COMPARATIVE ANATOMY (A VEGAN PERSPECTIVE)

I have left this file as I created it as a Raw/Live Vegan, so that you can appreciate the worldview space of this important stage of development along the Spectrum of Diet.

As a Raw/Live Vegan, I wrote: "Comparative anatomy works on the simple and demonstrable fact that the biological form usually defines function. Individual features, or species may break the rules, but a look at many factors will reveal a species true biological role. Science provides us with an indicator of human nutrition which was not established by culture, but is certainly that of a herbivore or frugivore and not a carnivore or omnivore."

I have significantly upgraded my nutritional perspective to a personal evolutionary one as outlined in the Spectrum of Diet and an Integral Approach to Nutrition.

For an updated Omnivorous Dietetic perspective, consider:

***"Man's Dietary History" in* Beyond Broccoli, and**
"Homo Omnivorous," An Excerpt from *The Omnivore's Dilemma* by Michael Pollan

Now, for your Integrated pleasure, a Vegan perspective on Comparative Anatomy.

With peaceful steps,

David Rainoshek, M.A. and Katrina Rainoshek
July 26, 2012

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Books:

Sunfood Diet Success System **by David Wolfe**
Conscious Eating **by Gabriel Cousens, M.D.**
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Mad Cowboy **by Howard Lyman**
Beyond Beef **by Jeremy Rifkin**
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Terms: **opportunistic feeder theory**

Is a Human Being A Carnivore or Herbivore?

	Carnivore	Herbivore	Human
1.	Teeth are long, sharp, and pointed. No flat molar teeth. Sharp canine teeth.	Front and canine teeth may be sharp or pointed. Back teeth are flattened for grinding	All teeth are flattened, especially the back molars. Dullest canine teeth of all primates.
2.	To facilitate tearing and biting, jaw can move up and down vertically.	To facilitate grinding of vegetable foods, jaw moves both up & down (vertical) & side to side (horizontal)	To facilitate grinding of vegetable foods, jaw moves both up & down (vertical) & side to side (horizontal)
3.	No lip or pouchy cheek structure.	Adaptable lip and pouchy cheek structure.	Refined lip and pouchy cheek structure.
4.	Shape of the face allows the carnivore to dig into a carcass and rip out the entrails.	Shape of the face allows the animal to pull vegetation off of the plants.	Shape of the face clearly indicates that humans have no ability to rip out entrails with their mouth.
5.	Drinks water by lifting it into the throat by tongue	Drinks water by suction.	Drinks water by suction.
6.	Tongue is rough and thin.	Tongue is smooth and thick to manipulate vegetable matter into the back molars for grinding.	Tongue is smooth and thick to manipulate vegetable matter into the back molars for grinding.
7.	Intestines - 3 times as long as trunk of the body; design facilitates rapid expulsion of fleshy matter.	Intestines - 8 to 12 times as long as trunk of the body; designed for extracting all nutrients from plant fiber.	Intestines - 12 times as long as the trunk; an integral part of most sophisticated juice extractor in the world: the human digestive system.
8.	Liver contains uricase, an enzyme used to break down uric acid; it can break down 10 to 15 times as much uric acid as an herbivore.	Liver has a low tolerance for uric acid.	Liver has a low tolerance for uric acid.
9.	Bowels are smooth and short for quick expulsion of waste matter.	Bowels are sulcified and complex for the reconstitution of waste matter.	Bowel walls are puckered, convoluted, and full of deep pouches for the reconstitution of waste matter.
10.	Digestive system has the capacity to expel large amounts of foreign cholesterol.	Digestive system has no capacity to expel foreign cholesterol.	Digestive system has no capacity to expel foreign cholesterol.
11.	Saliva is acidic.	Saliva is alkaline; it contains enzymes specifically designed to break down starchy carbohydrates.	Saliva is alkaline; it contains ptyalin, an enzyme specifically designed to break down starchy carbs.
12.	Blood is acidic.	Blood is alkaline.	Blood is alkaline.
13.	Urine is acidic.	Urine is alkaline.	Urine is alkaline.
14.	Cools itself primarily through action of the tongue and mouth (panting).	Cools itself primarily through perspiration.	Cools itself primarily through perspiration.
15.	All four feet are clawed (to rip into flesh).	All four feet are hooved (cloven) or hands and feet contain individual digits (fingers or toes) with nails.	Hands and feet contain individual digits with nails and opposable thumbs. Hands are perfectly designed to reach out, grab fruit, and peel it.

Source: *Sunfood Diet Success System* by David Wolfe, www.rawfood.com   Graphics by David Rainoshek, nutrientdensenutrition.com, juicefeasting.com

THE COMPARATIVE ANATOMY OF EATING

Source: Milton R. Mills, M.D., http://www.vegsource.com/veg_faq/comparative.htm

Humans are most often described as "omnivores." This classification is based on the "observation" that humans generally eat a wide variety of plant and animal foods. However, culture, custom and training are confounding variables when looking at human dietary practices. Thus, "observation" is not the best technique to use when trying to identify the most "natural" diet for humans. While most humans are clearly "behavioral" omnivores, the question still remains as to whether humans are anatomically suited for a diet that includes animal as well as plant foods.

A better and more objective technique is to look at human anatomy and physiology. Mammals are anatomically and physiologically adapted to procure and consume particular kinds of diets. (It is common practice when examining fossils of extinct mammals to examine anatomical features to deduce the animal's probable diet.) Therefore, we can look at mammalian carnivores, herbivores (plant-eaters) and omnivores to see which anatomical and physiological features are associated with each kind of diet. Then we can look at human anatomy and physiology to see in which group we belong.

Oral Cavity

> **"You can't tear flesh by hand, you can't tear hide by hand. Our anterior teeth are not suited for tearing flesh or hide. We don't have large canine teeth, and we wouldn't have been able to deal with food sources that required those large canines."**
> —Renowned anthropologist Dr. Richard Leakey[1]

Carnivores have a wide mouth opening in relation to their head size. This confers obvious advantages in developing the forces used in seizing, killing and dismembering prey. Facial musculature is reduced since these muscles would hinder a wide gape, and play no part in the animal's preparation of food for swallowing. In all mammalian carnivores, the jaw joint is a simple hinge joint lying in the same plane as the teeth. This type of joint is extremely stable and acts as the pivot point for the "lever arms" formed by the upper and lower jaws. The primary muscle used for operating the jaw in carnivores is the temporalis muscle. This muscle is so massive in carnivores that it accounts for most of the bulk of the sides of the head (when you pet a dog, you are petting its temporalis muscles). The "angle" of the mandible (lower jaw) in carnivores is small. This is because the muscles (masseter and pterygoids) that attach there are of minor importance in these animals. The lower jaw of carnivores cannot move forward, and has very limited side-to-side motion. When the jaw of a carnivore closes, the blade-shaped cheek molars slide past each other to give a slicing motion that is very effective for shearing meat off bone.

The teeth of a carnivore are discretely spaced so as not to trap stringy debris. The incisors are short, pointed and prong-like and are used for grasping and shredding. The canines are greatly elongated and dagger-like for stabbing, tearing and killing prey. The molars (carnassials) are flattened and triangular with jagged edges such that they function like serrated-edged blades. Because of the hinge-type joint, when a carnivore closes its jaw, the cheek teeth come together in a back-to-front fashion giving a smooth cutting motion like the blades on a pair of shears.

