Nutrition

Well, here is the rest of the story. There is a recap at the end of this, on what we already talked about. See here. You might want to look at it first, for review.

Up to this point, we have followed the evolution of life up to the time when forms with many cells came into being (about 500 to 600 million years ago). As we discussed, this requires both structure (to keep the thing from collapsing) and a circulatory system. Since most cells are not directly in the ocean anymore, they are physically separated from food and oxygen, so some sort of way to get food and oxygen to them is needed. Evolution provided the circulatory system.

Some things have not changed much in 4 billion years, like the basic metabolic cycle (that is, how cells get energy in order to do whatever they do), and the fat (lipid) character of the cell wall. Remember, oil (fat) and water are not compatible, so this forms a barrier between what's in the cell and what's outside the cell which was water, in the beginning.

Perhaps 400 million years ago the first plants and animals started living on land, out of the water. As you know, when floating in a pool the effects of gravity are much less than on dry land, so the structural requirements are more on land. It turns out that both carbohydrates and protein turn out to be good structural material, too. For example, the chitin that forms the hard shell of bugs is a form of carbohydrate; the cellulose that makes up most of a tree is also carbohydrate. Protein is a big part of what makes up muscles in animals.

Once animals had a circulatory system, a method for controlling the flow of energy-storing compounds in the fluid came into being. For mammals (like us), the main type of compound that transports energy internally is glucose, another form of sugar. Anything with the -ose ending is a sugar, such as sucrose, glucose, fructose, lactose, maltose, levulose, ribose, dextrose, etc. Sugar is key, but it's better to think of it as glucose, since "sugar" in the common sense usually means sucrose, one type of sugar.

Without getting into too much detail, evolution has devised a way to use certain chemical "keys" for allowing passage of materials into and out of the "locked" cell wall. One of the most important keys is insulin, produced in the pancreas. This "key" is produced as a feedback mechanism, much like the float in the toilet pinches off the water flow when it detects the level is

high enough. That is what the pancreas does with insulin to keep glucose levels in a safe range. The body is full of keys like that, in the form of enzymes and hormones.

Another peculiarity of the human body is the brain. As we discussed, probably hands and the brain are the two things that really distinguish humans from other animals. The brain is a glucose-hog—it has to have glucose, lots of it. There is even a back up system of ketones derived from body fat, in case food supply runs low, because the brain cannot tolerate a lack of food (glucose). Ketones can supply that, when food runs low.

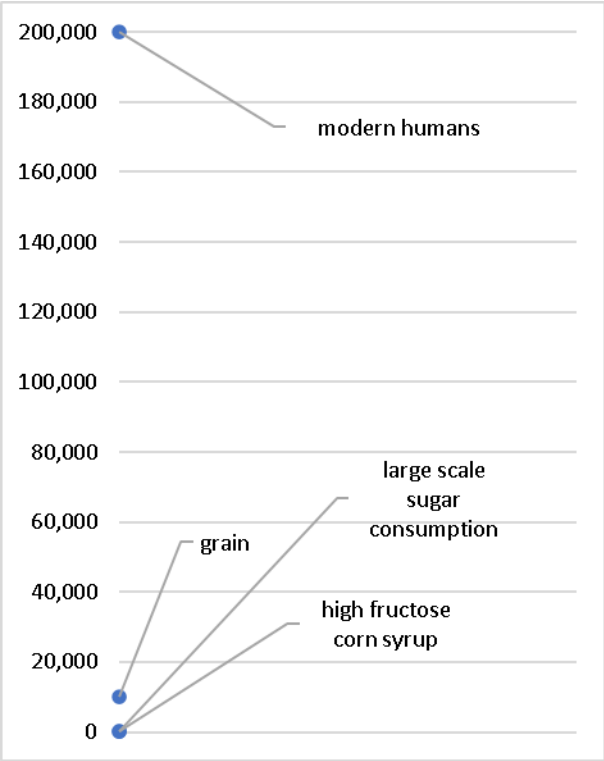
All of this probably evolved in the last 200,000 years or so. We ate nuts, berries, meat, grubs, things we could gather, for most of our existence. We invented cooking, which unleashed a whole lot more nutrition, which in turn improved survival. We did not eat grains, refined sugar, fast food, and stuff out of packages. The point being the items I have just mentioned we did *not* evolve to eat. Perhaps in 100,000 years we could evolve to live off McDonald's, but it ain't happened yet.

