Baboons Foodways

Overview

While baboons are monkeys, and thus further away from our evolutionary heritage than apes, they also parallel our own evolution in many ways, primarily because they adapted to living on the ground and even consuming many of the same foods as humans such as starchy seeds and roots. So through understanding their foodways, we can better understand the evolution of our own--and then apply that learning both now and in the next book. We are not sure but hypothesize that they emerged about two million years ago and we know that they coexisted with hominoids throughout their evolution in the same habitats, perhaps even competing for the same food.

Overall, baboons are broken down into five different species, the hamadryas, guinea, olie, yellow and chacma--and two other primates that are quite similar to baboons, the gelata and mandrills. They are usually around two to three or so feet in height and range in weight from around twenty to eighty pounds, with the males always being much larger than the females so they are the largest of all the monkeys. They live from somewhere between fifteen to thirty years, with the females living much longer, perhaps because males shorten their lifespans due to various agressions.

DIET

Baboons are unusually flexible, able to inhabit different types of terrains and eat many different types of foods; they are also highly selective, always choosing the best terrains and foods available. They most inhabit open savannas and grassland but also live in deserts and forests. While most primates feed only in the trees, they feed in the trees, on the ground and under the ground. They are omnivorous but mostly herbivorous. While perhaps preferring fruits like most primates, they also feed on starches, unlike most other primates, including seeds, roots and corms--as well as leaves, flowers, buds, bark, grasses and cacti while also eating insects, hares, birds, monkey, antelopes as well as fish and shellfish. As with chimpanzees, meat is prized by baboons--but little is consumed: one study showed that adult males spend only about two percent of their time hunting. In other words, their diet is enormously diverse: they eat just about anything from anywhere and feed opportunistically rather than selectively. They live in troops between five and two hundred and fifty members, but most troops are around fifty that are usually hierarchical and ultimately dominated by the larger males.

Olive baboons are ecologically flexible in that they consume a wide variety of foods and can live in a variety of habitats, but nonetheless they are selective about their diet choice and habitat usage (Whiten et al. 1991; Barton et al. 1992). Olive baboons can be found in habitats ranging from desert to montane forest. One reason they are able to adapt to these varying habitats could be their flexibility in foraging strategies and ability to extract food and nutrients from almost all strata of the environment (Whiten et al. 1991). They find food on the ground, in the

trees, and underground. On the ground, they forage in the grass or in thickets of savanna woodland, they forage in trees and find food at higher levels of the canopy, and finally, they dig up subterranean foods (Whiten et al. 1991). Baboons are omnivores and consume a huge variety of items including roots, tubers, corms, fruits, leaves, flowers, buds, seeds, bark, exudates, cacti, grasses, insects, birds, bird eggs, and vertebrates (including other primates) up to the size of a small antelope (Rowell 1966; Dunbar & Dunbar 1974; Harding 1976; Whiten et al. 1991; Hassan 2001).

While meat is a highly valued food item in the baboon diet, it does not constitute a major, nor even a significant portion of the baboon's total dietary intake. In one troop of baboons, adult males were reported to spend as little as 2% of their feeding time consuming meat, with the females, juveniles, and infants spending even less time (Harding 1974). Meat is never voluntarily shared among baboons (Harding 1974) (Goffe & Fischer 2016).

Interestingly, they frequently inhabit the same environments as savannah chimps--that is, chimps adapted to more open terrains. However, they do not compete for the same foods, as the chimps focus on fruit and only tubers as fallbacks, while the baboons focus on so many other foods. Accordingly, they are not aggressive towards each other. Additionally, baboons eat many of the same foods as indigenous people.

Even though baboons and savannah-woodland chimpanzees may sometimes live side by side in the same habitat at the forest fringes, baboons have more diverse diets than the chimpanzees (Ulijaszek, Mann, & Elton 2012, p.80)(Whiten et al. 1990). This is due to the baboons' ability to exploit tropical grasses and sedges (C4 resources) that the savannah-woodland chimpanzees do not consume. Humans today also make extensive use of tropical grasses and their animal consumers. Both baboons and modern humans utilize many of the same plant species for food, but often use different parts of the plant as food (Ulijaszek, Mann, & Elton 2012, pp. 43-46 and pp.79-.80).

SENSES

Although their sense of smell and hearing have not been studied in detail, we can hypothesize that they hear about as well as other primates, mostly for the purpose of hearing other members of their troup, less perhaps for identifying food. Despite their large, canine snouts, they nonetheless do not smell any better than other primates and likely use their smell less to find foods from afar but rather to further evaluate them once in hand, as they frequently pass their food across their nostrils, especially unfamiliar foods.

They have vision quite similar to our own but different from jungle primates, suggesting that we both have unique adaptation to more open and treeless terrains. They are trichromats, seeing the same range of colors as ourselves--while also seeing the same level of detail as ourselves. But most interestingly, they have elongated retinas, like humans, allowing them to

see extended distances in their open terrain. Overall, they use their vision to spy food from greater distances, including more colorful fruits, leaves and even other animals.

They taste all the five flavors as far as we know, based on limited studies. They are about as sensitive to sucrose as ourselves, able to detect the sugar in smaller concentrations, perhaps suggesting that they eat less sweet foods. But unlike most other primates, but like humans, they can taste the starch, maltose; in fact they taste it better than humans--thus showing their unique adaptation to starchy foods found on the ground, such as seeds, roots and the like, showing their and our unique adaptation to the ground. They are evidently more tolerant of bitters than other animals, at least some bitters, as they are able to consume bitter foods that humans and birds cannot, such as unripe fruits which they eat as fallback foods.

Vision

Baboons rely heavily on their vision for detecting food sources, spotting predators, and for social communication. Baboons evolved to have several visual abilities akin to humans. Baboons share “trichromacy” and a similar visual spectral sensitivity as humans, enabling them to perceive light and to detect and discriminate between colors as we do (Altmann 2009; de Valois 1990). They can also see fine details as we do (Fobes & King 1982). Baboons use their vision to see afar as well. Baboons have a more elongated visual field than forest primate species, and a more elongated retina, both of which are also characteristic of human vision (Kobayashi & Koshima 2001; Fischer & Kirby 1991).

