, H. 1868. *Elephant Haunts: Being a Sportsman's Narrative of the Search for Doctor Livingstone, with Scenes of Elephant, Buffalo, and Hippopotamus Hunting*. Hurst and Blackett, London.
Fernández-Jalvo, Y., Tormo, L., Andrews, P., Marin-Monfort, M.D. 2018. Taphonomy of burnt bones from Wonderwerk Cave (South Africa). *Quaternary International* 495, 19–29.
Flies, A.S., Mansfield, L.S., Grant, C.K., Weldele, M.L., Holekamp, K.E. 2015. Markedly elevated antibody responses in wild versus captive spotted hyenas show that environmental and ecological factors are important modulators of immunity. *PLoS One* 10, e0137679).
Forbes, H.O. 1885. *A Naturalist's Wanderings in the Eastern Archipelago: A Narrative of Travel and Exploration from 1878 to 1883*. Harper and Brothers, New York.
Forbes, S.L., Perrault, K.A., Comstock, J.L. 2017. Microscopic post-mortem changes: the chemistry of decomposition. In Schotsmans, E.M.J., Márquez-Grant, N., Forbes, S.L. (Eds.), *Taphonomy of Human Remains: Forensic Analysis of the Dead and the Depositional Environment*.

John Wiley and Sons, Chichester, pp. 26–38.
Fortes, M., Fortes, S.L. 1936. Food in the domestic economy of the Tallensi. *Africa* 2, 237–276.
Foster, C., Foster, D. 2000. *The Great Dance: A Hunter's Story* (a film directed by Craig Foster and Damon Foster, produced by Ellen Windemuth, an Aardvark/Earthrise/Liquid Pictures/Off The Fence production, in association with KirchMedia and Primedia Pictures, distributed by Ster-Kinekor, Johannesburg, 75 minutes).
Foster, W. 1905. *The Journal of John Jourdain, 1608–1617, Describing His Experiences in Arabia, India, and the Malay Archipelago*, 2nd Series, No. 16. Hakluyt Society, Cambridge.
Freidenreich, D.M. 2011. *Foreigners and Their Food: Constructing Otherness in Jewish, Christian, and Islamic Law*. University of California Press, Berkeley.
Freidenreich, D.M. 2015. Dietary law. In Silverstein, A.J., Stroumsa, G.G. (Eds.), *The Oxford Handbook of the Abrahamic Religions*. Oxford University Press, Oxford, pp. 466–482.
Fryke, C., Schewitzer, C. 1700. *A Relation of Two Several Voyages Made into the East-Indies, by Christopher Fryke, Surg. and Christopher Schewitzer. The Whole Containing an Exact Account of the Customs, Dispositions, Manners, Religion, &c. of the Several Kingdoms and Dominions in those Parts of the World in General: but in a More Particular Manner, Describing those Countries Which Are Under the Power and Government of the Dutch*. D. Brown, S. Crouch, J. Knapton, R. Knaplock, J. Wyate, B. Took, and S. Buckle, London.
Gage, T. 1677. *A New Survey of the West-Indies: Or the English American His Travel by Sea and Land, Containing a Journal of Three Thousand and Three Hundred Miles within the Main Land of America: Wherein Is Set Forth His Voyage from Spain to S. John de Vlhna...and Forward to Mexico: with the Description of that Great City, As It Was in Former Times, and Also at this Present...with His Abode XII Years About Guatemala, Especiall in the Indian Towns....* A. Clark, London.
Gagnon, F.-M., Senior, N., Ouellet, R. 2011. *Codex Canadensis and the Writings of Louis Nicolas: The Natural History of the New World, Histoire Naturelle des Indes Occidentales*. McGill–Queen's University Press, Montreal.
Galanaki, M.E. 2014. Waterborne diseases in the Hippocratic treatise *Airs, Waters, Places*. In Angelakis, A.N., Rose, J.B. (Eds.), *Evolution of Sanitation and Wastewater Technologies Through the Centuries*. IWA Publishing, London, pp. 419–428.
Gilbert, J.A., Blaser, M.J., Caporaso, J.G., Jansson, J.K., Lynch, S.V., Knight, R. 2018. Current understanding of the human microbiome. *Nature Medicine* 24, 392–400.
Girard, C., Tromas, N., Amyot, M., Shapiro, B.J. 2017. Gut microbiome of the Canadian arctic Inuit. *mSphere* 2, 1–14 (https://journals.asm.org/doi/10.1128/mSphere.00297-16).
Giraud, V. 1890. *Les Lacs de l'Afrique Équatoriale: Voyage d'Exploration Exécuté de 1883 à 1885*. Librairie Hachette, Paris.
Glave, E.J. 1893. *Six Years of Adventure in Congo-Land*. Sampson Low, Marston and Company, London.
Golden, D.A., Beuchat, L.R., Brackett, R.E. 1988. Inactivation and injury of *Listeria monocytogenes* as affected by heating and freezing. *Food Microbiology* 5, 17–23.
Goldsmith, D. 2021. Smellscapes in ancient Egypt. In Neumann, K., Thomason, A. (Eds.), *The Routledge Handbook of the Senses in the Ancient Near East*. Routledge, London, pp. 636–662.
Gompper, M.E. 2014. *Free-Ranging Dogs and Wildlife Conservation*. Oxford University Press, Oxford.
Gowlett, J.A.J. 2016. The discovery of fire by humans: a long and convoluted process. *Philosophical Transactions of the Royal Society (London), Series B. Biological Sciences* 371, 20150164.
Grant, J.A. 1864. *A Walk Across Africa; or, Domestic Scenes from My Nile Journal*. William Blackwood and Sons, Edinburgh.
Graves, G.R. 2017. Field measurements of gastrointestinal pH of New World vultures in Guyana. *Journal of Raptor Research* 51, 465–469.
Gray, W., Dochard, S.S. 1825. *Travels in Western Africa, in the Years 1818, 19, 20, and 21, from the River Gambia, Through Woolli, Bondoo, Galam, Kasson, Kaarta, and Foolidoo, to the River Niger*. John Murray, London.
Greenberg, R. 2019. *The Archaeology of the Bronze Age Levant from Urban Origins to the Demise of City–States, 3700–1000 BCE*. Cambridge University Press, Cambridge.
Grey, G. 1841. *Journals of Two Expeditions of Discovery in North-West and Western Australia, During the Years 1837, 38, and 39, Under the Authority of Her Majesty's Government. Describing Many Newly Discovered, Important, and Fertile Districts, with Observations on the Moral and Physical Condition of the Aboriginal Inhabitants, &c., &c*, Vol. 2. T. and W. Boone, London.
Grieneisen, L.E., Charpentier, M.J.E., Alberts, S.C., Blekhman, R., Bradburd, G., Tung, J., Archie, E.A. 2019. Genes, geology and germs: gut microbiota across a primate hybrid zone are explained by site soil properties, not host species. *Proceedings of the Royal Society, Series B. Biological Sciences* 286, 20190431.
Grivetti, L.E. 1978. Culture, diet, and nutrition: selected themes and topics. *BioScience* 28, 171–177.
Grivetti, L.E., Pangborn, R.M. 1974. Origin of selected Old Testament dietary prohibitions: an evaluative review. *Journal of the American Dietetic Association* 65, 634–638.
Groopman, E., Carmody, R.N., Wrangham, R.W. 2015. Cooking increases net energy gain from a lipid-rich food. *American Journal of Physical Anthropology* 156, 11–18.
Guinnard, A. 1861. *Trois Ans d'Esclavage chez les Patagons: Récit de Ma Captivité*, 2ème ed. P. Brunet, Paris.
Gupta, V.K., Paul, S., Dutta, C. 2017. Geography, ethnicity or subsistence-specific variations in human microbiome composition and diversity. *Frontiers in Microbiology* 8, 1–16 (https://www.frontiersin.org/articles/10.3389/fmicb.2017.01162/full).
Gwynn, C.W. 1911. A journey in southern Abyssinia. *Geo-*