So what? It's a big deal, because it's become very apparent that this "new" food source has messed up the feedback insulin control in many people. What first develops is insulin resistance, which means it takes more and more insulin to control the glucose across the cell wall (it's in a slightly different form by then, but let's avoid complication). The insulin also makes it easier for fat cells to take glucose and store it as fat. In the meantime, the muscles and other tissues are virtually starved of glucose. This is probably why a lot of overweight people are always eating; they're actually starving, even though they don't look like it. But instead of doing something rational, like changing their diet, they let the doctor prescribe them insulin to control it, which is really an extended death sentence.

After insulin resistance and the resulting imbalance of everything, including the slow down of metabolism, has occurred, a more serious condition of pre-diabetes or diabetes can set in. Slow down of metabolism can also happen from lack of muscle, due to an inactive life. Having strong muscles increases your metabolism, so you can burn more and not store as much energy; not having muscle has the opposite effect. Other side effects of a defective insulin system are heart disease and bad circulation. People with diabetes often have amputations due to bad circulation, or lose their eyesight, also due to bad circulation.

Since I am 68, I have seen this with my own eyes. When I was a kid, people already had sweet tooths, but once high fructose corn syrup was introduced when I was in my early 20s, I literally watched as the population ballooned to gigantic proportions. The CDC estimates 40% of the population is now overweight. Unfortunately, people focus on that, rather than the internal and irreversible damage this stuff does to them physically. Vanity seems more important than health. The other factor is these "new" foods are highly addictive.

To get the scale of this, let's make another timeline (the original large scale timeline is at the end of this discussion, this timeline would show up as just a line at the very bottom on the original!).



Does this look like we have had enough time to evolve to eat grain, sugar, and high fructose corn syrup?

(Hint: it usually takes thousands of years for an organism to evolve and adapt to new conditions)

It seems pretty clear that the present diet of processed foods full of sugar and other man-made compounds (such as trans-fats and vegetable oils) is not suitable for humans, because humans haven't had enough time to evolve to assimilate this stuff.

Sucrose is what is refined from sugar cane and sugar beets. Sucrose is the white stuff they put on the table in restaurants. It's actually two sugars combined, glucose and fructose. Glucose, as described above, is the main factor in delivering energy through the circulatory system. It shouldn't take a lot of imagination to see that eating large, unnatural amounts of it could mess up the whole insulin control system, and that's what it does.

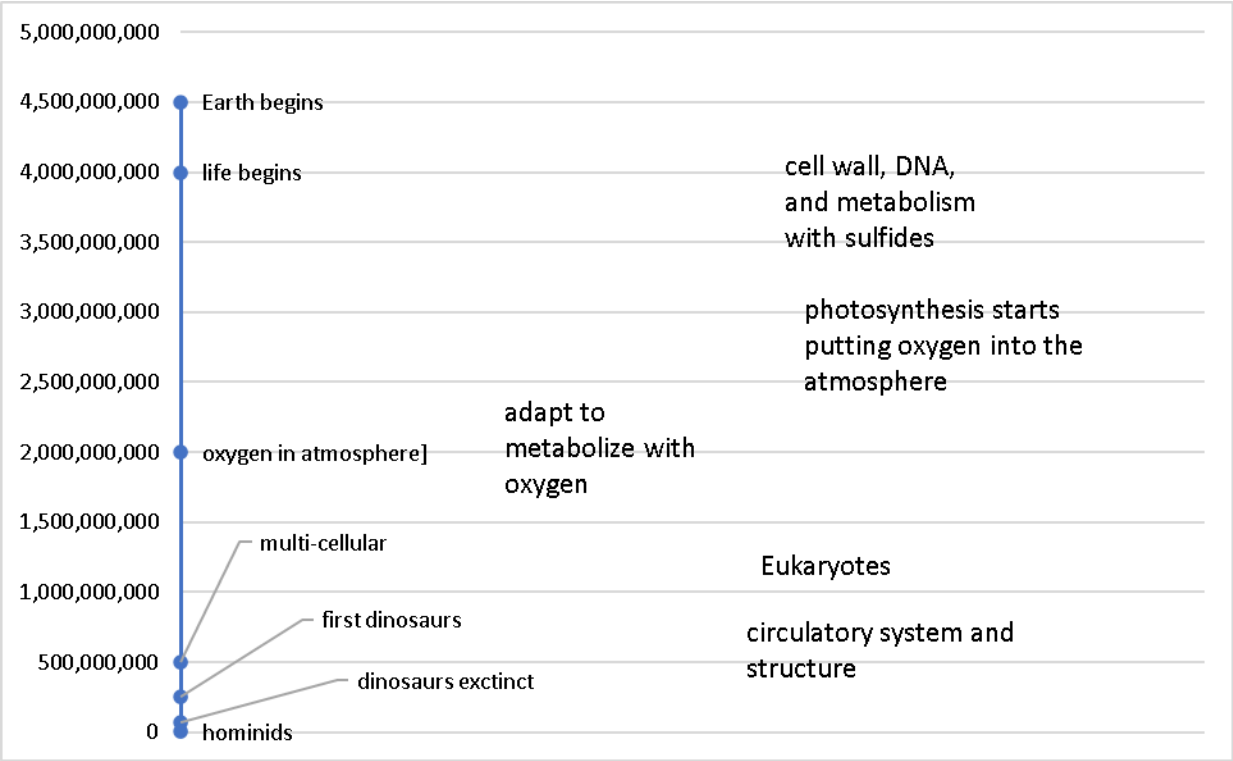
Fructose, the other half of sucrose, is even worse. The body really isn't equipped to handle it except for fat storage, so ends up trapping it in the form of fat in the liver. Over time this leads to liver failure. This condition is called non-alcoholic fatty liver disease (NAFLD). It's called non-alcoholic, since it duplicates what happens to an alcoholics' liver, except without having to be a drunk. Most of the COVID deaths had issues involving what I just described, along with old age.

