The Naïve Vegetarian
http://www.second-opinions.co.uk/carn_herb_comparison.html

In The Naive Vegetarian , I talked about Man's evolution and the sorts of food which the fossil record suggests we should eat and what modern primitives, untouched by civilisation eat. This all points to our being a carnivorous species. The third aspect of the evidence confirms this hypothesis by looking at our digestive system and comparing it with those of animals whose diet is known beyond doubt.
There are basically two types of animals in Nature:

- Herbivores: animals that eat vegetation. They are able to digest and use as food the cellulose which forms the cell walls of all plants.
- Carnivores: animals that eat herbivores. The carnivore's digestion is unable break down vegetable cell walls.

Many people today aver that we are a vegetarian species, or at the very least, that we are able to live healthily on a diet composed almost entirely of foods of vegetable origin. This falsehood, for such it is, must be scotched from the start if the present unhealthy trends are to be reversed.
There have been many stories over the past several decades of explorers getting lost and starving to death - in situations where they are surrounded by vast amounts of lush vegetation. It is a situation in which many animals would have no difficulty whatsoever in surviving. The reason Man does not survive is because he cannot live on vegetation alone. There is a very good reason for this, which is amply demonstrated if we consider the digestive tracts of three animals of roughly equal size, which are familiar to us all. We will look at a sheep (herbivore), a wolf (carnivore) and at a human.

The wolf

The wolf is a pure carnivore. As all carnivores' digestive systems are the simplest, being essentially a long piece of pipe with a single bulge near the beginning, we will consider the wolf first.
The first thing to note about the digestive system of all carnivores is that they are remarkably similar and they all function in exactly the same way. Although they will be of different lengths, because carnivorous animals come in different sizes, the overall length of carnivores' digestive tracts are rather short: about six times the length of the animal's body. Let us traverse the digestive tract from one end to the other to discover what each part does.
Mouth . The wolf's jaw contains incisors, canines and molar teeth in both jaws, and the molars are ridged. The jaw moves up and down. This fact, together with the ridging of the molars indicates that they are used for tearing or crushing. The salivary glands serve merely to lubricate, and do not have an important digestive function. Food is rarely chewed into small portions, but 'wolfed' down whole.
Stomach . The wolf's stomach, the only bulge in the digestive 'pipe', is small, holding about four pints. Its small size gives a good estimation of the amount of food the animal can consume at any one time. The stomach serves two purposes. Firstly it is a reservoir. Although relatively small, this is all that is needed, as the food of a carnivore, wholly of meat and fat, is nutrient dense, allowing one small meal to suffice for many hours. The second function of the stomach is to subject the food to concentrated solution of hydrochloric acid, which dissolves and liquefies it. Only food that is dissolved can be digested. Different foods dissolve at different rates and leave the stomach at different rates. The ones that cannot be digested - raw vegetable matter, cellulose and bone - pass right through the animal unchanged, those that are too big to pass into the small intestine are vomited. The wolf's stomach, if filled with its normal food of meat and fat will empty in about three hours. The stomach then rests until the next meal is eaten. So far very little digestion has taken place and, in the carnivore, the stomach is not an essential organ.
The small intestine . The small intestine, approximately twenty feet in length in a wolf, is vitally important. Without it, no digestion could take place and the animal could not survive. The dissolved food, called 'chyme' at this stage, leaves the stomach in a series of spurts, controlled by a valve, the pylorus, and enters the small intestine. It is in the small intestine that food is digested and enters the bloodstream. After a few inches, two ducts connect from the pancreas and the liver to the small intestine. These two organs supply and deliver the enzymes needed to break down the fats and proteins into their component fatty acids and amino acids. Only in this form can they pass through the gut wall into the bloodstream. These enzymes are vitally important to the carnivore. Those from the pancreas immediately start to break down the chyme into its basic components and continue to do this throughout the chyme's passage along the small intestine.
The chyme is a watery mixture but fat will not mix with water so it requires some special handling. This is where bile comes in. Bile is manufactured in the liver and stored in the gall bladder until such time as it

is needed. When fat is detected in the small intestine, this triggers the release of the stored bile, which enters the intestine through the bile duct. Bile acts just like a detergent in that it emulsifies the fat to make it soluble in water. This action makes fat susceptible to digestion by the digestive enzymes.

In the carnivore there are large amounts of fat in diet on occasion and, as bile is so important, its waste is not allowed. The liver makes bile continuously, the excess being diverted to the gall bladder to be saved and concentrated until it is needed (for the next meal). When a hormone in the upper gut signals that fat is again present in the gut, the stored bile is forcibly ejected to perform its function.

Digestion of food in a carnivore is performed by enzymes produced by glands in the animal's own body and all the absorption of nutrients in that food is through the wall of the small intestine. This is an important consideration when we compare it later to the digestion of a herbivore.

The digestion of protein and fat, with little or no carbohydrate, in the carnivore's gut is remarkably efficient. Experiments which have measured the amounts of various nutrients eaten and compared these with the amounts passed in the animal's excreta have shown that a healthy animal loses no more than four percent of its fat intake and only a trace of the protein.