Taste

Baboons may be slightly more sensitive to sweet than humans, and rank among the most sugar sensitive primates. They are particularly sensitive to the sugar maltose present in abundance in starchy plants (Laska 1999). Due to intense competition and sometimes limited resources of ripe fruit on the open savannah, baboons will at times resort to consuming bitter, unripe fruits which birds reject and humans would find highly bitter (Altmann 1998 p.358).

Smell

Baboons’ sense of smell is used in conjunction with taste in order to determine palatability. Unfamiliar foods are passed by the nares before ingesting (Altmann 1998 p.358). Young baboons have been observed rapidly alternating between tasting and smelling new foods by passing them from the tip of their tongue to their nares and back again, sometimes holding a food in their mouth for a moment to taste the food more fully (Altmann 2009). While baboons use their sense of smell in the selection of food, they do not have a particularly keen sense of smell, in spite of their large muzzles. Their large muzzles are thought to have evolved in order to accommodate the roots of their especially large canine teeth, rather than support any special smelling abilities (Lewis, Jurmain, & Kilgore 2013, p.119).

LOCOMOTION

As mentioned most baboons live on grasslands or savanna while some live in more marginal lands like deserts and forest, while selecting food from the trees, but also from the ground as well as from under the ground. Most primates need the cover of trees to escape over predation--but baboons due to their larger size and more ferocious manner are enabled to venture more on land; but even then, they nonetheless always stay close to trees or at least cliffs to escape from their predators, such as lions. Additionally, they are terrified of being left on the land at night, because they are more defenseless, so they always claim their beds before nightfall in trees of cliffs, usually sleeping in sitting positions on their callused hinies. The presence and distribution of trees also limits their living range, since the baboons won't live in areas without trees. This is because of the safety afforded by the trees, since they'll live near lions if there are trees, and won't live near lions without trees. The trees also provide food and water. All you need is food, shelter, and love!;) (Sandford 2009, p.68).

The size of their territories range considerably, mostly dependent upon the particulars of their ecosystem, their particular species, and even more so on the size of their group--which as we have seen can range from several to hundreds. For example, some groups of baboons with about fifteen to twenty five members inhabited smaller terrains, while locomoting about one half mile per day. However, another group of fifty inhabited territories of seven square miles and travelled about two miles per day. And another group of one hundred olives inhabited terrains of sixteen square miles and travelled around three miles per day. However, the amount of locomotion per day, per group of baboons, varies greatly from one day to the next, dependent upon the availability of food which is influenced by seasons, rainfall and other factors. Generally baboons all sleep in the same or close trees and when waking in the morning, first socialize, and then travel and feed as one group. As they feed, they do not communicate with each other like other primates; instead they merely are always closely observing what each other are eating, ostensibly because they can better see other members of the group in the more open terrain. After feeding, they rest midday, and then travel to another territory and feed and then travel back to their trees well before dark. As baboons are highly sociable, their feeding habits and what they feed upon is also contingent upon the feeding behavior of the other members of the group. No special food signals are involved. Baboons just continually observe the feeding of their group members. Sometimes they may also smell one another's muzzles while they are chewing to determine what they are eating (Altmann 2009).

Their ranges frequently overlap with other groups of baboons--but despite their more domineering nature and sharp teeth, baboons rarely actively protect their territories or engage in skirmishes. Instead the animals just peacefully coexist, presumably because there is plenty of food or the larger group shooed away the smaller group. In most cases, though, the male baboons prevent their females from interacting with the other group, to protect their genes.

Source: "Primate Info Net." *WNPRC*, pin.primate.wisc.edu/factsheets/entry/olive_baboon.

Generally they all sleep in the same area, wake, socialize,and then travel and feed, then rest and socialize, then vary their terrain, travel and feed and then return to sleep.

Ranges often overlap with other baboon groups --if so, the larger group displaces the smaller one who wanders off; or they just ignore each other and feed in the same terrain, probably because plenty of food is available. At the same time, the males of any group will keep their females from any contact with members of the other group, mostly to assure they are not reproducing.

In the Bole Valley, Ethiopia, olive baboons have home range sizes between .745 and 1.12 km² (.288 and.432 mi²) and range between .3 and 2.0 km (.186 and 1.24 mi) per day (Dunbar & Dunbar 1974). In one study at Laikipia Plateau, Kenya, home range and day length sizes were much larger than in the Bole Valley. Home range size was 43.8 km² (16.9 mi²) and the average distance traveled per day was 5.64 km (3.50 mi) (Barton et al. 1992). The drastic differences in habitat use can be partly attributed to group size. As group size increases, so does home range size and day range length (Barton et al. 1992). The study population used by Barton et al. (1992) numbered about 100 olive baboons while Dunbar and Dunbar (1974) studied seven groups ranging in size from 15 to 24 animals. This relationship exists because larger groups experience increased competition for resources such as food; therefore the area covered each day and subsequently the home range within which the group forages increases to accommodate the needs of a larger number of animals (Barton et al. 1992). At Gilgil, Kenya, the home range size of a group of 49 baboons was 19.7 km² (7.60 mi²) but 75% of their time was spent in a core area about 25% of the total size of the home range (Harding 1976). The average day length for the study group at Gilgil was around 5 km (3.11 mi), with the shortest distance traveled being 2.2 km (1.37 mi) and the longest day journey being 7.8 km (4.85 mi) (Harding 1976). At Ishasa, Uganda, where olive baboons spend up to 60% of their time in the rich, forested areas, home range size ranges between 3.88 and 5.18 km² (1.5 and 2 mi²) and day range length can be as short as a few hundred meters and up to 2.4 km (1.5 mi) (Rowell 1966). At Gombe, Tanzania, another forested site where olive baboons have been studied, home ranges average 3.88 to 5.18 km² (1.5 to 2 mi²) (Ransom 1981).

As seasonal rainfall influences food availability, it in turn affects home range size and daily ranging patterns (Nagel 1973; Harding 1976; Ransom 1981; Barton et al. 1992). Daily activity patterns are also variable, depending on the season and climatic conditions. Departure from the sleeping site, the time spent traveling, the maximum distance traveled from the sleeping site, the number and length of resting and feeding periods, and the distance covered per day are all variable from one day to the next and from one group of baboons to the next (Nagel 1973). The general pattern observed is a period of socializing after waking, moving from the sleeping site and feeding, resting, and then alternating feeding and resting until late afternoon at which time the group travels back to the sleeping site. Most social activities occur during the periods of rest throughout the day (Strum 1987). The home ranges of several groups of baboons often overlap, and when groups come into contact with one another, the larger group displaces the smaller group or the two groups largely ignore each other (Aldrich-Blake et al. 1971; Smuts 1985). In

many cases, the adult males within the group with chase the adult females of their troop away from the other troop. They threaten females presumably to reduce the contact of group females with outside males (Packer 1979a).