The saliva of carnivorous animals does not contain digestive enzymes. When eating, a mammalian carnivore gorges itself rapidly and does not chew its food. Since proteolytic (protein-digesting) enzymes cannot be liberated in the mouth due to the danger of autodigestion (damaging the oral cavity), carnivores do not need to mix their food with saliva; they simply bite off huge chunks of meat and swallow them whole.

According to evolutionary theory, the anatomical features consistent with an herbivorous diet represent a more recently derived condition than that of the carnivore. Herbivorous mammals have well-developed facial musculature, fleshy lips, a relatively small opening into the oral cavity and a thickened, muscular tongue. The lips aid in the movement of food into the mouth and, along with the facial (cheek) musculature and tongue, assist in the chewing of food. In herbivores, the jaw joint has moved to position above the plane of the teeth. Although this type of joint is less stable than the hinge-type joint of the carnivore, it is much more mobile and allows the complex jaw motions needed when chewing plant foods. Additionally, this type of jaw joint allows the upper and lower cheek teeth to come together along the length of the jaw more or less at once when the mouth is closed in order to form grinding platforms. (This type of joint is so important to a plant-eating animal, that it is believed to have evolved at least 15 different times in various plant-eating mammalian species.) The angle of the mandible has expanded to provide a broad area of attachment for the well-developed masseter and pterygoid muscles (these are the major muscles of chewing in plant-eating animals). The temporalis muscle is small and of minor importance. The masseter and pterygoid muscles hold the mandible in a sling-like arrangement and swing the jaw from side-to-side. Accordingly, the lower jaw of plant-eating mammals has a pronounced sideways motion when eating. This lateral movement is necessary for the grinding motion of chewing.

The dentition of herbivores is quite varied depending on the kind of vegetation a particular species is adapted to eat. Although these animals differ in the types and numbers of teeth they posses, the various kinds of teeth when present, share common structural features. The incisors are broad, flattened and spade-like. Canines may be small as in horses, prominent as in hippos, pigs and some primates (these are thought to be used for defense) or absent altogether. The molars, in general, are squared and flattened on top to provide a grinding surface. The molars cannot vertically slide past one another in a shearing/slicing motion, but they do horizontally slide across one another to crush and grind. The surface features of the molars vary depending on the type of plant material the animal eats. The teeth of herbivorous animals are closely grouped so that the incisors form an efficient cropping/biting mechanism, and the upper and lower molars form extended platforms for crushing and grinding. The "walled-in" oral cavity has a lot of potential space that is realized during eating.

These animals carefully and methodically chew their food, pushing the food back and forth into the grinding teeth with the tongue and cheek muscles. This thorough process is necessary to mechanically disrupt plant cell walls in order to release the digestible intracellular contents and ensure thorough mixing of this material with their saliva. This is important because the saliva of plant-eating mammals often contains carbohydrate-digesting enzymes which begin breaking down food molecules while the food is still in the mouth.

> **"Although we think we are one, and we act as if we are one, human beings are not natural carnivores. When we kill animals to eat them, they end up killing us because their flesh, which contains cholesterol and saturated fat, was never intended for human beings, who are natural herbivores."**
> —William C. Roberts, M.D., editor, *American Journal of Cardiology*[3]

Stomach and Small Intestine

Striking differences between carnivores and herbivores are seen in these organs. Carnivores have a capacious simple (single-chambered) stomach. The stomach volume of a carnivore represents 60-70% of the total capacity of the digestive system. Because meat is relatively easily digested, their small intestines (where absorption of food molecules takes place) are short&151;about three to five or six times the body length. Since these animals average a kill only about once a week, a large stomach volume is advantageous because it allows the animals to quickly gorge themselves when eating, taking in as much meat as possible at one time which can then be digested later while resting. Additionally, the ability of the carnivore stomach to secrete hydrochloric acid is exceptional. Carnivores are able to keep their gastric pH down around 1-2 even with food present. This is necessary to facilitate protein breakdown and to kill the abundant dangerous bacteria often found in decaying flesh foods.

Because of the relative difficulty with which various kinds of plant foods are broken down (due to large amounts of indigestible fibers), herbivores have significantly longer and in some cases, far more elaborate guts than carnivores. Herbivorous animals that consume plants containing a high proportion of cellulose must "ferment" (digest by bacterial enzyme action) their food to obtain the nutrient value. They are classified as either "ruminants" (foregut fermenters) or hindgut fermenters. The ruminants are the plant-eating animals with the celebrated multiple-chambered stomachs. Herbivorous animals that eat a diet of relatively soft vegetation do not need a multiple-chambered stomach. They typically have a simple stomach, and a long small intestine. These animals ferment the difficult-to-digest fibrous portions of their diets in their hindguts (colons). Many of these herbivores increase the sophistication and efficiency of their GI tracts by including carbohydrate-digesting enzymes in their saliva. A multiple-stomach fermentation process in an animal which consumed a diet of soft, pulpy vegetation would be energetically wasteful. Nutrients and calories would be consumed by the fermenting bacteria and protozoa before reaching the small intestine for absorption. The small intestine of plant-eating animals tends to be very long (greater than 10 times body length) to allow adequate time and space for absorption of the nutrients.

Colon

The large intestine (colon) of carnivores is simple and very short, as its only purposes are to absorb salt and water. It is approximately the same diameter as the small intestine and, consequently, has a limited capacity to function as a reservoir. The colon is short and non-pouched. The muscle is distributed throughout the wall, giving the colon a smooth cylindrical appearance. Although a bacterial population is present in the colon of carnivores, its activities are essentially putrefactive.

In herbivorous animals, the large intestine tends to be a highly specialized organ involved in water and electrolyte absorption, vitamin production and absorption, and/or fermentation of fibrous plant materials. The colons of herbivores are usually wider than their small intestine and are relatively long. In some plant-eating mammals, the colon has a pouched appearance due to the arrangement of the muscle fibers in the intestinal wall. Additionally, in some herbivores the cecum (the first section of the colon) is quite large and serves as the primary or accessory fermentation site.

What About Omnivores?

One would expect an omnivore to show anatomical features which equip it to eat both animal and plant foods. According to evolutionary theory, carnivore gut structure is more primitive than herbivorous adaptations. Thus, an omnivore might be expected to be a carnivore which shows some gastrointestinal tract adaptations to an herbivorous diet.

This is exactly the situation we find in the Bear, Raccoon and certain members of the Canine families. (This discussion will be limited to bears because they are, in general, representative of the anatomical omnivores.) Bears are classified as carnivores but are classic anatomical omnivores. Although they eat some animal foods, bears are primarily herbivorous with 70-80% of their diet comprised of plant foods. (The one exception is the Polar bear which lives in the frozen, vegetation poor arctic and feeds primarily on seal blubber.) Bears cannot digest fibrous vegetation well, and therefore, are highly selective feeders. Their diet is dominated by primarily succulent lent herbage, tubers and berries. Many scientists believe the reason bears hibernate is because their chief food (succulent vegetation) not available in the cold northern winters. (Interestingly, Polar bears hibernate during the summer months when seals are unavailable.)