graphical Journal 38, 113–139.
Hamlin, C. 1985. Providence and putrefaction: Victorian sanitarians and the natural theology of health and disease. *Victorian Studies* 28, 381–411.
Handler, K.S., Subalusky, A.L., Kendall, C.J., Dutton, C.L., Rosi, E.J., Post, D.M. 2021. Temporal resource partitioning of wildebeest carcasses by scavengers after riverine mass mortality events. *Ecosphere* 12, e03326.
Harley, D. 1993. Spiritual physic, Providence and English medicine, 1560–1640. In Grell, O.P., Cunningham, A. (Eds.), *Medicine and the Reformation*. Routledge, Abingdon, England, pp. 101–117.
Harmon, D.W. 1820. *A Journal of Voyages and Travels in the Interiour of North America, Between the 47th and 58th Degrees of North Latitude, Extending from Montreal Nearly to the Pacific Ocean, a Distance of About 5,000 Miles, Including an Account of the Principal Occurrences, During a Residence of Nineteen Years, in Different Parts of the Country…*. Flagg and Gould, Andover, MA.
Harney, W.E. 1951. Australian Aboriginal cooking methods. *Mankind* 4, 242–246.
Harris, W.C. 1839. *The Wild Sports of Southern Africa: Being the Narrative of an Expedition from the Cape of Good Hope, Through the Territories of the Chief Moselekatse, to the Tropic of Capricorn*. John Murray, London.
Harrison, P. 2007. *The Fall of Man and the Foundations of Science*. Cambridge University Press, Cambridge.
Harvey, S.A. 2006. *Scenting Salvation: Ancient Christianity and the Olfactory Imagination*. University of California Press, Berkeley.
Hassan, A., Blanchard, N. 2022. Microbial (co)infections: powerful immune influencers. *PLoS Pathogens* 18, e1010212.
Hatt, G., Taylor, K. 1969. Arctic skin clothing in Eurasia and America: an ethnographic study. *Arctic Anthropology* 5, 3–132.
Hauptmann, A.L., Paulová, P., Castro-Mejía, J.L., Hansen, L.H., Sicheritz-Pontén, T., Mulvad, G., Nielsen, D.S., 2020a. The microbial composition of dried fish prepared according to Greenlandic Inuit traditions and industrial counterparts. *Food Microbiology* 85, 103305.
Hauptmann, A.L., Paulová, P., Hansen, L.H., Sicheritz-Pontén, T., Mulvad, G., Nielsen, D.S., 2020b. Microbiota in foods from Inuit traditional hunting. *PLoS One* 15, e0227819.
Hauschild, A.H.W., Dodds, K.L. 1993. *Clostridium botulinum: Ecology and Control in Foods*. CRC Press, Boca Raton, FL.
Hearne, S. 1795. *A Journey from Prince of Wales's Fort in Hudson's Bay to the Northern Ocean, Undertaken by Order of the Hudson's Bay Company for the Discovery of Copper Mines, a North-West Passage, &c., in the Years 1769, 1771, and 1772*. A. Strahan and T. Cadell, London.
Henderson, J., Harrington, J.P. 1914. *The Ethnozoology of the Tewa Indians*. Bureau of American Ethnology, Washington, DC.
Henry, P.I., Morelli, G.A. 2022. Niche construction in hunter-gatherer infancy: growth and health trade-offs inform social agency. In Hart, S.L., Bjorklund, D.F. (Eds.), *Evolutionary Perspectives on Infancy*. Springer, Cham, Switzerland, pp. 213–236.
Hensey, A.F. 1924. *My Children of the Forest*. George H. Doran, New York.
Hewlett, B.S., Winn, S. 2014. Allomaternal nursing in humans. *Current Anthropology* 55, 200–229.
Hlubik, S., Berna, F., Feibel, C., Braun, D., Harris, J.W.K. 2017. Researching the nature of fire at 1.5 mya on the site of FxJj20 AB, Koobi Fora, Kenya, using high-resolution spatial analysis and FTIR spectrometry. *Current Anthropology* 58, S243–S257.
Hoe, A. 2019. *Keystone of 22 SAS: The Life and Times of Lieutenant Colonel J M (Jock) Woodhouse MBE MC*. Pen and Sword Books, Barnsley, Yorkshire, England.
Holton, S. 1984. Feminine authority and social order: Florence Nightingale's conception of nursing and health care. *Social Analysis* 15, 59–72.
Holub, E. 1881. *Seven Years in South Africa: Travels, Researches, and Hunting Adventures, Between the Diamond-Fields and the Zambesi (1872–79)*, Vol. 2. Sampson Low, Marston, Searle, and Rivington, London.
Houston, D.C. 1979. The adaptations of scavengers. In Sinclair, A.R.E., Norton-Griffiths, M. (Eds.), *Serengeti: Dynamics of an Ecosystem*. University of Chicago Press, Chicago, pp. 263–286.
Jack, R.E., Crivelli, C., Wheatley, T. 2018. Data-driven methods to diversify knowledge of human psychology. *Trends in Cognitive Sciences* 22, 1–5.
Jackson, F. 1930. *Early Days in East Africa*. Edward Arnold, London.
James, L.H. 1933. Effects of freezing on the spores and toxin of *Clostridium botulinum*. *Journal of Infectious Diseases* 52, 236–241.
Janzen, D.H. 1977. Why fruits rot, seeds mold, and meat spoils. *American Naturalist* 111, 691–713.
Johnston, H. 1908. *George Grenfell and the Congo: A History and Description of the Congo Independent State and Adjoining Districts of Congoland, Together with Some Account of the Native Peoples and their Languages, the Fauna and Flora; and Similar Notes on the Cameroons and the Island of Fernando Pô, the Whole Founded on the Diaries and Researches of the Late Rev. George Grenfell, B.M.S., F.R.G.S.; on the Records of the British Baptist Missionary Society; and on Additional Information Contributed by the Author, by the Rev. Lawson Forfeitt, Mr. Emil Torday, and Others*, Vol. 2. Hutchinson and Company, London.
Jones, S.C., Strauss, E.D., Holekamp, K.E. 2016. Ecology of African carrion. In Benbow, M.E., Tomberlin, J.K., Tarone, A.M. (Eds.), *Carrion Ecology, Evolution, and their Applications*. CRC Press, Boca Raton, FL, pp. 461–491.
Junker, W. 1890. *Travels in Africa During the Years 1875–1878*. Chapman and Hall, London.
Kane, A., Healy, K., Guillerme, T., Ruxton, G.D., Jackson, A.L. 2017. A recipe for scavenging in vertebrates—the natural history of a behaviour. *Ecography* 40, 324–334.
King, P.P. 1827. *Narrative of a Survey of the Intertropical and Western Coasts of Australia. Performed Between the Years*