As there is no enzyme in the carnivore capable of digesting cellulose, the material that the cell walls of all plants are composed, little or no digestion of carbohydrates can take place.

The caecum . The small intestine doesn't join the large intestine in a straight line, but at a right angle. At this point is a small appendage, two or three inches in length, called the caecum. While this has no functional use in a carnivore, it should be noted because it is one of the major differences between a carnivore and a herbivore.

The large intestine. By the time the chyme has passed through the animal's small intestine, the process of digestion and absorption of the nutrients in the food is complete. The large intestine, or colon , has just one function to perform. It would be wasteful to allow water to escape and so the colon extracts the water and compacts the rest of the waste material from what is left of the chyme into a small compact mass, where it is stored in the rectum until it is finally expelled through the anus. The colon in a carnivore is not essential, merely a convenience.

The gut flora. Practically the whole of the gastrointestinal tract of a carnivore is sterile. The hydrochloric acid in the stomach ensures that most bacteria and other micro-organisms in swallowed food are killed. Those that escape the stomach are rarely able to survive the digestive processes - they are, after all, made of protein. The colon is the exception. This, where no further digestive processes occur, does tend to harbour a variety of organisms which form certain vitamins such as pyridoxine, vitamin B-12, biotin, vitamin K and folic acid but, as these are not absorbed through the wall of the colon, they are of little account. These micro-organisms thrive in an alkaline environment and are of the putrefactive type.

The length of the gastrointestinal tract of a carnivore. The gut of any animal is usually measured after death when its muscles are relaxed. This gives a quite wrong impression. While that of the animal we have been discussing measures over thirty feet when the dead wolf is dissected, this is not its normal length when the animal is alive. It has been found by passing a rubber tube through a living dog, which has a similar gut length when dissected, that the front end appears at its anus when little more that ten feet has entered the mouth. From measurements such as these it is generally reckoned that the total length of a carnivore's gut is probably about five to six times the length of the animal's body.

The sheep

The sheep is a herbivore. While all carnivores' digestive tracts are similar, herbivores' digestive systems vary widely. There are two basic types of herbivore:

- Those with simple stomachs - horse, rabbit, gorilla
- Those with complex stomachs - cow, goat, camel, and sheep

The latter type are called ruminants because they 'ruminate' or chew a cud as part of their digestive process. A ruminant's stomach is complex, having four chambers. They also have a large caecum. Herbivores with simpler stomachs have a relatively larger caecum to help with digestion.

As we all know, a sheep is a herbivore that eats grass. A woolly ball on legs on the outside, a sheep's inside is unbelievably complicated. [1] The total length of the sheep's digestive tract is about twenty-seven times as long as the animal's body length. This dimension is common to all herbivores.

The first major difference between the herbivore and the carnivore is the sheer amount of food the herbivore is forced to eat. While a carnivore can usually manage with one small meal a day, the herbivore must eat so much that it is continually eating and its stomach is never empty.

The mouth. A sheep has no incisors or canine teeth in its upper jaw. It doesn't bite grass off; it tears it off. The sheep's molars are flat and its jaw movements are rotary, designed for grinding rather than for crushing or tearing. The sheep's salivary glands are very important. They produce the prodigious amounts of saliva necessary to fully permeate the food during rumination. While chewing is of little importance to the wolf,

it is vital to the sheep.
The rumen. As a sheep grazes, the grass passes straight into the first chamber of the stomach, the rumen . This has a capacity of some four gallons. When the rumen is full, and the sheep has an opportunity, it regurgitates small parcels or 'cuds' of food back to its mouth for chewing and further mixing with saliva. The saliva of a sheep does not contain amylase necessary for digesting starch, so this 'chewing the cud' must merely be to aerate, macerate and mix the saliva more thoroughly to aid digestion of the grass.
The rumen does not contain any digestive juices but it does contain billions of bacteria and protozoa which begin the process of breaking down the cellulose cell walls into cellobiose to begin the process of releasing the nutrients inside. This is a process entirely missing from the digestive system of a carnivore. Some carbohydrates are converted to fatty acids and others are absorbed by bacteria and other micro-organisms to be converted into other substances. About seventy percent of the cellulose is absorbed directly into the bloodstream from the rumen.
The reticulum. The next chamber after the rumen is the much smaller reticulum , with a capacity of about four pints. It is here that small parcels of food are compacted into cuds for regurgitation to the mouth for rumination. These then return to the rumen for more bacterial breakdown.
The omasum. In time, the contents of the rumen and reticulum pass to the third chamber, the omasum . This holds about a gallon of material. Again, the food is subjected to attack and breakdown by bacteria and other micro-organisms. Note that although we are three-quarters through the stomachs of the sheep, we have yet to encounter any digestive enzymes. All these chambers are solely concerned with the breakdown and liquefaction of the food into such a form that it can be digested when it is eventually subjected to such enzymes.
The obomasum. The fourth and last chamber of the sheep's stomach, the obomasum , which holds about two gallons, is the sheep's true stomach. The obomasum has glands which secrete hydrochloric acid, pepsin and a weak fat-splitting enzyme called lipase. All of these enzymes are much weaker in concentration that in the wolf's digestive system. These enzymes break down the plant proteins and fats and, much more importantly, they kill and absorb the billions of bacteria and other micro-organisms that have done all the work so far. In this way plant protein is transformed into animal protein within the herbivorous digestive tract, making it possible for herbivores to survive without even traces of animal protein in their diet.
Intestine. From here on digestion takes place much as it does in the wolf. The difference is the bacterial breakdown of the plant cell walls by the first three chambers of the sheep's stomach, which has no parallel in the carnivorous wolf.
The sheep's digestive system is very wasteful, unlike that of the wolf, over fifty percent of the food eaten is excreted.