In general, bears exhibit anatomical features consistent with a carnivorous diet. The jaw joint of bears is in the same plane as the molar teeth. The temporalis muscle is massive, and the angle of the mandible is small corresponding to the limited role the pterygoid and masseter muscles play in operating the jaw. The small intestine is short (less than five times body length) like that of the pure carnivores, and the colon is simple, smooth and short. The most prominent adaptation to an herbivorous diet in bears (and other "anatomical" omnivores) is the modification of their dentition. Bears retain the peg-like incisors, large canines and shearing premolars of a carnivore; but the molars have become squared with rounded cusps for crushing and grinding. Bears have not, however, adopted the flattened, blunt nails seen in most herbivores and retain the elongated, pointed claws of a carnivore.

An animal which captures, kills and eats prey must have the physical equipment which makes predation practical and efficient. Since bears include significant amounts of meat in their diet, they must retain the anatomical features that permit them to capture and kill prey animals. Hence, bears have a jaw structure, musculature and dentition which enable them to develop and apply the forces necessary to kill and dismember prey even though the majority of their diet is comprised of plant foods. Although an herbivore-style jaw joint (above the plane of the teeth) is a far more efficient joint for crushing and grinding vegetation and would potentially allow bears to exploit a wider range of plant foods in their diet, it is a much weaker joint than the hinge-style carnivore joint. The herbivore-style jaw joint is relatively easily dislocated and would not hold up well under the stresses of subduing struggling prey and/or crushing bones (nor would it allow the wide gape carnivores need). In the wild, an animal with a dislocated jaw would either soon starve to death or be eaten by something else and would, therefore, be selected against. A given species cannot adopt the weaker but more mobile and efficient herbivore-style joint until it has committed to an essentially plant-food diet test it risk jaw dislocation, death and ultimately, extinction.

What About Me?

The human gastrointestinal tract features the anatomical modifications consistent with an herbivorous diet. Humans have muscular lips and a small opening into the oral cavity. Many of the so-called "muscles of expression" are actually the muscles used in chewing. The muscular and agile tongue essential for eating, has adapted to use in speech and other things. The mandibular joint is flattened by a cartilaginous plate and is located well above the plane of the teeth. The temporalis muscle is reduced. The characteristic "square jaw" of adult males reflects the expanded angular process of the mandible and the

> **"In the next ten years, one of the things you're bound to hear is that animal protein ... is one of the most toxic nutrients of all that can be considered."**
> —Dr. T. Colin Campbell, director of the Cornell-China-Oxford Project on Nutrition, Health, and the Environment

enlarged masseter/pterygoid muscle group. The human mandible can move forward to engage the incisors, and side-to-side to crush and grind.

Human teeth are also similar to those found in other herbivores with the exception of the canines (the canines of some of the apes are elongated and are thought to be used for display and/or defense). Our teeth are rather large and usually abut against one another. The incisors are flat and spade-like, useful for peeling, snipping and biting relatively soft materials. The canines are neither serrated nor conical, but are flattened, blunt and small and function Like incisors. The premolars and molars are squarish, flattened and nodular, and used for crushing, grinding and pulping noncoarse foods.

Human saliva contains the carbohydrate-digesting enzyme, salivary amylase. This enzyme is responsible for the majority of starch digestion. The esophagus is narrow and suited to small, soft balls of thoroughly chewed food. Eating quickly, attempting to swallow a large amount of food or swallowing fibrous and/or poorly chewed food (meat is the most frequent culprit) often results in choking in humans.

Man's stomach is single-chambered, but only moderately acidic. (Clinically, a person presenting with a gastric pH less than 4-5 when there is food in the stomach is cause for concern.) The stomach volume represents about 21-27% of the total volume of the human GI tract. The stomach serves as a mixing and storage chamber, mixing and liquefying ingested foodstuffs and regulating their entry into the small intestine. The human small intestine is long, averaging from 10 to 11 times the body length. (Our small intestine averages 22 to 30 feet in length. Human body size is measured from the top of the head to end of the spine and averages between two to three feet in length in normal-sized individuals.)

The human colon demonstrates the pouched structure peculiar to herbivores. The distensible large intestine is larger in cross-section than the small intestine, and is relatively long. Man's colon is responsible for water and electrolyte absorption and vitamin production and absorption. There is also extensive bacterial fermentation of fibrous plant materials, with the production and absorption of significant amounts of food energy (volatile short-chain fatty acids) depending upon the fiber content of the diet. The extent to which the fermentation and absorption of metabolites takes place in the human colon has only recently begun to be investigated.

In conclusion, we see that human beings have the gastrointestinal tract structure of a “committed” herbivore. Humankind does not show the mixed structural features one expects and finds in anatomical omnivores such as bears and raccoons. Thus, from comparing the gastrointestinal tract of humans to that of carnivores, herbivores and omnivores we must conclude that humankind's GI tract is designed for a purely plant-food diet.

SUMMARY

FACIAL MUSCLES

Carnivore - Reduced to allow wide mouth gape
Herbivore - Well-developed
Omnivore - Reduced
Human - Well-developed

JAW TYPE
Carnivore - Angle not expanded
Herbivore - Expanded angle
Omnivore - Angle not expanded
Human - Expanded angle

JAW JOINT LOCATION
Carnivore - On same plane as molar teeth
Herbivore - Above the plane of the molars
Omnivore - On same plane as molar teeth
Human - Above the plane of the molars

JAW MOTION
Carnivore - Shearing; minimal side-to-side motion
Herbivore - No shear; good side-to-side, front-to-back
Omnivore - Shearing; minimal side-to-side
Human - No shear; good side-to-side, front-to-back

MAJOR JAW MUSCLES
Carnivore - Temporalis
Herbivore - Masseter and pterygoids
Omnivore - Temporalis
Human - Masseter and pterygoids

MOUTH OPENING VS. HEAD SIZE
Carnivore - Large
Herbivore - Small
Omnivore - Large
Human - Small

TEETH (INCISORS)
Carnivore - Short and pointed
Herbivore - Broad, flattened and spade shaped
Omnivore - Short and pointed
Human - Broad, flattened and spade shaped

TEETH (CANINES)
Carnivore - Long, sharp and curved
Herbivore - Dull and short or long (for defense), or none
Omnivore - Long, sharp and curved
Human - Short and blunted

TEETH (MOLARS)
Carnivore - Sharp, jagged and blade shaped
Herbivore - Flattened with cusps vs complex surface
Omnivore - Sharp blades and/or flattened

Human - Flattened with nodular cusps

CHEWING
Carnivore - None; swallows food whole
Herbivore - Extensive chewing necessary
Omnivore - Swallows food whole and/or simple crushing
Human - Extensive chewing necessary

SALIVA
Carnivore - No digestive enzymes
Herbivore - Carbohydrate digesting enzymes
Omnivore - No digestive enzymes
Human - Carbohydrate digesting enzymes

STOMACH TYPE
Carnivore - Simple
Herbivore - Simple or multiple chambers
Omnivore - Simple
Human - Simple

STOMACH ACIDITY
Carnivore - Less than or equal to pH 1 with food in stomach
Herbivore - pH 4 to 5 with food in stomach
Omnivore - Less than or equal to pH 1 with food in stomach
Human - pH 4 to 5 with food in stomach