1818 and 1822. With an Appendix Containing Various Subjects Relating to Hydrography and Natural History, Vol. 1. John Murray, London.

Kozlov, A.I., Zdor, E.V. 2003. Whaling products as an element of indigenous diet in Chukotka. *Anthropology of East Europe Review* 17, 127–138.

Landor, A.H.S. 1907. *Across Widest Africa: An Account of the Country and People of Eastern, Central and Western Africa as Seen During a Twelve Months' Journey from Djibuti to Cape Verde*, Vol. 2. Hurst and Blackett, London.

Leevongcharoen, W., Thanpolphat, S., Charaslertrangsi, T. 2018. A review of thermal and pH stability of important foodborne pathogen toxins and their applications. *Thai Journal of Toxicology* 33, 83–94.

Letherman, J. 1856. Sketch of the Navajo Tribe of Indians, Territory of New Mexico. In *Tenth Annual Report of the Board of Regents of the Smithsonian Institution*. Cornelius Wendell, Washington, DC, pp. 283–297.

Liberman, Z., Woodward, A.L., Sullivan, K.R., Kinzler, K.D. 2016. Early emerging system for reasoning about the social nature of food. *Proceedings of the National Academy of Sciences* 113, 9480–9485.

Licciardello, J.J., Nickerson, J.T.R., Ribich, C.A., Goldblith, S.A. 1967. Thermal inactivation of Type E *botulinum* toxin. *Applied Microbiology* 15, 249–256.

Littré, É. 1839–1861. *Oeuvres Complètes d'Hippocrate*, Tomes 1–10. J. B. Baillière, Paris.

Losikoff, M.E. 1978. Establishment of a heat inactivation curve for *Clostridium botulinum* 62A toxin in beef broth. *Applied and Environmental Microbiology* 36, 386–388.

Lumholtz, C., 1920. *Through Central Borneo: An Account of Two Years' Travel in the Land of the Head-Hunters Between the Years 1913 and 1917*, Vol. 1. Charles Scribner's Sons, New York.

Lyons, K.E., Ryan, C.A., Dempsey, E.M., Ross, R.P., Stanton, C., 2020. Breast milk, a source of beneficial microbes and associated benefits for infant health. *Nutrients* 12, 1039.

MacDonald, K. 2017. The use of fire and human distribution. *Temperature* 4, 153–165.

MacDonald, K., Scherjon, F., van Veen, E., Vaesen, K., Roebroeks, W. 2021. Middle Pleistocene fire use: the first signal of widespread cultural diffusion in human evolution. *Proceedings of the National Academy of Sciences USA* 118, e2101108118.

MacKenzie, C. 1889. The Mississouri Indians: a narrative of four trading expeditions to the Mississouri, 1804–1805–1806, for the North-West Company. In Masson, L.R. (Ed.), *Les Bourgeois de la Compagnie du Nord-Ouest: Récits de Voyages, Lettres et Rapports Inédits Relatifs Publiés avec une Esquisse Historique et des Annotations*, Vol. 1. Imprimerie Générale A. Coté, Québec, Québec, pp. 315–394.

Maes, J. 1909. Les Warumbi. *Anthropos* 4, 607–629.

Mahar, K.M., Portelli, S., Coatney, R., Chen, E.P. 2012. Gastric pH and gastric residence time in fasted and fed conscious beagle dogs using the Bravo® pH system. *Journal of Pharmaceutical Sciences* 101, 2439–2448.

Majno, G. 1975. *The Healing Hand: Man and Wound in the Ancient World*. Harvard University Press, Cambridge, MA.

Majno, G. 1991. The ancient riddle of σῆψις (sepsis). *Journal of Infectious Diseases* 163, 937–945.

Markley, R. 2010. "A putridness in the air": monsoons and mortality in seventeenth-century Bombay. *Journal for Early Modern Cultural Studies* 10, 105–125.

Marlowe, F.W. 2010. *The Hadza: Hunter–Gatherers of Tanzania*. University of California Press, Berkeley.