The Shepherd

A look at the shepherd's digestive system shows that it is remarkably similar to that of the wolf in form, digestive enzymes and length. The only significant difference is that our saliva contains amylase, an enzyme that is used to digest starch. However, in common with all carnivores, we have no digestive enzyme that will break down a plant's cell walls to release that starch. Unlike the sheep we also do not possess in our guts bacteria or other micro-organisms to do the job. If we eat a largely plant-based diet, the bacteria in our colons will change to the fermentative type. These will break down plant material but, as no absorption of nutrients these contain takes place in the human colon, this is of no nutritional value.
The differences between the three species are summarised in Table 1.
Table 1: Functional And Structural Comparison Of Man's Digestive Tract With That Of The Wolf And Sheep. (From Walter Voegtlin, The Stone Age Diet, 1976)

	MAN	WOLF	SHEEP
TEETH			
incisors	both jaws	both jaws	lower jaw only
molars	ridged	ridged	flat
canines	small	large	absent
JAW			
movements	vertical	vertical	rotary
function	tearing-crushing	tearing-crushing	grinding
mastication	unimportant	unimportant	vital function
rumination	never	never	vital function
STOMACH			
capacity	4 pints	4 pints	8 1/2 gallons
emptying time	3 hours	3 hours	never empties
interdigestive rest	yes	yes	no
bacteria present	no	no	yes - vital
protozoa present	no	no	yes - vital
gastric acidity	strong	strong	weak
cellulose digestion	none	none	70% - vital
digestive activity	weak	weak	vital function
COLON AND CAECUM			
size of colon	Short - small	Short - small	Long - capacious
size of caecum	tiny	tiny	Long - capacious
function of caecum	none	none	vital function
appendix	vestigial	absent	cecum
rectum	small	small	capacious
digestive activity	none	none	vital function
cellulose digestion	none	none	30% - vital

bacterial flora	putrefactive	putrefactive	fermentative
food absorbed from	none	none	vital function
volume of faeces	small - firm	small - firm	voluminous
gross food in faeces	rare	rare	large amount
GALLBLADDER			
size	well-developed	well-developed	often absent
function	strong	strong	weak or absent
DIGESTIVE ACTIVITY			
from pancreas	solely	solely	partial
from bacteria	none	none	partial
from protozoa	none	none	partial
digestive efficiency	100%	100%	50% or less
FEEDING HABITS			
frequency	intermittent	intermittent	continuous
SURVIVAL WITHOUT			
stomach colon and cecum	possible possible	possible possible	impossible impossible
microorganisms	possible	possible	impossible
plant foods	possible	possible	impossible
animal protein	impossible	impossible	possible
RATIO OF BODY LENGTH TO			
entire digestive tract small intestine	1:5 1:4	1:7 1:6	1:27 1:25

All this evidence points to our being pure carnivores, as are the big cats.
But we also have a sense of taste for sweet things, a sense we would not have if it were not useful in some way. So fruit or honey may have formed part of our diet. But it cannot have been an important part of that diet because fruit contains little or no protein, and honey none at all; and protein on a daily basis is essential for health. The evidence above demonstrates that the human digestive tract is extremely inefficient when coping with foods of vegetable origin. With no bacteria and no enzymes capable of breaking down the cell walls to release the small amounts of nutrients inside, we can only eat many of these foods after they have been cooked. As Nature must have intended that all foods should be eaten raw, they cannot have formed a significant part of our diet during our evolution. During our evolution, therefore, when we lived well, our diet must have been high in animal protein and fat, supplemented with wild fruit, but only during lean times would it include other foods of vegetable origin. As more than 99.9% of our genetic makeup evolved and was determined before we, as a species, started to heat and cook foods, that must still be the correct diet for us today.
In The Naive vegetarian I compared the size of the gorilla to that of a man. The gorilla is a herbivorous animal with a simple stomach. Robert Yerkes found that, in the wild, this vegetarian animal had many protozoa in its stomach which digested plant proteins and synthesised animal proteins. [2] In captivity, however, Yerkes noted that these protozoa gradually disappeared from the gorilla's stomach. In this state, the gorilla was unable to synthesise its own animal protein, and had to be fed meat, milk, or other animal proteins to remain healthy.
References
1. MacGregor R. Structure of the Meat Animals . The Technical Press Ltd. London, 1952.
2. The Great Apes. Yerkes R M. New Haven-Yale University Press,1929.