STOMACH CAPACITY
Carnivore - 60% to 70% of total volume of digestive tract
Herbivore - Less than 30% of total volume of digestive tract
Omnivore - 60% to 70% of total volume of digestive tract
Human - 21% to 27% of total volume of digestive tract

LENGTH OF SMALL INTESTINE
Carnivore - 3 to 6 times body length
Herbivore - 10 to more than 12 times body length
Omnivore - 4 to 6 times body length
Human - 10 to 11 times body length

COLON
Carnivore - Simple, short and smooth
Herbivore - Long, complex; may be sacculated
Omnivore - Simple, short and smooth
Human - Long, sacculated

LIVER
Carnivore - Can detoxify vitamin A

Herbivore - Cannot detoxify vitamin A
Omnivore - Can detoxify vitamin A
Human - Cannot detoxify vitamin A

KIDNEY
Carnivore - Extremely concentrated urine
Herbivore - Moderately concentrated urine
Omnivore - Extremely concentrated urine
Human - Moderately concentrated urine

NAILS
Carnivore - Sharp claws
Herbivore - Flattened nails or hooves
Omnivore – Sharp Claws
Human – Flattened Nails

ARE HUMANS CARNIVORES OR HERBIVORES?

Source: http://www.stevepavlina.com/blog/2005/09/are-humans-carnivores-or-herbivores-2/

Are human beings anatomically more similar to natural carnivores or to natural herbivores? Let's find out….

- **Intestinal tract length.** Carnivorous animals have intestinal tracts that are 3-6x their body length, while herbivores have intestinal tracts 10-12x their body length. Human beings have the same intestinal tract ratio as herbivores.
- **Stomach acidity.** Carnivores' stomachs are 20x more acidic than the stomachs of herbivores. Human stomach acidity matches that of herbivores.
- **Saliva.** The saliva of carnivores is acidic. The saliva of herbivores is alkaline, which helps pre-digest plant foods. Human saliva is alkaline.
- **Shape of intestines.** Carnivore bowels are smooth, shaped like a pipe, so meat passes through quickly — they don't have bumps or pockets. Herbivore bowels are bumpy and pouch-like with lots of pockets, like a windy mountain road, so plant foods pass through slowly for optimal nutrient absorption. Human bowels have the same characteristics as those of herbivores.
- **Fiber.** Carnivores don't require fiber to help move food through their short and smooth digestive tracts. Herbivores require dietary fiber to move food through their long and bumpy digestive tracts, to prevent the bowels from becoming clogged with rotting food. Humans have the same requirement as herbivores.
- **Cholesterol.** Cholesterol is not a problem for a carnivore's digestive system. A carnivore such as a cat can handle a high-cholesterol diet without negative health consequences. A human cannot. Humans have zero dietary need for cholesterol because our bodies manufacture all we need. Cholesterol is only found in animal foods, never in plant foods. A plant-based diet is by definition cholesterol-free.

- **Claws and teeth.** Carnivores have claws, sharp front teeth capable of subduing prey, and no flat molars for chewing. Herbivores have no claws or sharp front teeth capable of subduing prey, but they have flat molars for chewing. Humans have the same characteristics as herbivores.

But aren't humans anatomically suited to be omnivores?

Nope. We don't anatomically match up with omnivorous animals anymore than we do with carnivorous ones. Omnivores are more similar to carnivores than they are to herbivores. For a more detailed summary table that compares the properties of carnivores, herbivores, and omnivores side by side, see this page:

Comparative Anatomy & Taxonomy

The link above also debunks the **opportunistic feeder theory**, which states that because humans *can* eat like omnivores, that we must therefore *be* omnivores. And this is of course false because mere behavior doesn't indicate suitability. There are plenty of things we *can* do as a species that would threaten our survival if we all considered them suitable default behavior, such as shooting each other, lobbing hand grenades, or sending spam.

Feature	Carnivore	Herbivore	Omnivore	Human
Facial Muscles	Reduced to allow wide mouth gape	Well-developed	Reduced	Well-developed
Jaw Type	Angle not expanded	Expanded angle	Angle not expanded	Expanded angle
Jaw Joint Location	On same plane as molar teeth	Above the plane of the molars	On same plane as molar teeth	Above the plane of the molars
Jaw Motion	Shearing; minimal side-to-side motion	No shear; good side-to-side, front-to-back	Shearing; minimal side-to-side	No shear; good side-to-side, front-to-back
Major Jaw Muscles	Temporalis	Masseter and pterygoids	Temporalis	Masseter and pterygoids
Mouth Opening vs. Head Size	Large	Small	Large	Small
Teeth: Incisors	Short and pointed	Broad, flattened and spade shaped	Short and pointed	Broad, flattened and spade shaped
Teeth: Canines	Long, sharp and curved	Dull and short or long (for defense), or none	Long, sharp and curved	Short and blunted
Teeth: Molars	Sharp, jagged and blade shaped	Flattened with cusps vs complex surface	Sharp blades and/or flattened	Flattened with nodular cusps

Chewing	None; swallows food whole	Extensive chewing necessary	Swallows food whole and/or simple crushing	Extensive chewing necessary
Saliva	No digestive enzymes	Carbohydrate digesting enzymes	No digestive enzymes	Carbohydrate digesting enzymes
Stomach Type	Simple	Simple or multiple chambers	Simple	Simple
Stomach Acidity	Less than or equal to pH 1 with food in stomach	pH 4 to 5 with food in stomach	Less than or equal to pH 1 with food in stomach	pH 4 to 5 with food in stomach
Stomach Capacity	60% to 70% of total volume of digestive tract	Less than 30% of total volume of digestive tract	60% to 70% of total volume of digestive tract	21% to 27% of total volume of digestive tract
Length of Small Intestine	3 to 6 times body length	10 to more than 12 times body length	4 to 6 times body length	10 to 11 times body length
Colon	Simple, short and smooth, no fermentation	Long, complex; may be sacculated, may ferment	Simple, short and smooth, no fermentation	Long, sacculated, may ferment
Liver	Can detoxify vitamin A	Cannot detoxify vitamin A	Can detoxify vitamin A	Cannot detoxify vitamin A
Kidney	Extremely concentrated urine	Moderately concentrated urine	Extremely concentrated urine	Moderately concentrated urine
Nails	Sharp claws	Flattened nails or blunt hooves	Sharp claws	Flattened nails
Thermostasis	Hyperventilation	Perspiration	Hyperventilation	Perspiration

Adapted from *The Comparative Anatomy of Eating* by Milton R. Mills, M.D., formerly at http://www.newveg.av.org/anatomy.htm (broken link)

THE OPPORTUNISTIC FEEDER THEORY

Source: http://www.tierversuchsgegner.org/Gesundheit/taxonomy.html

Various folk promote the *opportunistic feeder theory* which suggests that because man **can** or **has** fed on meat, eggs, insects and other animal matter, then man is an opportunistic *omnivore*. This theory also counters the conclusions of taxonomy presented above, suggesting it is misleading and that species have individual feeding habits and cannot be pigeonholed as taxonomy suggests. The basis of this argument is that animal behaviour and adaptability indicates dietary suitability.