Martin, M.A., Sela, D.A. 2013. Infant gut microbiota: developmental influences and health outcomes. In Clancy, K.B.H., Hinde, K., Rutherford, J.N. (Eds.), *Building Babies: Primate Development in Proximate and Ultimate Perspective. Springer*, New York, pp. 233–256.

Martinez, M., Malgrat, P., Vila, C., Llagostera, R., Salgot, M. 2014. History of the sewerage system in Barcelona, Spain: from its origins to Garcia Faria Plan. In Angelakis, A.N., Rose, J.B. (Eds.), *Evolution of Sanitation and Wastewater Technologies Through the Centuries*. IWA Publishing, London, pp. 383–400.

Mas, S. de 1843. *Informe Sobre el Estado de las Islas Filipinas en 1842, Escrito por el Autor del Aristodemo, del Sistema Musical de la Lengua Castellana, etc.*, Tomo 1. Publisher not identified, Madrid.

Maybury-Lewis, D. 1974. *Akwe-Shavante Society*. Oxford University Press, New York.

McCauley, B., Collard, M., Sandgathe, D. 2020. A cross-cultural survey of on-site fire use by recent hunter–gatherers: implications for research on Palaeolithic pyrotechnology. *Journal of Paleolithic Archaeology* 3, 560–578.

McDonald, L. 2004. Notes on nursing for the labouring classes: editor's introduction. In McDonald, L. (Ed.), *Florence Nightingale on Public Health Care. Collected Works of Florence Nightingale*, Vol. 6. Wilfrid Laurier University Press, Waterloo, Ontario, pp. 17–29.

McFall-Ngai, M., Hadfield, M.G., Bosch, T.C.G., Carey, H.V., Domazet-Lošo, T., Douglas, A.E., Dubilier, N., Eberl, G., Fukami, T., Gilbert, S.F., Hentschel, U., King, N., Kjelleberg, S., Knoll, A.H., Kremer, N., Mazmanian, S.K., Metcalf, J.L., Nealson, K., Pierce, N.E., Rawls, J.F., Reid, A., Ruby, E.G., Rumpho, M., Sanders, J.G., Tautz, D., Wernegreen, J.J. 2013. Animals in a bacterial world, a new imperative for the life sciences. *Proceedings of the National Academy of Sciences USA* 110, 3229–3236.

McLaren, M.R., Callahan, B.J. 2020. Pathogen resistance may be the principal evolutionary advantage provided by the microbiome. *Philosophical Transactions of the Royal Society (London), Series B. Biological Sciences* 375, 2019.0592.

Meggitt, M.J. 1958. The Enga of the New Guinea Highlands: some preliminary observations. *Oceania* 28, 253–330.

Mirsky, J. 1937. The Eskimo of Greenland. In Mead, M. (Ed.), *Cooperation and Competition Among Primitive Peoples*. McGraw-Hill, New York, pp. 51–86.

Moffat, R. 1842. *Missionary Labours and Scenes in Southern Africa*. John Snow, London.

Morin, E. 2020. Rethinking the emergence of bone grease procurement. *Journal of Anthropological Archaeology* 59,