The larger body size of baboons allows them to venture into open, treeless areas to access food without being at as much risk of predation as other smaller primates, such as vervet monkeys (who also live in the savannah), but who remain in close proximity to trees (Altmann 1998, p.366). Baboons' size also enables them to travel longer distances in search of food, sometimes tolerating acute food shortages that could not be as well tolerated by smaller primates. With their greater size and strength, baboons can excavate foods below ground that other smaller, weaker animals cannot access. Their size also allows them to better compete for food, and produce larger and stronger offspring that are less at risk of predation and better equipped to fend for themselves (Altmann 1998, p.?).

As expected, baboons locomote both on the ground and trees. When on the ground, they typically walk quadrupedally--that is, on all fours and obviously will walk miles every day. They will also walk bipedally for short distances, like humans, so they can survey their surroundings or capture food from tree branches. And when convenient, they also shuffle along on their bottoms from one patch of food to another. They can also run fast--but only for short distances.

Baboons have evolved to be able to move readily within trees, on shrubs, and on the ground, allowing them to exploit any potential food resources literally from the ground up (Altmann 1998, p.358). Although, baboons primarily travel and forage on the ground, walking on all fours (Fleagle 1988, p.170). Baboons are accustomed to walking great distances in order to find their food which is often sparsely distributed over their very large home ranges (Strum 1987, p.56). Baboons will rise up on their back legs and walk bipedally on occasion in order to better survey their surroundings or to reach up to grasp high hanging foods (D'Aout & Vereecke 2011, p.62). Whenever it is more convenient, baboons will shuffle along on their bottoms from one patch of food to another (Strum 1987, p.19). To avoid predators, baboons climb trees or rocky cliffs for sleeping and resting. On the ground, baboons can run fast, but not for any significant length of time. To help avoid predators out in the open, baboons do not wander away from the troop (Sandford 2009, p.68).

Note: Some other interesting info about baboons' sleeping behaviors- 1. The callused areas on their haunches allow baboons to sleep sitting up, which allows the troop to sleep in only a few trees. Also, they're terrified of the dark, so they always arrive at the trees before nightfall and stay in the branches until it's completely light outside.

Every baboon troop has its own home range. Baboons, particularly females and youngsters, are reluctant to cross out of the home range, but they are not interested in defending the borders of their range (Strum 1987, p.303). Baboons are rarely aggressive towards other species who are not predators (Sandford 2009, pp.67 & 70).

CAPTURE

While many primates are opportunistic feeders, baboons seem even moreso, likely due to the nature of their environment. Because they feed more on the ground, their food is under more competition from all sorts of terrestrial mammals, which is not the case with other primates; furthermore, their food tends to be more scattered, more variable and fluctuating and overall more unpredictable. So instead of knowing the location of food, and then travelling to that food based on some amount of reliable predictions, baboons merely wander their terrains more--feeding on whatever is available at that time, be that plants or animals. At the same time, however, they intentionally choose the best and most refined foods available at any time, even when those foods require more locomotion or processing--thus optimizing their foraging. Additionally, when certain foods come into season, they gorge on them exclusively. During two weeks of time, caterpillars were abundant in grasses and baboons fed upon them almost exclusively for that amount of time.

They are opportunistic but select the best food. Their food is under greater competition (land animals), more in flux, consistently variable, often scarce, cannot plan on specific foods being in specific places at specific times--thus exploit foods that are readily available

The baboons' major underlying strategy for the capture of food can be summed up in one word as "opportunistic." Rather than this strategy being a less intelligent plan of action involving little conscious effort, this strategy likely evolved in response to the consistently variable, and often scarce, food resources available on the savannah (Altmann 2009). In other words, planning or depending upon only certain foods at certain times and in specific places might not be realistic in a habitat where competition is so high and the choice foods are always in flux.

Thus, baboons are well adapted to exploit whatever foods they come upon that are most abundant, highest in nutritional quality, and most easily accessed, but are willing to put in substantial effort in terms of traveling far to get to a high quality food, running down suitable prey, and taking the time and energy to process a plant food to get to the most palatable and nutrient dense portion of a plant (Strum 1987, p.130)(Harding 1974)(Altmann 2009). Baboons will shift their diet according to the highest quality foods available at any one time. For instance, one researcher notes that when a major outbreak of a single species of caterpillars occurred, for around two weeks the baboons focused their diet almost entirely upon capturing and consuming the nutrient dense caterpillars, using both hands to pull them efficiently off the grasses (Altmann 2009).

As mentioned baboons capture their food both in the trees, on the ground and under the ground--thus giving them greater access to nutrition. As compared to all their other competitors--terrestrial animals--they have more dexterous hands that allow them to pluck, hold, pull, break and dig to capture their food.

While most animals only look for food at one level, baboons look for food at all levels, including below ground as well. The ability to move freely from the ground up, exploiting a remarkable diversity and quantity of different foods would not be as useful without the baboon's dexterous hands with opposable thumbs that allow baboons to harvest foods that would otherwise be unavailable (Strum 1987, p.56). By using their hands to dig, pluck, hold, pull, break and other fine manual manipulations they are able to get at more nutrient dense, high quality food items that most other animals cannot access (Altmann 1998, p.358). (Perhaps this paragraph should be the first section under capture-transitioning from the locomotion section. It could also help provide context for how their anatomy allows them to be 'opportunists' with regard to food-just a thought. It might also be worth mentioning here that baboons don't use tools for capture (Cheney & Seyfarth 2007, p.278). Since this comes after the capuchin section, my brain automatically goes to 'tools' and I start to wonder whether baboons also use their dexterity through the employment of tools. Perhaps emphasize that, not only do they use their hands for the tasks above, but that their hands are well-suited to those particular tasks.)