This theory is false and unscientific. Of course *tradition* is not scientific, and the practice of humans eating meat is old, but has nothing to do with what we are biologicaly equipped to feed upon. **We ate meat to survive, now we eat it out of habit and not need.**

Another quasi-scientific theory is associated with the opportunistic feeder theory. This can be called the *biochemical individuality theory* which is often seen in far eastern "medicines" such as Traditional Chinese Medicine, and the Ayurvedic systems. This theory suggests that since we are biochemically individual we should all eat individual diets suited to our moods, illnesses and other contrived indicators.

The logic behind biochemical individuality theory is fallacious, for although we are all unique biochemical beings, we are predominantly the same biochemical system, with low level variations. At the molecular level we differ, at the system level we are alike. If anyone imagines they can adjust their diet according to these individual metabolic variations, they are fooling themselves.

By picking **only** the low level system differences to indicate information about dietary choices, or moods, yin and yang and so forth, and extrapolating to the whole, we produce a gross misrepresentation of the facts. As far as we know, all cattle graze, all lions eat raw flesh, all chimps eat a diet of mainly raw fruit and vegetation and all chickens peck for grubs and grains. No animal on earth, that we know of, cooks its food before eating it, except humans. Only human behaviour breaks the taxonomic definition that that science defines for it. Humans prefer culture and technology over nature, and since our natural role is as a raw food herbivore, and because our bodies are only suited to that role, any significant perversion of it must, and does, lead to ill health. One cannot choose what to eat healthily, based on cultural imperitives since one will most likely present the wrong kind and quantity of precursor molecules, as well as introducing poisons to the body. A healthy human body cannot be operated on the wrong chemical inputs. "Garbage in equals garbage out"!

Our anatomy is clearly unsuited to deal with animal matter in the diet, however our digestive chemistry can deal with animal tissues and obtain some nutrition. But this does not indicate biological suitability or desirability. Cattle, which are herbivorous ruminents may eat many insects while they feed, chimps may occassionally kill and eat a small monkey. A pet cat may eat bread and margarine. So what? Are cattle to be defined as insectivores or omnivores, or opportunistic feeders? Is the pet cat an opportunistic feeder? Certainly, and the chimp an opportunistic feeder? Why not. None of this distorts taxonomy or suprises the biologist. All herbivores will be able to process animal protein to some degree or other since all protein is biochemically related. It is possible with modern processing methods to produce a "cat food" derived solely from plant material and non-animal matter that will keep a cat alive. Is this a herbivorous cat? No, it is a domestic animal eating an industrial diet. Higher lifeforms display a broader range of behaviours, and feeding behaviour simply reflects this, but does not reflect our true biological feeding requirements.

The opportunistic feeder theory is based on **circular logic**, "I do therefore I am" and is hard to **falsify***, since at a molecular level, food is chemically similar, because all animal tissues are made up of broken down plant tissues.

The fact that opportunistic feeding theory is circular and hard to falsify make it unscientific, and useless in any discussion of **what humans should eat**. Taxonomy is accurate, logical but not exact. Since there are exceptions it is falsifiable.

THE NATURAL HUMAN DIET

Source: http://www.goveg.com/naturalhumandiet.asp

According to biologists and anthropologists who study our anatomy and our evolutionary history, humans are herbivores who are not well suited to eating meat.

Unlike natural carnivores, we are physically and psychologically unable to rip animals limb from limb and eat and digest their raw flesh. Even cooked meat is likely to cause human beings, but not natural carnivores, to suffer from food poisoning, heart disease, and other ailments.

People who pride themselves on being part of the human hunter tradition should take a second look at the story of human evolution. Prehistoric evidence indicates that humans developed hunting skills relatively recently and that most of our short, meat-eating past was spent scavenging and eating almost anything in order to survive; even then, meat was a tiny part of our caloric intake.

Humans lack both the physical characteristics of carnivores and the instinct that drives them to kill animals and devour their raw carcasses. Ask yourself: When you see dead animals on the side of the road, are you tempted to stop for a snack? Does the sight of a dead bird make you salivate? Do you daydream about killing cows with your bare hands and eating them raw? If you answered "no" to all of these questions, congratulations—you're a normal human herbivore—like it or not. Humans were simply not designed to eat meat.

HUMAN PHYSIOLOGY

Although many modern humans eat a wide variety of plant and animal foods, earning us the honorary title of "omnivore," we are anatomically herbivorous. Biologists have established that animals who share physical characteristics also share a common diet. Comparing the anatomy of carnivores with our own clearly illustrates that we were not designed to eat meat.

Teeth and Nails

To contrast human physiology with that of carnivores, start at the beginning of the digestive tract. Teeth, nails, and jaw structure indicate that nature intended for people to eat a plant-based diet. They have much shorter and softer fingernails than animals and pathetically small "canine" teeth (they're canine in name only). In contrast, carnivores all have sharp claws and large canine teeth capable of tearing flesh.

The jaws of carnivores move only up and down, requiring them to tear chunks of flesh from their prey and swallow it whole. Humans and other herbivores can move their jaws up and down and from side to side, a movement that allows them to grind up fruit and vegetables with their back teeth. Like other herbivores, human back molars are flat and allow the grinding of fibrous plant foods. Carnivores lack these flat molars. If humans had been meant to eat meat, they would have the sharp teeth and claws of carnivores. Instead, their jaw structure, flat molars, and lack of claws indicate that they are best suited for a plant-based diet.

Dr. Richard Leakey, a renowned anthropologist, summarizes, "You can't tear flesh by hand, you can't tear hide by hand. Our anterior teeth are not suited for tearing flesh or hide. We don't have large canine teeth, and we wouldn't have been able to deal with food sources that require those large canines."

Stomach Acidity

After using their sharp claws and teeth to capture and kill their prey, carnivores swallow their food whole, relying on their extremely acidic stomach juices to do most of the digestive work. The stomach acid of carnivores actually plays a dual role-besides breaking down flesh, the acid also kills the dangerous bacteria that would otherwise sicken or kill the meat-eater.

As illustrated in the chart below, our stomach acids are much weaker in comparison because strong acids aren't needed to digest pre-chewed fruits and vegetables. In comparing the stomach acidity of carnivores and herbivores, it is obvious that humans fall into the latter category. We can cook meat to kill some of the bacteria and make it easier to chew, but it's clear that humans, unlike all natural carnivores, are not designed to easily digest meat.

Intestinal Length

Evidence of our herbivorous nature is also found in the length of our intestines. Carnivores have short intestinal tracts and colons that allow meat to pass through it relatively quickly, before it has a chance to rot and cause illness. Humans, on the other hand, have intestinal tracts that are much longer than carnivores of comparable size. Like other herbivores, longer intestines allow the body more time to break down fiber and absorb the nutrients from a plant-based diet.

The long human intestinal tract actually makes it dangerous for people to eat meat. The bacteria in meat have extra time to multiply during the long trip through the digestive system, and meat actually begins to rot while it makes its way through the intestines. Many studies have also shown that meat can cause colon cancer in humans.

Comparing our anatomies clearly illustrates the fact that the human body is built to run on a vegetarian diet. Humans have absolutely none of the distinguishing anatomical characteristics that either carnivores or even natural omnivores have. Read author John Robbins' discussion of the anatomical differences between humans and carnivores.

Here is a chart from "The Comparative Anatomy of Eating" by Dr. Milton Mills that compares the typical anatomical features of carnivores, omnivores, herbivores, and humans.[2] Notice how closely human physical characteristics match those of herbivores. Review Dr. Mills' entire article on the topic.