101178.
Moser, M.B. 1988. Seri history (1904): two documents. *Journal of the Southwest* 30, 469–501.
Müller-Böker, U. 1999. *The Chitawan Tharus in Southern Nepal: An Ethnoecological Approach*. Franz Steiner Verlag, Stuttgart.
Murdaca, G., Greco, M., Borro, M., Gangemi, S. 2021. Hygiene hypothesis and autoimmune diseases: a narrative review of clinical evidences and mechanisms. *Autoimmunity Reviews* 20, 102845.
Ndueze, O.U., Okiwelu, S.N., Umeozor, O.C., Noutcha, M.A.E. 2013. Arthropod succession on wildlife carcasses in lowland rainforest, Rivers State, Nigeria. *European Journal of Experimental Biology* 3, 106–110.
Neumann, A.H. 1898. *Elephant-Hunting in East Equatorial Africa: Being an Account of Three Years' Ivory-Hunting Under Mount Kenia and Among the Ndorobo Savages of the Lorogi Mountains, Including a Trip to the North of Lake Rudolph*. Rowland Ward, London.
Newcomb, W.W. 1961. *The Indians of Texas: From Prehistoric to Modern Times*. University of Texas Press, Austin.
Nicholas, J.L. 1817. *Narrative of a Voyage to New Zealand Performed in the Years 1814 and 1815 in Company with the Rev. Samuel Marsden, Principal Chaplain of New South Wales*, Vol. 1. James Black and Son, London.
Nichols, M.F. 2017. *Author and Audience in Vitruvius' De Architectura*. Cambridge University Press, Cambridge.
Nightingale, F. 1861. *Notes on Nursing for the Labouring Classes*. Harrison, London.
Nys, F. 1896. *Chez les Abarambos: Ce que Devient l'Afrique Mystérieuse*. R. Huyerechts, Anvers.
Oaten, M., Stevenson, R.J., Case, T.I. 2009. Disgust as a disease-avoidance mechanism. *Psychological Bulletin* 135, 303–321.
O'Connell, J.F., Hawkes, K., Blurton Jones, N. 2002. Meat-eating, grandmothering, and the evolution of early human diets. In Ungar, P.S., Teaford, M.F. (Eds.), *Human Diet: Its Origin and Evolution*. Bergin and Garvey, Westport, CT, pp. 49–60.
Ohishi, I., Sakaguchi, G., Riemann, H., Behymer, D., Hurvell, B. 1979. Antibodies to *Clostridium botulinum* toxins in free-living birds and mammals. *Journal of Wildlife Diseases* 15, 3–9.
Ordóñez, J.A., de la Hoz, L. 2007. Mediterranean products. In Toldrá, F. (Ed.), *Handbook of Fermented Meat and Poultry*. Blackwell, Oxford, England, pp. 333–347.
Oswald, F. 1915. *Alone in the Sleeping-Sickness Country*. Kegan Paul, Trench, Trubner and Company, London.
Owen, W.F. 1833. *Narrative of Voyages to Explore the Shores of Africa, Arabia, and Madagascar; Performed in H. M. Ships Leven and Barracouta, Under the Direction of Captain W. F. W. Owen, R. N. By Command of the Lords Commissioners of the Admiralty*, Vol. 1. Richard Bentley, London.
Pain, D.J., Cunningham, A.A., Donald, P.F., Duckworth, J.W., Houston, D.C., Katzner, T., Parry-Jones, J., Poole, C.M., Prakash, V., Round, P.D., Timmins, R.J. 2003. Causes and effects of temporospatial declines of *Gyps* vultures in Asia. *Conservation Biology* 17, 661–671.
Pannaraj, P.S., Li, F., Cerini, C., Bender, J.M., Yang, S., Rollie, A., Adisetiyo, H., Zabih, S., Lincez, P.J., Bittinger, K., Bailey, A., Bushman, F.D., Sleasman, J.W., Aldrovandi, G.M. 2017. Association between breast milk bacterial communities and establishment and development of the infant gut microbiome. *JAMA Pediatrics* 171, 647–654.
Papy, L. 1949. Les populations Batéké (Afrique Equatoriale Française). *Cahiers d'Outre-Mer* 2, 112–134.
Parker, R. 1983. *Miasma: Pollution and Purification in Early Greek Religion*. Clarendon Press, Oxford.
Paterson, W. 1789. *A Narrative of Four Journeys into the Country of the Hottentots, and Caffraria in the Years One Thousand Seven Hundred and Seventy-Seven, Eight, and Nine*. J. Johnson, London.
Pearn, N., Donkin, W. 1934. A camel journey from Tugurt to Kano. *Geographical Journal* 83, 399–409.
Peney, A. 1859. Études sur l'ethnographie, la physiologie, l'anatomie et les maladies des races du Soudan, en réponse à diverses questions posées par l'Académie des Sciences. *Bulletin de la Société de Géographie* 17, 321–355.
Percival, R. 1804. *An Account of the Cape of Good Hope; Containing an Historical View of Its Original Settlement by the Dutch, Its Capture by the British in 1795, and the Different Policy Pursued There by the Dutch and British Governments. Also a Sketch of Its Geography, Productions, the Manners and Customs of the Inhabitants, &c. &c*. C. and B. Baldwin, London.
Pereira, L.M., Owen-Smith, N., Moleón, M. 2014. Facultative predation and scavenging by mammalian carnivores: seasonal, regional and intra-guild comparisons. *Mammal Review* 44, 44–55.
Peris, J.F., Barciela González, V., Blasco, R., Cuartero, F., Fluck, H., Sañudo, P., Verdasco, C. 2012. The earliest evidence of hearths in southern Europe: the case of Bolomor Cave (Valencia, Spain). *Quaternary International* 247, 267–277.
Petäjä-Kanninen, E., Puolanne, E. 2007. Principles of meat fermentation. In Toldrá, F. (Ed.), *Handbook of Fermented Meat and Poultry*. Blackwell, Oxford, pp. 31–36.
Petherick, J. 1861. *Egypt, the Soudan and Central Africa: With Explorations from Khartoum on the White Nile to the Regions of the Equator, Being Sketches from Sixteen Years' Travel*. William Blackwood and Sons, Edinburgh.
Petrović, A. 1939. Contributions to the study of the Serbian Gypsies, Part 2. the eating of carrion. *Journal of the Gypsy Lore Society* 18, 21–25.
Pfefferkorn, I. 1949. *Sonora: A Description of the Province*. University of New Mexico Press, Albuquerque.
Pi, C., Allott, E.H., Ren, D., Poulton, S., Lee, S.Y.R., Perkins, S., Everett, M.L., Holzknecht, Z.E., Lin, S.S., Parker, W. 2015. Increased biodiversity in the environment improves the humoral response of rats. *PLoS One* 10, e0120255).
Picard, E. 1896. *En Congolie*. Paul Lacomblez, Bruxelles.
Pierce, E.C., Morin, M., Little, J.C., Liu, R.B., Tannous, J., Keller, N.P., Pogliano, K., Wolfe, B.E., Sanchez, L.M., Dutton, R.J. 2021. Bacterial-fungal interactions revealed

by genome-wide analysis of bacterial mutant fitness. *Nature Microbiology* 6, 87–102.

Pilkington, W. 1980. *The Journals of Samuel Kirkland: 18th Century Missionary to the Iroquois, Government Agent, Father of Hamilton College*. Hamilton College, Clinton, NY.

Pinto, S. 1881. *Comment J'ai Traversé l'Afrique Depuis l'Atlantique Jusqu'à l'Océan Indien à Travers des Régions Inconnues*, Tome 1. Librairie Hachette, Paris.

Polack, J.S. 1838. *New Zealand: Being a Narrative of Travels and Adventures During a Residence in that Country Between the Years 1831 and 1837*, Vol. 1. Richard Bentley, London.

Pop, E., Kuijper, W., van Hees, E., Smith, G., García-Moreno, A., Kindler, L., Gaudzinski-Windheuser, S., Roebroeks, W. 2016. Fires at Neumark-Nord 2, Germany: an analysis of fire proxies from a last interglacial Middle Palaeolithic basin site. *Journal of Field Archaeology* 41, 603–617.

Portlock, N. 1789. *A Voyage Round the World; But More Particularly to the North-West Coast of America: Performed in 1785, 1786, 1787, and 1788, in the King George and Queen Charlotte, Captains Portlock and Dixon*. John Stockdale and George Goulding, London.

Posey, D.A. 1990. The application of ethnobiology in the conservation of dwindling natural resources: lost knowledge or options for the survival of the planet. In Posey, D.A., Overal, W.L. (Eds.), *Ethnobiology: Implications and Applications*, Vol. 1. Museu Paraense Emilio Goeldi, Belém, Brazil, pp. 47–59.

Powell-Cotton, P.H.G. 1904. *In Unknown Africa: A Narrative of Twenty Months' Travel and Sport in Unknown Lands and Among New Tribes*. Hurst and Blackett, London.

Purchas, S. 1625. *Purchas His Pilgrimes: In Five Bookes. The Second Part*. William Stansby for Henrie Fetherstone, London.

Putnam, P. 1948. The Pygmies of the Ituri Forest. In Coon, C.S. (Ed.), *A Reader in General Anthropology*. Holt, Rinehart and Winston, New York, pp. 322–342.