Detoxification

Compared to other primates, baboons are not as evolved for plant toxins, due to their diet being more refined. However, they still must deal with them and do so through the usual methods, Since they can consume plants poisonous to humans without any effects, they can clearly detoxify some toxins with some sort of antidote. At the same time, they are quite selective, like most primates, of the plants they eat, the amount of those plants, as well as the parts of those plants--all to minimize the effects of the toxins.

However, they can eat without problem plants that are poisonous to humans, suggesting that they are able to neutralize these toxins likely with other molecules. At the same time, they are selective of what part of the plant. They eat the seeds of the acacia tree which contain contain the antinutrient "trypsin inhibitor." However, they have been observed eating from specific types of acacia trees that create less of this toxin. At the same time, they do not eat the pods or the coats of the seeds that are also high in this toxin and in the end, reduce their consumption of this toxin by ninety percent.

Baboons consume plants and certain parts of plants that are poisonous to humans. Thus, baboons appear to have evolved to be able to metabolize and eliminate certain plant toxins that humans cannot (Peters & O'Brien 1994, p.170). Compared to other primates, however, baboons are not specially adapted for a very high intake of plant toxins. Leaf-eating primates such as the colobine monkeys evolved to have enlarged, multi-chambered complex stomachs with compartments containing bacteria that aid in the breakdown of plant toxins through fermentation (Whiten et al. 1991). Baboons, on the other hand, evolved to have a much less specialized gut suited for the digestion of a wide range of foods, typically of a very high, nutrient dense quality.

To make up for a lack of any extensive digestive specializations for eliminating plant toxins, baboons exercise extreme selectivity of plant foods to decrease the toxin load. This selection occurs at the level of the species of plants chosen, as well as the parts of each particular plant that are actually consumed (Whiten et al. 1991).

The remarkable degree of selectivity involved is exemplified in how they select for the soft green seeds of umbrella trees (Acacia tortilis). Like corms, these seeds are an important fallback food for baboons, but they contain a potent toxin known as "trypsin inhibitor." In order to minimize their intake of this toxin, baboons only feed from specific umbrella trees that are thought to be genetically configured to produce less of this toxin. The pods containing the seeds and the seeds' coats, both of which contain significant amounts of this toxin, are always removed. The baboons do not eat from all of the pods that are picked, and do not remove all of the seeds in the pod to be consumed. In the end, through all of their various methods of selectivity, the baboons are estimated to reduce their intake of trypsin inhibitor by 91%! Even so, sometimes the baboons vomit after consuming these seeds (Altmann 2009).

Beyond plant toxins, there is also some evidence to suggest that baboons select plant foods in a way that maximizes protein intake and minimizes fiber intake (Whiten et al. 1991).

HUNTING

Generally, only the males hunt and even when females stumble upon prey, the males take it from them. We believe that their hunting is not instinctive but learned behavior and then handed down through cultural evolution. Sometimes, they hunt by chance, just stumble upon some prey, like insects, frogs, termites and the like; at other times, they intentionally locomote to places where their prey is found. Other times, however, they intentionally stalk and then chase down their prey. In some rather extraordinary footage from the BBC, one baboon hid in the bushes and then at the right time chased down one pink flamingo, feeding on a sandbar, before it had time to escape with its long and slow wings.

While baboons typically do not hunt with others, one troop of baboons, called the pumphouse gang, evidently pioneered cooperative hunting--at least momentarily. One male in their troop was a particularly fond and determined hunter, attempting to chase down small antelopes and at first the other baboons ignored him but once becoming more successful, they started to observe him more carefully. Then one day, they watched as he was chasing one young antelope, quickly becoming exhausted, when another baboon jumped into the chase and caught the antelope. The baboons appeared to learn from this behaviour because from thereon out, they engaged through consecutive chases, creating better results for themselves. However, once these males eventually left their troop, these hunting strategies were not continued and furthermore never observed in any other troop of baboons, suggesting that the behaviour was not learned. However, it did not result in cultural evolution, because the behavior was not passed down to the young.

While baboons consume primarily plant matter, they do on occasion capture and consume meat (Sandford 2009, p.67). Thomson gazelle infants and other small antelopes, hares, quails, and small birds, are all potential prey, but which animals are commonly sought out and captured is specific to a baboon troop (This sentence reads a little weird from ‘but which’ moving forward, maybe start a new sentence there). Male baboons are the primary hunters, and some males are more motivated to hunt than others. Females may rarely attempt to capture small animals that they happen to come across, but if they are spotted by a male, they will likely be forced into giving up their meat (Harding 1974). Hunting and meat eating among baboons appear to be learned, culturally rooted traditions that are promoted or eliminated depending upon the group. Past experiences, observation, and imitation of others all play roles in whether hunting and meat eating occurs (Strum 1987, p.130).

Many captures are based on mere chance, and involve stumbling upon some potential prey while out on their daily travels. Some captures, however, involve a more conscious effort to seek out potential prey such as baby antelopes within a herd, or involve leaving the group to go and search in a habitat where a certain type of prey is commonly found (Harding 1974). There are generally no coordinated group efforts to acquire prey. Hunting most typically entails individual males opportunistically stalking and if need be, chasing down prey. In some instances, male baboons have been observed engaging in the chase of some prey that is already being chased by another baboon, but these efforts appear to be independently based, and although simultaneous, are not indicative of true cooperative hunting (Harding 1974)(Goffe & Fischer 2016). Olive baboons are ecologically flexible in that they consume a wide variety of foods and can live in a variety of habitats, but nonetheless they are selective about their diet choice and habitat usage (Whiten et al. 1991; Barton et al. 1992). Olive baboons can be found in habitats ranging from desert to montane forest. One reason they are able to adapt to these varying habitats could be their flexibility in foraging strategies and ability to extract food and nutrients from almost all strata of the environment (Whiten et al. 1991). They find food on the ground, in the trees, and underground. On the ground, they forage in the grass or in thickets of savanna woodland, they forage in trees and find food at higher levels of the canopy, and finally, they dig up subterranean foods (Whiten et al. 1991). Baboons are omnivores and consume a huge variety of items including roots, tubers, corms, fruits, leaves, flowers, buds, seeds, bark, exudates, cacti, grasses, insects, birds, bird eggs, and vertebrates (including other primates) up to the size of a small antelope (Rowell 1966; Dunbar & Dunbar 1974; Harding 1976; Whiten et al. 1991; Hassan 2001).