MEAT: DELICIOUS OR DISGUSTING?

While carnivores take pleasure in killing animals and eating their raw flesh, any human who killed an animal with his or her bare hands and dug into the raw corpse would be considered deranged. Carnivorous animals are aroused by the scent of blood and the thrill of the chase. Most humans, on the other hand, are revolted by the sight of raw flesh and cannot tolerate hearing the screams of animals being ripped apart and killed. The bloody reality of eating animals is innately repulsive to us, more proof that we were not designed to eat meat.

Ask yourself: When you see dead animals on the side of the road, are you tempted to stop for a snack? Does the sight of a dead bird make you salivate? Do you daydream about killing cows with your bare hands and eating them raw? If you answered "no" to all of these questions, congratulations—you're a normal human herbivore—like it or not. Humans were simply not designed to eat meat. Humans lack both the physical characteristics of carnivores and the instinct that drives them to kill animals and devour their raw carcasses.

If we were meant to eat meat, why is it killing us?

In addition to being anatomically ill equipped to digest meat in the short-term, the long-term damage that a meat-based diet wreaks on the human body confirms that we were not meant to eat flesh. Natural carnivores never suffer from heart disease, cancer, diabetes, strokes, or obesity, ailments that are caused in humans by the consumption of the saturated fat and cholesterol in meat.

Dr. William C. Roberts, M.D., editor of the authoritative *American Journal of Cardiology*, sums it up this way: "[A]lthough we think we are one and we act as if we are one, human beings are not natural carnivores. When we kill animals to eat them, they end up killing us because their flesh, which contains cholesterol and saturated fat, was never intended for human beings, who are natural herbivores."

Studies have shown that even when fed 200 times the amount of animal fat and cholesterol that the average human consumes each day, carnivores do not develop the hardening of the arteries that leads to heart disease and strokes in humans.[1] Indeed, researchers have found that it is impossible for carnivores to develop hardening of the arteries, no matter how much animal fat they consume.[2]

[1] William C. Roberts, M.D., "Twenty Questions on Atherosclerosis," *Baylor University Medical Center Proceedings*, Apr. 2000.
[2] Ibid.

Carnivores are capable of metabolizing all the fat and cholesterol in meat, but humans are a different story: Our bodies were not designed to process animal flesh, so all the excess fat and cholesterol from a meat-based diet makes us sick. Heart disease, for example, is the number one cause of death in America according to the American Heart Association, and medical experts agree that this ailment is the result of the consumption of animal products.[3] In fact, meat-eaters have a 50 percent higher risk of developing heart disease than vegetarians, and a low-fat, completely vegetarian diet has been repeatedly used to unclog the arteries of heart disease patients—it not only prevents but also treats the disease.[4] Learn more about animal products and heart disease.

> **"Nothing will benefit human health and increase the chances for survival of life on Earth as much as the evolution to a vegetarian diet."**
> —Albert Einstein

In addition to pointing out the damage done by saturated fat and cholesterol, scientists have also shown that eating animal protein can be harmful to human health. We consume twice as much protein as we need when we eat a meat-based diet, and this leads to osteoporosis and kidney stones.[5] Animal protein raises the acid level in human blood, causing calcium to be excreted from the bones to restore the blood's natural pH balance. This calcium depletion leads to osteoporosis, and the excreted calcium ends up in the kidneys, where it can form kidney stones. The strain of processing all the excess animal protein from meat can also trigger kidney disease in meat-eaters.

The consumption of animal protein has also been linked to cancer of the colon, breast, prostate, and pancreas. In fact, according to Dr. T. Colin Campbell, the director of the Cornell-China-Oxford Project on Nutrition, Health, and the Environment, "In the next ten years, one of the things you're bound to hear is that animal protein … is one of the most toxic nutrients of all that can be considered."

Eating meat can also have negative consequences for stamina and sexual potency. One Danish study indicated that "Men peddling on a stationary bicycle until muscle failure lasted an average of 114 minutes on a mixed meat and vegetable diet, 57 minutes on a high-meat diet, and a whopping 167 minutes on a strict vegetarian diet."[6] Besides having increased physical endurance, vegans are also less likely to suffer from impotence.

Since we don't have strong stomach acids like carnivores to kill all the bacteria in meat, dining on animal flesh can also give us food poisoning. In fact, according to the USDA, meat is the cause of 70 percent of foodborne illnesses in the United States because it's often contaminated with dangerous bacteria like *E. coli*, listeria, and campylobacter.[7] Every year in the United States alone, food poisoning sickens over 75 million people and kills more than 5,000.[8] While carnivores can process all the saturated fat, protein, and bacteria in animal flesh, a meat-based diet can send humans to an early grave. Clearly, people were not intended to eat meat. Learn more about how meat affects human health.

EARLY HUMAN EVOLUTION

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[3] Reuters Health, "Heart Disease Still Number-One Killer in U.S.," *Cardiovascular News Center*, 1 Jan. 2002.
[4] Elizabeth Somer, "Eating Meat: A Little Doesn't Hurt," *WebMD*, 1999.
[5] University of Iowa Health Care Center, "Protein: How Much Is Enough?" 1999.
[6] John Robbins, M.D., *Diet for a New America*, Walpole, New Hampshire: Stillpoint Publishing, 1987, pp. 156-58.
[7] Amy Ellis Nutt, "In Soil, Water, Food, Air," *The Star Ledger*, 8 Dec. 2003.
[8] Reuters, "CSPI: Seafood, Eggs Biggest Causes of Food Poisoning in U.S.," CNN.com, 7 Aug. 2000.

If it's so unhealthy and unnatural for humans to eat meat, why did our ancestors turn to animal flesh for sustenance?

During most of our evolutionary history, we were largely vegetarian.[9] You could probably figure this out by noting that all the great apes, our closest living relatives, are also predominantly herbivorous. Like apes, our bodies evolved to eat fruits, nuts, and vegetables.[10]

Harvard anthropologist Richard Wrangham and his colleagues first explained that root vegetables—and the ability to cook them—prompted the evolution of large brains, smaller teeth, modern limb proportions, and even male-female bonding.[11] Plant foods like potatoes made up the bulk of our ancestors' diet and spurred our advancement as a species.

The addition of modest amounts of meat to the early human diet came with the invention of fire, which allowed us to eat meat without being killed by it (usually). This practice did not turn our ancestors into carnivores but rather supplemented their traditional plant foods and allowed early humans to survive in periods when plant foods were unavailable.

Anthropologists believe that early humans started to consume small amounts of meat when climate changes made plant foods scarce. During this period, starting a little over a million years ago, humans began to hunt animals for sustenance in the ever-changing landscapes they encountered during their migrations.[12]

Modern Humans

Fully modern human beings (*Homo sapiens*) evolved about 150,000 years ago in Africa and soon spread across the globe.[13] With the advent of agriculture, about 23,000 years ago, humans began to gather seeds and cultivate crops to provide a more consistent food supply.[14] Our ancestors occasionally killed animals for their flesh, but they still received most of their nutrition from plant sources. Until recently, only the wealthiest people could afford to feed, raise, and slaughter animals for their flesh. Consequently, prior to the 20th century, only the rich died from diseases like heart disease, obesity, and strokes.