Ragir, S., Rosenberg, M., Tierno, P. 2000. Gut morphology and the avoidance of carrion among chimpanzees, baboons, and early hominids. *Journal of Anthropological Research* 56, 477–512.

Rampelli, S., Schnorr, S.L., Consolandi, C., Turroni, S., Severgnini, M., Peano, C., Brigidi, P., Crittenden, A.N., Henry, A.G., Candela, M. 2015. Metagenome sequencing of the Hadza hunter-gatherer gut microbiota. *Current Biology* 25, 1682–1693.

Ray, J. 1691. *The Wisdom of God Manifested in the Works of the Creation. Being the Substance of Some Common Places Delivered in the Chappel of Trinity–College, in Cambridge*. Printed for Samuel Smith, London.

Reeve, T.E. 1921. *In Wembo-Nyama's Land: A Story of the Thrilling Experiences in Establishing the Methodist Mission Among the Atetela*. Smith and Lamar, Nashville, TN.

Rivero, J. 1883. *Historia de las Misiones de los Llanos de Casanare y los Rios Orinoco y Meta, Escrita el Año 1736*. Imprenta de Silvestre y Compañia, Bogotá.

Robinson, J.A.T. 1976. *Redating the New Testament*. Westminster Press, Philadelphia.

Roggenbuck, M., Schnell, I.B., Blom, N., Bælum, J., Bertelsen, M.F., Sicheritz-Pontén, T., Sørensen, S.J., Gilbert, M.T.P., Graves, G.R., Hansen, L.H. 2014. The microbiome of New World vultures. *Nature Communications* 5, 1–7.

Rossen, N.G., MacDonald, J.K., de Vries, E.M., D'Haens, G.R., de Vos, W.M., Zoetendal, E.G., Ponsioen, C.Y. 2015. Fecal microbiota transplantation as novel therapy in gastroenterology: a systematic review. *World Journal of Gastroenterology* 21, 5359–5371.

Roth, H.L. 1896. *The Natives of Sarawak and British North Borneo, Based Chiefly on the MSS. of the Late Hugh Brooke Low, Sarawak Government Service*, Vol. 1. Truslove and Comba, New York.

Rothschild, D., Weissbrod, O., Barkan, E., Kurilshikov, A., Korem, T., Zeevi, D., Costea, P.I., Godneva, A., Kalka, I.N., Bar, N., Shilo, S., Lador, D., Vila, A.V., Zmora, N., Pevsner-Fischer, M., Israeli, D., Kosower, N., Malka, G., Wolf, B.C., Avnit-Sagi, T., Lotan-Pompan, M., Weinberger, A., Halpern, Z., Carmi, S., Fu, J., Wijmenga, C., Zhernakova, A., Elinav, E., Segal, E. 2018. Environment dominates over host genetics in shaping human gut microbiota. *Nature* 555, 210–215.

Rottman, J., DeJesus, J., Greenebaum, H. 2019. Developing disgust: theory, measurement, and application. In LoBue, V., Pérez-Edgar, K., Buss, K.A. (Eds.), *Handbook of Emotional Development*. Springer, Cham, Switzerland, pp. 283–309.

Samson, A., Ramakrishnan, B. 2017. Scavenging mode of vertebrate scavengers on domestic buffalos *Bubalus bubalis* (Linnaeus, 1785) killed by tiger *Panthera tigris* and natural deaths in southern India. *Podoces* 12, 22–26.

Sandgathe, D.M., Dibble, H.L., Goldberg, P., McPherron, S.P., Turq, A., Niven, L., Hodgkins, J.M. 2011. Timing of the appearance of habitual fire use. *Proceedings of the National Academy of Sciences USA* 108, E298.

Sato, H. 1983. Hunting of the Boyela, slash-and-burn agriculturalists, in the central Zaire forest. *African Study Monographs* 4, 1–54.

Schnorr, S.L. 2015. The diverse microbiome of the hunter-gatherer. *Scientific American* 312, S14–S15.

Schnorr, S.L. 2018. Meanings, measurements, and musings on the significance of patterns in human microbiome variation. *Current Opinion in Genetics and Development* 53, 43–52.

Schnorr, S.L., Crittenden, A.N., Henry, A.G. 2016. Impact of brief roasting on starch gelatinization in whole foods and implications for plant food nutritional ecology in human evolution. *Ethnoarchaeology* 8, 30–56.

Schnorr, S.L., Sankaranarayanan, K., Lewis Jr., C.M., Warinner, C. 2016. Insights into human evolution from ancient and contemporary microbiome studies. *Current Opinion in Genetics and Development* 41, 14–26.

Schöller, M. 1901. *Mitteilungen über Meine Reise nach Äquatorial-Ost-Afrika und Uganda 1896–1897*, Band I. Dietrich Reimer Verlag, Berlin.

Schweinfurth, G. 1874. *The Heart of Africa: Three Years' Trav-*

els and Adventures in the Unexplored Regions of Central Africa from 1868 to 1871, Vol. 1. Harper and Brothers, New York.

Seeber, P.A., Morrison, T., Ortega, A., East, M.L., Greenwood, A.D., Czirják, G.Á. 2020. Immune differences in captive and free-ranging zebras (*Equus zebra* and *E. quagga*). *Mammalian Biology* 100, 155–164.

Selous, F.C. 1881. *A Hunter's Wanderings in Africa: Being a Narrative of Nine Years Spent Amongst the Game of the Far Interior of South Africa, Containing Accounts of Explorations Beyond the Zambesi, on the River Chobe, and in the Matabele and Mashuna Countries, with Full Notes Upon the Natural History and Present Distribution of All the Large Mammalia*. Richard Bentley and Son, London.

Sennefelt, K. 2021. A pathology of sacral kingship: putrefaction in the body of Charles XI of Sweden. *Past and Present* 253, 83–117.

Shaffer, N., Wainwright, R.B., Middaugh, J.P., Tauxe, R.V. 1990. Botulism among Alaska natives: the role of changing food preparation and consumption practices. *Western Journal of Medicine* 153, 390–393.

Shahani, G, 2016. Food, filth, and the foreign: disgust in the seventeenth-century travelogue. In Eschenbaum, N.K., Correll, B. (Eds.), *Disgust in Early Modern English Literature*. Routledge, New York, pp. 13–40.