That being said, there has been one group of male olive baboons dubbed the “Pumphouse Gang” that developed more cooperative and sophisticated hunting techniques while under the observation of a group of scientists. It began with one meat hungry male who began employing some novel means to try to capture meat. This male would more intensively search and stalk potential prey, and in one instance, raided a group of antelopes, surprising a mother and fawn, and attempting to lunge and grab the baby. At first, the others ignored him, but as his success rate became more apparent, the other males became interested. On one occasion, this particular male was chasing a baby tommy gazelle. As he began to get tired and lose speed,

another male who spotted his pursuit took over and ran after the prey. This behavior continued, with a male chasing until he reached exhaustion at which point another male would take over in the fashion of a sort of relay race. Perhaps by accident, but possibly with some intention, one male ended up chasing the baby antelope right into the arms of another male. The scientists noted that the baboons appear to have learned from this event, mimicking this capture strategy again and again, each time increasing in efficiency, leading to rises in success rates. While this displays the potential for baboons to exercise creativity and intelligence to innovate new techniques for capturing prey more efficiently, these observations were recorded in isolation and have not been subsequently seen among other baboon groups. As the males who observed and were a part of these more sophisticated cooperative hunting techniques left or disappeared from this particular baboon troop, and new males took their place, these hunting techniques were forgotten and no longer employed (Strum 1987, p.130).

MEAT PROCESSING

Once they capture their prey, the baboons eat the animal on the spot, hurriedly, to keep their prey from being taken from other animals, with smaller animals consumed whole, such as birds, insects and the like. When capturing larger prey, such as antelope, they first consume the underside of the animal, the belly, without even first killing the animal, by gripping their canines and pulling out chunks of flesh. On average, they eat their larger prey over the course of fifteen minutes to one hour, eating hares, for example, in fifteen minutes and antelopes longer. Generally, in the end, nothing remains except for some fur and longer and larger bones.

Apparently baboons do not instinctually eat the brains of their prey but some learn to by observing other baboons, through piercing the skull with their canines, cracking the skull between their molars, or eating through the palate to access the bottom of the braincase

It is clear that not all baboons know how to access the brain, but still many other observations suggest that a number of baboons do (Harding 1974) (Strum 1987, p.132). The brain has been observed to be accessed in a few different ways. Piercing the skull with the male baboon's canines is a frequently used method (Harding 1974). Cracking the skull between the molars or eating through the upper palate to reach the soft bottom of the braincase are other less common ways in which baboons gain access to the brain (Strum 1987, p.132). Baboons learn to eat meat by observation and imitation of their troop members. Young baboons watch and imitate their mothers and male friends (Strum 1987, p.130).

Once animal prey is captured, it is eaten immediately. Smaller animals such as small birds are consumed in almost one mouthful, while larger animals such as baby antelope are more carefully eaten. When a newborn antelope is captured, baboons typically start by eating the soft underside of the animal. This is done even before the animal is dead as baboons do not make any attempt to kill the animal once captured. The skin may be stripped with the front teeth, but generally, baboons do not skin their prey before eating. Chunks of flesh are torn off by gripping the flesh with their front teeth as they hold the prey and pull their head back. Baboons eat their

meat quickly, gulping down as much meat as they can before another baboon or predatory competitor gains access. On average, a meat eating session lasts less than one hour. For a hare, it might take just 15 minutes to down the whole hare. Baby antelopes, of course, take longer. In the end, very little is left behind except for perhaps a few scraps of skin or an occasional long bone (Harding 1974).

SCAVENGING

Baboons are not scavengers and have frequently been observed passing up carrion. Baboons will only eat meat that has been recently killed by themselves or another baboon in their troop. If they witnessed the killing first hand or if another baboon felt the meat was safe, then they might also be persuaded into eating it. However, if the origin of the carcass is unknown, or if other baboons re One researcher reported that a carcass was often abandoned with the antelope's skull still intact and untouched, but this appears to depend upon a particular baboon troop's shared knowledge of the presence of a fat laden brain inside, and how it might be accessed (Strum 1987, p.132).

PLANT PROCESSING

While most primates do not process their food much, if at all, before consumption, baboons process most of their plant foods, with the exception of grass shoots and berries. They process using both their dexterous hands, as well as pouches in their mouth, teeth and tongue to generally strip away dirt, fibrous shells, as well as various toxins, leaving piles of debris. In fact, through this processing, they remove about ninety percent of the toxins from their food.

When eating acacia seeds, baboons first consume the whole pod--and then spit out the pod, leaving only the seeds that are then stored in pouches inside of their mouth--thus allowing them to consume more seeds because they do not need to slow down to further process them. Later, the baboons then place the seeds back into their mouth, remove the toxic , fibrous seed husk with lips, teeth and tongue and spit that out and then eat the seed. When seeds are toxic, such as the many found in fruits, baboons spit them out.

Baboons feed on grass but greatly prefer the coms and roots of various grasses, herbs, tubers and other plants. In the case of coms, baboons first dig them from the ground and using their teeth and hands discard the roots, the top of the plant, as well as the harder, outer shell of the com itself--and then finally eat the starchy com.

With the exception of young grass shoots and soft berries, most baboon plant foods are processed before they are ingested. The baboons' dexterous hands with their opposable thumbs are essential to processing, just as they are to harvesting plant foods (see note above about emphasizing their hands) (Altmann 1998, p.358). Baboons use their nimble fingers and their opposable thumbs to pry, peel, husk, pluck, and to remove dirt (Harris & Ross p.103). In the process, the toxic, fibrous and indigestible parts of plants are removed and discarded,

resulting in a pile of debris. In this way, baboons are able to greatly increase the nutritional density of their diet while at the same time reducing their exposure to plant toxins and fibrous bulk (Altmann 2009) (Whiten et al. 1991). Their hands give them much more control over the final composition of the food they ingest. (I think it's particularly interesting that they are able to reduce the amount of toxins by 91% due to their 'food processing' behaviors-I see it's mentioned below, but it might be nice here to give the reader some idea of just how well the baboons can enhance the nutritional value of their food, as well as how well they decrease toxicity, to help them fully appreciate how skilled the baboons truly are in this regard.)