HUMANS INVENT FACTORY FARMING

During the past 50 years, traditional small-scale farms have been replaced by massive, mechanized agricultural operations. Technological advances have allowed factory farmers to produce huge quantities of food and ship it anywhere in the

…Heart Disease With Diet? Eat Like an Ape," 22 Aug. 2003.
…Diet Good at Reducing Cholesterol," 23 Jul. 2003.
…Tubers Spur the Evolution of Bigger Brains?" *Science*, 26 Mar.
…the Origins of Scavenging and Hunting in Early Hominids," 4 Jul. 2000.
13 Encyclopedia Britannica, "Homo Sapiens," 14 Dec. 2004.
14 BBC News, "Farming Origins Gain 10,000 Years," *BBC News Online*, 23 Jun. 2004.

world, and agribusiness entrepreneurs soon bought out and consolidated smaller agrarian operations. When America was founded, roughly 90 percent of Americans lived on farms.[15]

Today, the percentage of Americans who farm for a living has fallen to less than 2 percent.[16] The "family farm" is now practically extinct.

The industrialization of animal production has led to huge factory farms that raise thousands of animals in cramped, filthy warehouses. This crowding, combined with other cost-cutting practices (like grinding up the scraps from dead animals and feeding them back to the survivors) and huge agricultural subsidies (corporate welfare) has made meat cheap and readily available. In addition, our natural aversion to killing animals for food is bypassed by the modern farming system-immigrants and poor, rural Americans do the dangerous dirty work in the slaughterhouses, and the rest of us are never confronted with the task of killing the animals ourselves (or even having to watch it happen). Read more about factory farming.

Since 1950, the *per capita* consumption of meat has almost doubled; now that animal flesh has become relatively cheap and easily available, deadly ailments like heart disease, strokes, cancer, and obesity have spread to people across the socio-economic spectrum.[17] And as the Western lifestyle spills over into less developed areas in Asia and Africa, they, too, have started to die from the diseases associated with meat-based diets.

A HEALTHY HUMAN DIET

"T. Colin Campbell, the former senior science advisor to the American Institute for Cancer Research, is outspoken on the diet/disease connection. He says, 'The vast majority of all cancers, cardiovascular diseases, and other forms of degenerative illness can be prevented simply by adopting a plant-based diet.'"[18] In *Vegan: The New Ethics of Eating*, he states, "I now consider veganism to be the ideal diet. A vegan diet—particularly one that is low in fat—will substantially reduce disease risks. Plus, we've seen no disadvantages from veganism. In every respect, vegans appear to enjoy equal or better health in comparison to both vegetarians and non-vegetarians."[19]

William Castelli, M.D. says: "A low-fat, plant-based diet would not only lower the heart attack rate about 85 percent, but would lower the cancer rate 60 percent."[20]

Our anatomy reveals that we are herbivores, as does our natural aversion to meat and the fact that it is harmful to our health. Meat-eaters are out of step with our evolutionary past. Our closest living relatives—the great apes—and ancestral human populations are and have been predominately vegetarian. They may eat the occasional rodent and some raw bugs, but the vast majority of their

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[15] Education Orchard, "Challenges and Changes in Education," 1997.
[16] Cooperative State Research, Education, and Extension Service, "Extension," 3 Nov. 2004.
[17] Jim Motavalli, "The Trouble With Meat," *E Magazine*, May/Jun. 1998.
[18] Robbins, p. 39.
[19] Erik Marcus, *Vegan: The New Ethics of Eating*, McBooks Press: Ithaca, NY, 2000, p. 30.
[20] Robbins, p. 47.

caloric intake is herbivorous. The key to human health lies in adopting a diet that is consistent with their anatomy and evolutionary history.

JOHN ROBBINS RESPONDS TO RAY AUDETTE'S "NEANDERTHIN" AND OTHER "PALEOLITHIC" DIETS

Source: http://www.goveg.com/naturalhumandiet.asp

Dear John,

What is your response to Ray Audette's "NeanderThin" and other "Paleolithic" diets? Such programs claim that the appropriate diet for humans includes only those foods available to Paleolithic man (meat and wild fruits, nuts and veggies). They claim that grains and beans are not natural foods for humans and that consumption of these foods causes diabetes, cancer, obesity, heart disease, etc.. The author claims to have cured himself of arthritis and diabetes on such a diet. If you have already answered this or a similar question, or can recommend another forum where I may find the answer, please let me know.

Jamie

Dear Jamie,

Thanks for your question.

My sense of Ray Audette is that he is a well-meaning and intelligent man who writes well, and who is almost completely ignorant of what has been learned in medical research regarding diet and health. His book has no footnotes, so there is no way to verify or substantiate the research that he says provides supporting documentation.

Central to Audette's views is his belief that we are natural meat-eaters. If you think there is validity to his argument, then I would ask you to consider a simple experiment. The next time you see a deer or wildebeest, see if you can run it down, jump up on its back, and dig your teeth into its hide. I think that you would discover several things. You'd probably find out that you don't have a lot of desire to do this. Even if you tried, though, you'd probably find that you can't run fast enough or jump high enough to manage the task. And even if you could, you'd find that your mouth doesn't open very wide, and your canine teeth aren't very long or very sharp or very hard. And even if you could bite off a piece, I think you'd find yourself quite displeased with the result.

I believe you'd find that you really aren't anatomically equipped to hunt down and eat raw meat. In this regard I think you'd find yourself decidedly inferior to the natural carnivores. For instance, the cat.

Have you ever seen a cat yawn? Have you noticed how wide their mouths can open? And how long and sharp are their canine (or feline?) teeth? Cats are designed for hunting and they are true carnivores. Our teeth and jaws, in contrast, are much more like those of rabbits, deer, or horses. Our canine teeth are vestigial and are hardly longer than our molars.

Here's another test, to see if you are a natural meat-eater. Can you move your lower jaw forward and back? Can you slide your lower teeth in front of your upper teeth, and then back? And can you move your lower jaw left and right, side to side? Because if you can perform these movements, then you are not a carnivore. There is not a true carnivore on the planet that can do either of those movements. Dogs can't, cats can't, hyenas can't, minks can't, etc.. Their jaws are simple hinges and can only move up and down. They are designed to rip off hunks of flesh, and then to swallow them more or less whole (ever noticed how fast a dog or cat eats?). Their teeth are far harder, longer and sharper than ours. In contrast, the jaws and teeth of herbivores (horses, cows, rabbits, etc.) are designed for grinding plant matter. Carnivores devour, herbivores graze.

Human beings, obviously, are omnivorous, but I believe that when it comes to eating we have far more anatomical characteristics in common with herbivores than with carnivores. Do you feel better when you wolf down your food, or when you eat leisurely and with relaxation? Which is more appealing and inviting to you, a slaughterhouse or a fruit orchard?

The stomachs of natural meat eaters secrete levels of hydrochloric acid that are capable of dissolving raw meat and bone. The levels of hydrochloric acid in the human stomach are miniscule in comparison. If you were to swallow a capsule containing the digestive secretions of a cat, the contents of that capsule would be so acidic that they would almost instantly ulcerate the lining of your stomach.