Shimelmitz, R., Kuhn, S.L., Jelinek, A.J., Ronen, A., Clark, A.E., Weinstein-Evron, M. 2014. 'Fire at will': the emergence of habitual fire use 350,000 years ago. *Journal of Human Evolution* 77, 196–203.

Shivik, J.A. 2006. Are vultures birds, and do snakes have venom, because of macro- and microscavenger conflict? *BioScience* 56, 819–823.

Shooter, J. 1857. *The Kafirs of Natal and the Zulu Country*. E. Stanford, London.

Siegel, L.S. 1993. Destruction of *botulinum* toxins in food and water. In Hauschild, A.H.W., Dodds, K.L. (Eds.), *Clostridium botulinum Ecology and Control in Foods*. CRC Press, Boca Raton, FL, pp. 323–342.

Skåra, T., Axelsson, L., Stefánsson, G., Ekstrand, B., Hagen, H. 2015. Fermented and ripened fish products in the northern European countries. *Journal of Ethnic Foods* 2, 18–24.

Smith, A.R., Carmody, R.N., Dutton, R.J., Wrangham, R.W. 2015. The significance of cooking for early hominin scavenging. *Journal of Human Evolution* 84, 62–70.

Song, Y., Peressin, K., Wong, P.Y., Page, S.W., Garg, S. 2016. Key considerations in designing oral drug delivery systems for dogs. *Journal of Pharmaceutical Sciences* 105, 1576–1585.

Sonnini, C.S. 1799. *Travels in Upper and Lower Egypt: Undertaken by Order of the Old Government of France*, Vol. 2. John Stockdale, London.

Soppitt, C.A. 1887. *A Short Account of the Kuki-Lushai Tribes on the North-East Frontier (Districts Cachar, Sylhet, Naga Hills, etc., and the North Cachar Hills), with an Outline Grammar of the Rangkhol–Lushai Language and a Comparison of Lushai with Other Dialects*. Assam Secretariat Press, Shillong, India.

Soubrier, J. 1936. Au Libéria par la forêt tropicale. *Revue des Deux Mondes* 33, 158–179.

Sparrman, A.A. 1785. *A Voyage to the Cape of Good Hope, Towards the Antarctic Polar Circle, and Round the World: But Chiefly into the Country of the Hottentots and Caffres, from the Year 1772, to 1776*, Vol. 2. G. G. J. and J. Robinson, London.

Speth, J.D. 2017. Putrid meat and fish in the Eurasian Middle and Upper Paleolithic: are we missing a key part of Neanderthal and Modern Human diet? *PaleoAnthropology* 2017, 44–72.

Speth, J.D. 2019. Neanderthals, Vitamin C, and scurvy. *Quaternary International* 500, 172–184.

Spray, Z. 2002. Alaska's vanishing arctic cuisine. *Gastronomica* 2, 30–40.

Stannus, H.S. 1910. Notes on some tribes of British Central Africa. *Journal of the Royal Anthropological Institute of Great Britain and Ireland* 40, 285–335.

Steedman, A. 1835. *Wanderings and Adventures in the Interior of Southern Africa*, Vol. 2. Longman, London.

Stefansson, V. 1914. *The Stefánsson-Anderson Arctic Expedition of the American Museum: Preliminary Ethnological Report*. Anthropological Paper 14(1). American Museum of Natural History, New York.

Stefansson, V. 1920. Food tastes and food prejudices of men and dogs. *Scientific Monthly* 11, 540–543.

Stevenson, R.J., Oaten, M.J., Case, T.I., Repacholi, B.M., Wagland, P. 2010. Children's response to adult disgust elicitors: development and acquisition. *Developmental Psychology* 46, 165–177.

Stigand, A.G. 1913. Notes on N'gamiland. *Transactions of the Royal Society of South Africa* 3, 379–391.

Stinson, L.F., Sindi, A.S.M., Cheema, A.S., Lai, C.T., Mühlhäusler, B.S., Wlodek, M.E., Payne, M.S., Geddes, D.T. 2021. The human milk microbiome: who, what, when, where, why, and how? *Nutrition Reviews* 79, 529–543.

Strachan, D.P. 1989. Hay fever, hygiene, and household size. *British Medical Journal* 299, 1259–1260.

Stuhlmann, F. 1894. *Mit Emin Pascha ins Herz von Afrika: Ein Reisebericht mit Beiträgen von Dr. Emin Pascha, in Seinem Auftrage Geschildert*, Band 1. Deutsch-Ost-Afrika. Dietrich Reimer, Berlin.

Tench, W. 1793. *A Complete Account of the Settlement at Port Jackson, in New South Wales, Including an Accurate Description of the Situation of the Colony; of the Natives; and of Its Natural Productions: Taken on the Spot, by Captain Watkin Tench, of the Marines*. G. Nicol and J. Sewell, London.

Terry, E. 1655. *A Voyage to East-India. Wherein Some Things Are Taken Notice of in Our Passage Thither, but Many More in Our Abode There, within that Rich and Most Spacious Empire of the Great Mogol. Mix't with Some Parallel Observations and Inferences Upon the Storie, to Profit as Well as Delight the Reader*. Printed by T. W. for J. Martin, and J. Allestrye, London.

Theal, G.M. 1900. *Records of South-Eastern Africa Collected in Various Libraries and Archive Departments in Europe*, Vol. VI. Government of the Cape Colony, Printed by William Clowes and Sons, London.

Theis, K.R., Whittaker, D.J., Rojas, C.A. 2020. A hologenomic approach to animal behavior. In Banzhaf, W., Cheng, B.H.C., Deb, K., Holekamp, K.E., Lenski, R.E., Ofria, C., Pennock, R.T., Punch, W.F., Whittaker, D.J. (Eds.), *Evolution in Action: Past, Present and Future—A Festschrift in Honor of Erik D. Goodman*. Springer, Cham, Switzerland, pp. 247–263.

Thomas, D.H. 1985. Integrative synthesis: the lacustrine biome as viewed from Hidden Cave. In Thomas, D.H. (Ed.), *The Archaeology of Hidden Cave, Nevada*. Anthropological Paper 61(1). American Museum of Natural History, New York, pp. 374–391.