A quick review of the ways humans use and have used their hands with the opposable thumb to process food reveals that the baboons' way of processing plant foods is not too different from our own. Go to any Major League Baseball game, and you will see modern humans engaging in the same sort of processing behavior, using their thumbs and fingers to remove the outer shell of salted peanuts, discarding the hard and fibrous inedible shell to the wayside. Some of the lazier or perhaps just creative humans might be seen popping the whole peanut—shell and all—into their mouths, and after a few moments, a wet shell drops out of their mouth. These peanut eaters are engaging in a type of oral processing in which they use the teeth, lips and tongue to remove the outer shell, extracting the much desired peanut, and releasing the unwanted debris.

Baboons also engage in this type of oral processing, particularly with seeds. The seeds inside the green acacia pods are removed by the joint action of the baboons' lips, teeth and tongue. The remaining pods are dropped from the mouth without the aid of the hands. Unlike humans, however, baboons don't swallow the seeds right away, but typically put them into special pouches located inside their cheeks that allow them to store the seeds for later consumption. This provides baboons an advantage in not just providing an afternoon or midnight snack, but enables the baboons to continue orally processing other pods before swallowing so that they can ingest and process as many pods as possible within a given amount of time.

Later on, when the baboons are in a safe place, the seeds can be brought back into the oral cavity at which time the seed coats are removed with the joint action of the lips, teeth, and tongue, and then finally dropped out. As the seed coats fall from the lips, the naked seeds are chewed and swallowed. Some fruits contain inedible seeds that are not chewed or swallowed but are spat out, helping to avoid carrying around extra weight from an abundance of seeds in the gut. With their large, sharp-crested molars, baboons can easily separate the flesh of fruit from its seeds (Altmann 1998, p.359)(Strier 2016, p.51).

With their hands, baboons are able to access edible parts of plants growing below the soil's surface as well. In contrast to other grass feeders who may only consume the grass shoot, baboons focus on the less fibrous, starch rich base of grass shoots (Altmann 1998, p.359). Bases, corms, bulbs of lilies, and other underground storage organs of herbs, grasses and sedges require some of the most intensive processing of any plant foods consumed by baboons (Altmann 2009). First, acquiring them often requires digging into the hard ground of the open

savannah. After they are dug from the ground, the baboons use both of their hands along with their teeth to remove and discard the inedible parts including the top of the plant, the roots, and the outer dry sheath of the corm, leaving only the soft and moist inner portion of corm tissue to be consumed (Whiten et al. 1991) (Strum 1987, p.19) (Altmann 2009). While corms and other underground storage organs require a lot of time and energy to prep for eating, they serve as important fallback foods for baboons during the dry season when fruits and flowers are not available (Altmann 2009).

FOOD SHARING

Baboons do not share much food: even mothers share little, to no, food with their babies. Baboons share meat, inadvertently. In some cases, they skill animals like antelopes that they cannot eat immediately or entirely. In that case, baboons will share meat, inadvertently--that is, passively not actively. Typically, the alpha makes the kill and then has access to the flesh. However, other males crowd around him from time to time and if the alpha or any other male is perhaps content with enough food, other baboons are allowed to partake. Or if full, the baboon abandons the carcass and then others partake. In some cases, males also actively allow females and jueveniles to partake if they are bonded in some way--but males do not swap food for sex, as is the case with chimps.

MEAT SHARING

Hunters have first access to the carcass and may choose whether or not they will share (the exception being female hunters who are typically forced into giving up their catch to a male). Baby antelope carcasses are never consumed entirely by the hunter. Meat sharing among baboons only involves a form of passive sharing whereby one baboon consuming meat tolerates another baboon approaching to gain access to the meat, or a baboon who is satiated leaves a carcass which is taken up by another baboon. Active sharing that would involve a baboon actually handing over a piece of meat to another baboon has never been reported in any species of baboon (Goffe & Fischer 2016).

Not all species of baboons have been observed sharing meat (This sentence right after the previous paragraph's statement that active sharing has never been reported is a little confusing. I realize that there is a difference here between 'active sharing' and more general 'sharing', but I wonder if there's a different word that can be used to reduce reader confusion? Perhaps, simply always qualify sharing as 'passive' or 'active' to help the reader to distinguish). The degree to which meat is shared or contested over also depends upon the species of baboon (Goffe & Fischer 2016). A kill can cause marked increases in aggression among a troop, particularly between males. The male of highest social rank often succeeds in the most kills and ends up consuming the most meat, but male status does not always play a role in meat distribution with the lowest ranking male sometimes gaining access to a carcass ahead of the highest ranking male. Meat sharing among males occurs very rarely. Male baboons will typically try to force the male eating to leave the carcass by sitting nearby and staring like a vulture, occasionally

venturing over to suggest a threat and put greater pressure upon the male to leave the carcass. If this does not work, theft may ensue (Harding 1974).

Female baboons do not attempt to steal meat from males, nor do they harass males in order to coerce them into sharing. Females may either scavenge a carcass left behind by a male, or a male may tolerate them approaching and consuming some of the meat, especially if they hold an intimate social bond or are friends who engage in grooming (Goffe & Fischer 2016)(Strum 1987, p.132). Infants and juveniles who groomed with or are often seen in close proximity to males might also be tolerated. Thus, social relationships strongly influence meat sharing among baboons. Meat is not exchanged directly for copulations nor does a female's reproductive status appear to influence the degree of meat sharing (Goffe & Fischer 2016). The amount of meat females manage to gain access to ranges significantly depending upon the particular baboon troop. As females very rarely capture their own prey, they are dependent upon males to share in order to obtain meat (Goffe & Fischer 2016)(Strum 1987, p.132).

I thought it was interesting that a mother won't share meat (or other food) with her infant (Strum 1987, p.132), how sad! Also, the fact that male baboons' sharing of meat with females isn't a quid pro quo for sex was quite refreshing to read! The fact that the sharing is really related to how close they are to the female generally seems so much more 'human' to me.

DIGESTION

Baboons possess cheek pouches that allow them to harvest more food faster, and then save the chewing and digestion for later, while also allowing their food, seeds in many cases, to soak and soften and and even begin to digest and possibly even ferment with the amylase found in their saliva--not too dissimilar to humans who both soak and predigest grains in various ways. (Strier 2016, p.51). (These cheek pouches are awesome, I love picturing the baboons with their pouches filled with snacks for later on!)