Audette and other advocates of "Paleolithic diets" say that our ancestors were heavy meat eaters. Is this true? Not according to paleontologist Richard Leakey, who is widely acknowledged as one of the world's foremost experts on the evolution of the human diet. Leakey points out, "You can't tear flesh by hand, you can't tear hide by hand. Our anterior teeth are not suited for tearing flesh or hide. We don't have large canine teeth, and we wouldn't have been able to deal with food sources that required those large canines."

In fact, says Leakey, even if cavemen had large canine teeth, they still almost certainly would only rarely have eaten meat. Their diet would have been similar to that of our closest genetic relative - the chimpanzee.

Molecular biologists and geneticists have compared proteins, DNA, and the whole spectrum of biological features, and have established convincingly that humans are closer to chimpanzees than horses are to donkeys. This is remarkable, because horses and donkeys can mate and reproduce, although their offspring, mules, are sterile. A significant difference between humans and chimpanzees, though, is that chimpanzees have large canine teeth that can tear apart their prey, and they have more strength and speed than humans. Still, even with these traits, which would be advantages for a meat-eater, chimpanzees, like other primates, eat a mainly vegetarian diet. Dr. Jane Goodall, whose work with chimpanzees represents the longest continuous field study of any living creature in science history, says chimpanzees often go months without eating any meat whatsoever. Indeed, she says, "The total amount of meat consumed by a chimpanzee during a given year will represent only a very small percentage of the overall diet."

I am reminded of something Harvey Diamond once said: "You put a baby in a crib with an apple and a rabbit. If it eats the rabbit and plays with the apple, I'll buy you a new car."

Audette's desire to eat more naturally is admirable. He is certainly correct that modern food technology has created some truly unnatural foods that undermine the health of people who consume them. He is absolutely right that modern food technology has refined, processed, and adulterated natural foods to the point of contributing to many degenerative diseases. His appreciation of the dangers of dairy products and sugar, and of refined carbohydrates such as white flour, is commendable. The dangers of technologically tampering with our food supply need to be far more widely understood.

But these basic and valid insights are intermixed in Audette's theories with a host of ideas that are far more dubious, and some of which are outright bizarre. For example, his fundamental premise, to which he returns over and again, is that you should not eat anything that you could not eat "naked and with a sharp stick on the African savanna… To see how this primeval grassland (African savannas) appeared all we need to do is look at any lawn of golf course." So much for the complex ecological realities of African savannas.

Audette's diet is heavily meat based. This emphasis on meat, he says, is natural. "My definition of nature," he says, "is the absence of technology… I eat only those foods that would be available to me if I were naked of all technology save that of a convenient sharp stick or stone." Accordingly, he believes that ideally one would eat all one's food raw. At the same time, however, he acknowledges that "meats, poultry, eggs and seafood are prone to contamination and should be cooked enough to sterilize them." This puts Audette in a bind. He sees that animal products carry extremely dangerous pathogens such as E. coli 0157:H7, salmonella, trichinosis, Listeria, and campylobacter. How to resolve this dilemma with his ideal of eating everything raw? Audette's answer is remarkable, coming as it does from an author whose entire program is based squarely upon eating only those foods that don't require technology for their production, preparation, or consumption.

"Irradiated foods," he says "will eliminate this risk and make steak tartar and raw eggs much more possible."

When it comes to grasping the functioning of the human intestinal tract seems, some of the things Audette says are, frankly, out to lunch. "The hunter-gatherer's miracle food, pemmican (equal parts raw, dehydrated, powdered red meat and tallow - rendered animal fat), makes practicing the NeanderThin program easy," he writes. "If eaten exclusively, a small amount per day will sustain you indefinitely without vitamin or mineral deficiencies…. It produces no waste… Pemmican is almost totally absorbed by the body. Very little waste remains from its digestion. As such pemmican is an excellent first solid food for infants, and a good choice for anyone suffering from a gastrointestinal disorder." Actually, exclusive dependence on such a food would create gross deficiencies in vitamin C and many other essential nutrients. And a food that "is almost totally absorbed by the body" and "produces no waste" would be a good choice for anyone wishing to experience constipation.

Audette's understanding of obesity issues similarly seems to be missing in action. "Overweight people," he says, "eat significantly less than lean persons do…. Fat is good for you."

Audette says that you should never eat grains, beans, or potatoes. In fact, his admonition never to eat these foods is fundamental to what he calls his "Ten Commandments." Calling his advice by such a Biblical term may provide the appearance of grandeur and importance, but it does not make his counsel any more valid or healthful. He says repeatedly that human beings are not designed to eat grains, beans, or potatoes. But these foods have been the primary source of food energy for the human race for many centuries. Today they account for the satisfaction of 70% of our species' energy needs. On the other hand, the meats he is saying to eat are (along with dairy products) the chief sources of saturated fat and cholesterol in the human diet, the principal causes of heart disease, and the primary carriers of food-borne disease.

Modern meat is a far cry from the flesh of Paleolithic animals. For example, chickens raised for meat traditionally took twenty-one weeks to reach 4-pound market weight. But today, with the birds having been systematically bred for rapid weight gain, it takes only seven weeks for them to reach the same weight. One not-so-slight problem with this is that those chickens who are used for breeding must be kept under severe food restriction - otherwise they rapidly become too obese to reproduce.

Loren Cordain, author of *The Paleo Diet*, recommends that more than half your diet should be meat and fish, and then goes on to say "the mainstays of the Paleo Diet are the lean meats, organ meats, and fish and seafood that are available at your local supermarket… Turkey breast is one of the best and cheapest sources of very lean meat…and fortunately, it's available almost everywhere."

Well, yes, turkey breasts are available at almost every supermarket, and yes their breasts are low in fat, but it is hard for me to grasp how authors recommending that we go back to eating the way they say our ancestors did can recommend such a product.

Turkeys today are far from the wild birds of yore. For one thing, thanks to a host of technological manipulations, they grow so fast that they literally find it impossible to mate naturally. By the time they reach reproductive age they are literally so obese that they simply cannot get close enough to physically manage. As a result, all 300 million turkeys born annually in the United States every year are the result of an act of artificial insemination.

(How, you may wonder, is this done? Suffice it to say that there are people who have become adept at handling male turkeys in just the right way. The procedure is called-with delicacy but without anatomical accuracy-"abdominal massage." After the semen is thus collected, and then mixed with a myriad of chemicals, there are other "experts" whose job it is to inject the material into the females, using an implement that looks, rather ironically, remarkably like a turkey baster.)

Each year at Thanksgiving, the U.S. president and vice president pardon a turkey and a vice turkey. This is a nice gesture, but after the turkeys are sent to a small farm, within a few months they die from heart attacks or lung collapse because their hearts and lungs can't support the ever increasing bulk. A farm journal noted that "If a seven-pound human baby grew at the same rate that today's turkeys grow, when the baby reached 18 weeks of age it would weigh 1,500 pounds."

There may be some individuals who - by dint of their unique biochemical individuality - do well on a diet that avoids grains, beans and/or potatoes. If you want to experiment by not eating these foods for a time to see what happens and how you feel, all power to you. But I believe it is the rare person who will find that cereal grains and legumes are the health disaster they are said to be by the authors of these diet books.

For the vast majority of people, I am afraid that diets which are so very heavy on animal protein will lead to constipation, increased risks for heart disease, cancer, obesity, diabetes, and many other diseases.

We are always learning,
John Robbins, www.foodrevolution.org