Strategies for avoiding these conditions are numerous, but it can be reduced to a few rules:

1) Don't try to live off of carbohydrates. Eat fats and protein, too.
2) As far as carbohydrates go, especially avoid its basic building block, sugar.
3) Don't eat anything that comes out of a box, including most frozen products. We have not evolved to eat these extremely recent inventions of chemical engineers.
4) Don't eat trans-fats, vegetable oil (margarine), weirdly colored energy drinks. Avoid anything "low-fat" or "diet." These are also recent inventions of chemical engineers we have not had time to adapt to yet. Maybe in a thousand years…
5) Don't eat fast foods—they usually come out of a huge box in the restaurant's kitchen, and contain all those engineered food product inventions.
6) Don't drink pop or fruit juices. They are all concentrated sugar. Example, orange juice.
7) The longer something has been around, the more likely it won't be bad for you. So things like coffee, wine, roast pork, lettuce are most likely good for you; people have been eating those for thousands of years. Fast foods and boxed products probably aren't.
8) Grain is a special case. Timeline shows it a few thousand years old, but small compared with the existence of humans, but often it depends on the individual whether they can handle it. Just have to be aware of side-effects.
9) There are other nutrients besides macro-nutrients that you need. Mostly obtained from unprocessed meat (excludes hot dogs, for example), fruits, nuts, and vegetables.
10) Build muscle. This "burns" energy at a higher rate, and provides a sense of well-being that is hard to get any other way. Eliminates need for anti-depressants.

Summary of what we talked about before:

The main ideas were about metabolism, DNA (carries the code for how we are built), and the cell wall (made of *fats*, also known as lipids; water and fats do not mix) that separates the inside of the living microscopic cell from the outside environment. All of these developed pretty much as they are today in plants and animals a long, long time ago, but all in the ocean, nothing on land at first. This timeline tries to put it in perspective, with the idea that evolution takes time, lots of time:



Hominids are the mammals that eventually evolved into being humans. Eukaryotes are organisms whose cells have a nucleus, which contains the DNA. Most of the timeline belongs to prokaryotes in the ocean, usually single cell organisms with DNA, but no nucleus. Humans are eukaryotes.

We also mentioned that DNA was made from a sugar (ribose), a naturally occurring organic compound. An organic compound is something containing carbon. A very basic organic compound is methane, which is mostly what natural gas is, used for cooking and heating. Another organic compound is gasoline. When you burn gasoline in a car, it burns at high temperature, but releases energy that makes the engine go. You put in gasoline and oxygen, and

what comes out of the tail pipe is carbon dioxide and water. Metabolism is similar—you put in fuel and oxygen, and get carbon dioxide and water out. The big difference is it's not done at high temperatures. *Carbohydrates* are organic compounds containing carbon and hydrogen; its basic building blocks are various sugars. Enzymes help the reaction go, without the need for high temperatures. Enzymes are mostly made of *proteins*.

Therefore, we have now identified the three basic materials of life: fat (lipid), carbohydrates, and protein. They are also called the three macro-nutrients, since we can "burn" all three of them for fuel. A given amount of carbohydrate or protein may contain 4 units of energy each, while the same amount of fat has 9 units of energy. Therefore fat contains a lot more energy per a given amount, so it should be no surprise we use it to store energy, among other things.

All this existed by the time where our discussion left off, about 500,000,000 years ago, when the first multi-cellular plants and animals came into existence.

Back to beginning