They follow the usual patterns in their digestive systems for primates that consume more refined foods: smaller overall guts relative to their size, smaller stomachs, longer small intestines, and smaller colons--in fact, like the capuchins, all quite similar to humans as well. (Harris & Ross 1987, p.103). They pass their food slower and in times of famine can slow down the passage even more, to attain more short chain fatty acids from the colon. (Ulijaszek, Mann, & Elton 2012, pp.46-47).

METABOLISM

Although we do not have any direct studies, we can theorize that baboons follow the usual patterns in primates for metabolism, storage and synthesis. While nearly all other primates receive their sugars from fruit, baboons receive their sugars from fruit, perhaps even preferentially, but also consume several starches, tubers, seeds, and cmos--which provide straight glucose for their brains, without them needing to synthesize fructose into glucose--thus, perhaps, providing some advantages: better nutrition, with less metabolism to utilize that

nutrition for the brain--which, curiously, is one of the patterns found in our own hominoid evolution.

For muscle and heart catabolism, baboons use the usual: extra glucose directly, or extra glucose converted into fatty acids, or limited fatty acids from their diet, or short chain fatty acids from fermentation.

From catabolism, they appear to consume enough animals whole to provide them both with complete and collagenous proteins, as well as all fatty acids, including the ones needed for the brain.

Perhaps of all the primates studies so far, baboons perform the least amount of nutrient synthesis, due to receiving more glucose than fructose in their diet from starch--thus reducing the amount of gluconeogenesis, providing them with advantages.

Interestingly when baboons feed from the refuse of humans, they become fat just like humans: increasing their body fat to many multiples, to around twenty three percent.

(Brooker, Widmaier, Graham, and Stilling) (Sandford 2009, p.67) (Ulijaszek, Mann, & Elton 2012, p.93).

ENCEPHALIZATION

Baboons have the largest brains of all the monkeys due to their size; also, like the capuchin and spider, baboons are also one of the most encephalized monkeys--with only apes having larger brains and greater encephalization. At the same time, they have longer lifespans, ranging from twenty to thirty years, giving enough time to program those brains.

They are also highly sociable, living in enormous groups--which also trends them towards greater encephalization.

Pigeons could maximally memorize between 800 and 1,200 picture–response associations before reaching the limit of their performance. In contrast, baboons minimally memorized 3,500–5,000 items and had not reached their limit after more than 3 years of testing (Williams pp.288-289).

CULTURE

As noted before, baboons vary in the size of their groups but typically live in enormous troops, of around one hundred or more individuals, likely to protect themselves from the greater predation found on the ground as compared to the trees. They all seem to know each other, as they recognize both kin and rank in other baboons.

Females raise their babies for only about one year, much less than, say, chimps. If the mother is higher ranked, her baby likely receives better care than other babies; and may also show greater fertility. At puberty or at any other time, males leave their troupe of origin while females stay for all of their lives in their family of origin, forming strong bonds with their sisters and other kin. In their troops, baboons have many more females than males--perhaps five times as much. Since so large one troop may contain as many as eight or nine different groups of bonded females, from different families, that sometimes fight with each other. The larger group of females, as well as the smaller groups, have their own social structures, with alphas at the top who are there less because of their fitness but rather because of inheritance. These alphas receive preferential treatment around access to food, sex and grooming.

They recognize both kin (more likely to bond) and help each other and rank.

Short term bonds for mating and friendships and involve cooperate child rearing
nurse for one year only. Mothers of high rank give their babies better treatment. Lower ranking females slower growing babies and less fertility.

Matrilocal
females stay in groups for life. Generally many females in the group, bonded, from eight or nine different families and sometimes conflict with each other

Group Structure, Kin, Rank, & Male-Female Relations
Baboons live in groups of up to 100-150 individuals who all travel together. Each group is centered upon a core of genetically related females typically consisting of around 8 or 9 matrilineal families, and a much small number of males ranging from around 3 to 12 per group. The number of males is continually changing as young adult males leave and join neighboring groups. Females remain in the same group they are born into for their entire lives. Social relations play an important part in baboon life. Baboons recognize rank and kin relations, and social interactions and behavior are carefully acted out to be in line with both. Females of close kin are more likely to unite and offer support to one another. A female baboon's kin and their past or recent behavior may affect how other females of other kin interact with them. Within a group, alliances may be formed between a few baboons, and occasionally, larger scale battles may occur between families of different matrilines (Cheney & Seyfarth 2007)(Note: This information came from various places in the Cheney & Seyfarth book, so I would say we just reference the entire book, as opposed to referencing a ton of different pages).

Males and females form short-term bonds for mating and longer-term friendships that involve cooperative child rearing (Cheney & Seyfarth 2007, p.12). Males compete for reproductive access to females (Goffe & Fischer 2016). Males' dominance hierarchy is based on fitness and the outcome of aggressive interactions. Rank changes often so that the alpha-male seldom maintains his rank for more than one year. Fights usually only occur between males of comparable rank. Males of significantly distant ranks typically only intensely fight over valued resources such as meat, sexually receptive females, and infants of female friends who are

subject to infanticide (Cheney & Seyfarth 2007, pp. 54 & 103). (One thing I'm wondering, that isn't clear from the information provided in Rebecca's notes, is if the males of distant ranks are fighting to protect the infants of female friends? I'm guessing this is the case, if so, cool! However, it's just not clear from reading this whether that is indeed the case or not.)

Females also have a dominance hierarchy, but it is largely inherited, not based upon fitness or health, and much more permanent, lasting for years, decades, and in some cases, even for generations. Thus, female baboons abide by more of a hierarchy of matrilines. High ranking females have priority access to food resources. Females of a higher rank may act to "supplant" another female to obtain their sitting position, grooming partner, or food. The alpha-female may supplant any female. The second in rank may supplant all females but the alpha, and so on (Cheney & Seyfarth 2007, pp. 65 & 75).

Child Rearing

Female baboons undergo 6 months of gestation, and the infant is dependent upon the mother for roughly one year. At 15 months, the infant baboon can feed and move on its own. Depending upon the mother's social rank, the infant is cared for differently. The offspring of higher ranking females are better attended to (Cheney & Seyfarth 2007, pp.50-51 & p.66). Due to differential access to food, the female dominance hierarchy factors prominently into child-rearing. Females of lower rank who have more limited access to food often give birth to infants with lower growth rates than higher ranking females. Lower ranking females may also experience decreased fertility and longer inter-birth intervals (Swedell & Leigh 2006, pp.36-37).