Thompson, J.C., Wright, D.K., Ivory, S.J., Choi, J.-H., Nightingale, S., Mackay, A., Schilt, F., Otárola-Castillo, E., Mercader, J., Forman, S.L., Pietsch, T., Cohen, A.S., Arrowsmith, J.R., Welling, M., Davis, J., Schiery, B., Kaliba, P., Malijani, O., Blome, M.W., O'Driscoll, C.A., Mentzer, S.M., Miller, C., Heo, S., Choi, J., Tembo, J., Mapemba, F., Simengwa, D., Gomani-Chindebvu, E. 2021. Early human impacts and ecosystem reorganization in southern-central Africa. *Science Advances* 7, 1–13 (doi:10.1126/sciadv.abf9776).

Tieman, M., Hassan, F.H. 2015. Convergence of food systems: Kosher, Christian and Halal. *British Food Journal* 117, 2313–2327.

Torday, E., Joyce, T.A. 1922. *Notes Ethnographiques sur des Populations Habitant les Bassins du Kasai et du Kwango Oriental*: I. *Peuplades de la Forêt*. 2. *Peuplades des Prairies*. Musée Royal de l'Afrique Centrale, Bruxelles.

Tremearne, A.J.N. 1912. *The Tailed Head-Hunters of Nigeria: An Account of an Official's Seven Years' Experiences in the Northern Nigerian Pagan Belt, and a Description of the Manners, Habits, and Customs of the Native Tribes*. J. B. Lippincott, Philadelphia.

Tronick, E.Z., Morelli, G.A., Winn, S. 1987. Multiple caretaking of Efe (Pygmy) infants. *American Anthropologist* 89, 96–106.

Urquhart, J.A. 1935. The most northerly practice in Canada. *Canadian Medical Association Journal* 33, 193–196.

Vanak, A.T., Dickman, C.R., Silva-Rodriguez, E.A., Butler, J.R.A., Ritchie, E.G. 2014. Top-dogs and under-dogs: competition between dogs and sympatric carnivores. In Gompper, M.E. (Ed.), *Free-Ranging Dogs and Wildlife Conservation*. Oxford University Press, Oxford, pp. 69–93.

Vasundhara, T.S., Kumudavally, K.V., Sharma, T.R. 1983. Altered free fatty acid levels in fresh or canned mutton as indicators of spoilage. *Journal of Food Protection* 46, 1050–1054.

Vervloet, G., 1909. Aux sources du Nil dans la région des volcans, du Lac Albert-Edouard et du Ruwenzori. Zone de la Rutshuru-Beni (Congo Belge). *Bulletin de la Société Royale Belge de Géographie* 33, 395–430.

Vitruvius, M. [20s BCE] 1914. *Vitruvius: The Ten Books on Architecture* (Translated by M.H. Morgan). Harvard University Press, Cambridge, MA.

Vrieze, A., de Groot, P.F., Kootte, R.S., Knaapen, M., van Nood, E., Nieuwdorp, M. 2013. Fecal transplant: a safe and sustainable clinical therapy for restoring intestinal microbial balance in human disease? *Best Practice and Research Clinical Gastroenterology* 27, 127–137.

Wadley, L. 2020. A camera trap record of scavengers at a kudu carcass: implications for archaeological bone accumulations. *Transactions of the Royal Society of South Africa* 75, 245–257.

Waller, H. 1874. *The Last Journals of David Livingstone, in Central Africa, from 1865 to His Death. Continued by a Narrative of His Last Moments and Sufferings, Obtained from His Faithful Servants Chuma and Susi*, Vol. 2. John Murray, London.

Walton, W. 1790. *A Narrative of the Captivity and Sufferings of Benjamin Gilbert and His Family; Who Were Surprised by the Indians, and Taken from Their Farms, on the Frontiers of Pennsylvania, in the Spring, 1780*. James Phillips, London.

Wander, K., O'Connor, K., Shell-Duncan, B. 2012. Expanding the hygiene hypothesis: early exposure to infectious agents predicts delayed-type hypersensitivity to *Candida* among children in Kilimanjaro. *PLoS One* 7, e0037406.

Wastyk, H.C., Fragiadakis, G.K., Perelman, D., Dahan, D., Merrill, B.D., Yu, F.B., Topf, M., Gonzalez, C.G., Van Treuren, W., Han, S., Robinson, J.L., Elias, J.E., Sonnenburg, E.D., Gardner, C.D., Sonnenburg, J.L. 2021. Gut-microbiota-targeted diets modulate human immune status. *Cell* 184, 4137–4153.

Weihmüller, M.P., Costa, T., Castro, L.B., Barri, F.R. 2021. Diversidad faunística y potenciales agentes tafonómicos en el Chaco Árido (Córdoba, Argentina): una aproximación preliminar con cámaras trampa. *Intersecciones en Antropología* 22, 125–138.

Wesley, J. 1872. *The Works of John Wesley*, Vol. 7. *Second Series of Sermons Concluded; also Third, Fourth and Fifth Series (through 141)*. Zondervan Publishing House, Grand Rapids, MI.

Wood, J.G. 1874. *Natural History of Man: Being an Account of the Manners and Customs of the Uncivilized Races of Men*. George Routledge and Sons, London.

Worseley, P.M. 1961. The utilization of natural food resources by an Australian Aboriginal tribe. *Acta Ethnographica Academiae Scientiarum Hungaricae* 10, 153–190.

Wrangham, R.W. 2009. *Catching Fire: How Cooking Made Us Human*. Basic Books, New York.

Yamin-Pasternak, S., Kliskey, A., Alessa, L., Pasternak, I., Schweitzer, P. 2014. The rotten renaissance in the Bering Strait: loving, loathing, and washing the smell of foods with a (re)acquired taste. *Current Anthropology* 55, 619–646.

Yatsunenko, T., Rey, F.E., Manary, M.J., Trehan, I., Dominguez-Bello, M.G., Contreras, M., Magris, M., Hidalgo, G., Baldassano, R.N., Anokhin, A.P., Heath, A.C., Warner, B., Reeder, J., Kuczynski, J., Caporaso, J.G., Lozupone, C.A., Lauber, C., Clemente, J.C., Knights, D., Knight, R., Gordon, J.I. 2012. Human gut microbiome viewed across age and geography. *Nature* 486, 222–227.