Baboons have evolved to be able to reproduce throughout the year, in large part due to their dietary flexibility that enables them to obtain adequate nutrition in every season. However, severe environmental conditions that threaten food resources can lengthen female baboons' inter-birth intervals and decrease female reproductive output. In periods of drought and heat, females are much less likely to cycle, conceive, or have a successful pregnancy (Altmann 2009). When food is abundant, females of all ages produce more offspring. When food is limited, all females produce fewer offspring (Strum 1987, p.140). When food resources are readily available, females can reproduce at a younger age than is typical (Swedell & Leigh 2006, pp.283-284).

Baboon neonates are born with larger brains compared to other similar sized primates. At birth, a baboon's brain size may even reach an adult's size. This suggests that baboons' brains start growing in size earlier and at a faster rate in order to reach completion far sooner than other similarly sized primates (Swedell & Leigh 2006, pp.283-284). (I wonder if this earlier/faster brain growth is related to nutrient availability? Perhaps the fact that baboons consume nutrient rich diets helps contribute to this brain development?)

Sexual Dimorphism

All baboon species display sexual dimorphism. Male baboons are bigger than females, weigh twice as much, and are dominant over females. Males develop large canine teeth and large, dog-like muzzles (Cheney & Seyfarth 2007, p.50). In some species of baboons, males and females display differences in the color of their fur. Male hamadryas baboons, for instance, develop large white manes not seen among hamadryas female baboons (http://animals.sandiegozoo.org/animals/hamadryas-baboon). Female baboons often live to more than 20 years of age, while males' lives are much shorter (Cheney & Seyfarth 2007, p.51). Female and male baboons also have distinctive calls and other vocalizations (see below).

(I came across some fun facts about Hamadryas baboons on the San Diego zoo website. Apparently, they were so highly regarded in ancient times that some were mummified after death. Also, Egyptians believed they were sacred to Thoth, the god of learning.)

(Regarding lifespan of baboons- From what I can tell, this varies widely by species, with some data suggesting baboons live 25-30 years in the wild. For example: Olive baboons live 25-30 years in the wild, and yellow baboons live an average of 27 years in the wild (wisc.edu). So, we may want to revisit this information so more.)

Calls

(No findings on food calls)
Baboons give alarm calls for lions, leopards, crocodiles and snakes. Males produce loud alarm "wahoos" while females and juveniles have alarm "barks." (I want to hear this...) Baboons appear to have distinct alarm calls for mammalian carnivores (i.e. lions), crocodiles, and snakes that result in different responses among listening baboons. For example, a lion bark might elicit running towards a tree, while a crocodile bark might cause baboons to run a short distance from the water before peering back into the water in search of a crocodile. In general, alarm calls depend upon the type of predator and the degree of danger (Cheney & Seyfarth 2007, pp.221-223).

Males also wahoo when engaging in competitive contests with other males. Females and juveniles produce "contact barks" when they become lost or separated from their companions. Of all vocalizations made by baboons, grunting is the most common. The "move grunt" made during group movements is most common when baboons are just beginning to move, moving through the woods or tall grass where vision may be blunted, or when attempting a more dangerous water-crossing (Cheney & Seyfarth 2007, p.223).

(I found on wisc.edu that yellow baboons will make grunts when they're feeding together, but that's the only info I found-I only looked briefly, so let me know if you need me to do additional research on this.)

Territorial

Every baboon troop has its own home range. Baboons, particularly females and youngsters, are reluctant to cross out of the home range, but they are not interested in defending the borders of their range (Strum 1987, p.303). Baboons are rarely aggressive towards other species who are not predators (Sandford 2009, pp.67 & 70).

Similarities & Differences in Dietary Strategies

- among BABOONS, HUMANS, & SAVANNAH CHIMPS

Even though baboons and savannah-woodland chimpanzees may sometimes live side by side in the same habitat at the forest fringes, baboons have more diverse diets than the chimpanzees (Ulijaszek, Mann, & Elton 2012, p.80)(Whiten et al. 1990). This is due to the baboons' ability to exploit tropical grasses and sedges (C4 resources) that the savannah-woodland chimpanzees do not consume. Humans today also make extensive use of tropical grasses and their animal consumers. Both baboons and modern humans utilize many of the same plant species for food, but often use different parts of the plant as food (Ulijaszek, Mann, & Elton 2012, pp. 43-46 and pp.79-.80).

COMMUNICATION

They have limitations upon their communication. They vocalize to warn others of their predators, lions, leopards, crocodiles, snakes etc. They als vocalize to let others in their troops know their whereabouts but typically only when they are occasionally in forests or brush and other baboons cannot see them. And to establish dominance and submission. And males bark at each as expressions of aggression. However, they do not vocalize to identify food or its location; as mentioned, in the open terrain, they all just watch others closely, so that overall their vocabulary and communication overall seems somewhat limited, at least as compared to some few, other select primates.

TOOLS

Despite their encephalization, we do not have any reason to believe that baboons use any tools.

SUMMARY

As noted earlier, almost all large primates have slower metabolisms and thus eat rougher foods, such as leaves and indeed nearly all of them are folivorous. But at twenty to eighty pounds, baboons are one of the largest primates out there, second mostly only to the apes like the chimp and gorilla. Yet, as we can see, they eat more refined foods. More specifically, if you recall, the howler weighs about twenty pounds and eats mostly leaves while the baboon weighs well over double that but eats mostly fruits, starches and other animals, showing the refinement of their diet, While this rule of larger primates eating rougher diets applies to nearly all monkeys, some few primates broke the rule, namely the apes as well as the baboon--so that

they were enabled to create the energetics of encephalization with the longer lifespans--thereby allowing them greater encephalization and observed intelligence.
So they have:

Refined diet (all macronutrients)
equals

sensing (about the same)
locomotion (enhanced, given their larger territories)
digestion (reduced)
synthesis (reduced)
metabolism (enhanced for primate of their size)

encephalization (enhanced) especially for even more diverse diet
intelligence (enhanced) yes
culture (greatly enhanced) even more enhanced, with so many animals
communication (the same)
tools (none)

if following the usual rule, that more encephalized primates have slightly higher metabolisms, relative to other animals their size, then assume higher metabolism.