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The more we know about the food and brain connection, the better choices we can make about the diet. Starting several million years ago, we had enough additional caloric energy through changes in lifestyle and diet to actually build a completely new section of brain. This new brain, the prefrontal cortex, PFC, plays key roles in memory, attention, perceptual awareness, thought, language, and consciousness. How is this structure best fueled? What are the ramifications of the brain not receiving its daily requirements of nutrients? This presentation looks at the food sources required to optimize the brain.

The value of feeding people especially cooking for children, has been underestimated for quite some time.

Preparing food has many virtues. It provides a social setting for our gatherings. It resets the eight hunger signals sent from the gut-brain to the big-brain. It nourishes the body. It expresses nurturance from the preparer to the consumer.

How do we take care of the sick? The grieving? How do we celebrate? We express concern, condolence and congratulations by preparing food. We cook.

Brains are calorically expensive, very expensive. Where did we get the energy for building and fueling a new brain structure?

While the brain itself has only increased in size about threefold in the past five million years, the size of the PFC has increased sixfold.

The Original Brains

Animal life first originated in the sea, where there was an abundance of omega-3 fatty acids. These are the same fatty acids that now form our eyes' photo receptors and our brain's cell membranes.

Eventually plants came along and brought us a brand new fatty acid family. The seed oils of these plants contained omega-6 fatty acids. The omega-3 and omega-6 fatty acids combined to start entire new set of species, mammals.

The Big Change

Human beings are thought to have lived on earth for millions of years. However, the biggest brain change happened only in the last couple 100,000.



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- What caused the change in human brains?
- Why did some human brains change and not others?

There were some early human populations that showed greater intelligence than others. In the East African Rift Valley and on the southern Cape of South Africa the intelligence levels were much higher than other areas.

It was discovered that docosahexaenoic acid (omega-3) was responsible for large brain growth. It was found in seafood. Not surprisingly early humans who ate seafood experienced the big brain change.

The inland people who did not have access to omega-3 got stuck at a brain capacity that was about the size of a chimpanzee's for three million years.

When we look at the bones of Neanderthals who lived 130,000 to 28,000 years ago in Europe we find that Neanderthals ate mostly red meat from the larger animals that roamed Europe at that time. In contrast, the bones from 28,000 to 20,000 years ago of early modern humans found in Britain, Russia and the Czech Republic, show that fish and seafood made up 10 - 50% of their dietary protein. Omega-3 from seafood boosted the brain power of these early humans.

About 2/3 of your brain is composed of fats. But not just any kind of fat, specialized fats, the fats that allowed the brains of our prehistoric ancestors to evolve at a fast rate. These same fats are incorporated into the structure of today's brains.

When fat is eaten, it is broken down into fatty acid molecules of various lengths. We use these raw materials to build special types of fat that make cell membranes.

Essential Fatty Acids are Essential Building Materials

To build brain cells you need fatty acids. Two kinds of fatty acids are essential, which means you must get these essential fatty acids (EFAs) from the food you eat because your body doesn't manufacture them.

The first essential fatty acid you need is Alpha-linolenic acid (ALA). ALA is the foundation of the omega-3 family of fatty acids. Food sources of omega-3 ALA include, flax seeds, chia seeds, walnuts, sea vegetables which we commonly call seaweed (kelp, wakame, dulse and arame), green leafy vegetables, and cold water fish like salmon, sardines, mackerel and trout.

The second essential fatty acid you need is Linoleic acid (LA). LA is the foundation of the omega-6 family of fatty acids. Food sources for omega-6 LA include: poultry, eggs, avocado, nuts, cereals, whole-grain breads, most vegetable oils, walnuts, and coconut.

The brain's ability to assemble fatty acids can be compromised by stress, infections, alcohol, excess sugar, and vitamin or mineral deficiencies – factors common today.

How much omega-3 to eat depends on how much omega-6 we eat.

Over the last 4-5 million years we maintained a ratio of roughly 1:1, avoiding modern inflammatory diseases like heart disease, cancer, and diabetes.

Starting with the industrial revolution, 140 years ago, consumption of omega-6 increased at the



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expense of omega-3. This was a result of the advent of modern vegetable oil industry and the use of cereal grains for feeding livestock.

This makes our average intake of omega-6 up to 25 times higher than evolutionary norms, and 8.6 times higher than optimally/accepted.

One study showed that replacing corn oil with olive oil and canola oil to reach an optimal omega-6 to omega-3 ratio led to a 70% decrease in total mortality.

"The increases in world LA consumption over the past century may be considered a very large uncontrolled experiment that may have contributed to increased societal burdens of aggression, depression and cardiovascular mortality."

-Joseph Hibbeln, Researcher at the National Institute of Health

Simply increasing omega-3 without simultaneously decreasing omega-6 is not enough. One of the best approaches is to limit omega-6 intake as much as possible, ideally to less than 2% of calories, and moderately increase omega-3 intake by eating a 4 oz. portion of salmon twice a week.

Diets without omega-3 fatty acids can have learning, motivation and motor problems. These diets seem to affect systems that use the neurotransmitters dopamine and serotonin in the frontal cortex.

Brain Blockers - Trans Fats

Today the human brain now faces a new challenge. Recently something has become fundamentally different with many of the fats we consume. Modern food processing techniques have altered a basic building block of the brain.

By modifying natural fats, we have weakened the brain's architecture. Poorly structured human brains are failing to cope with life's stresses.

The trans fatty acids, TFA, we eat get incorporated into brain cell membranes, including the myelin sheath. They replace the natural omega-3 in the membrane, which affects the electrical activity of the neuron. The TFA also cause cellular degeneration and diminished mental performance.

Trans Fats Change Brain Cells

Brain cells require flexibility to function correctly. This is done by maintaining a balance of different types of fatty acids in the cell membrane. The particular physical size and shape of individual fatty acid molecules give the cell membrane its structural flexibility. Normal fatty acids have a natural curve to their molecular shape. When they fit together, enough space still remains so that the membrane has the proper structure it needs to function at its best.

When these fat molecules are changed by manufactured food processes, or if they are heated for long periods, i.e. deep frying, they mutate into a form rarely found in nature. Now the molecules are straighter, narrower and do not have their original curved shape.

These altered fats will pack more tightly together into the cell membrane, making it more saturated and rigid, less flexible and less able to function. For 50 years no attention was paid to trans fatty acids. Now they are being recognized for the damage they cause.



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The Gut - Brain Connection

There is an invisible technology that made a very important impact on us. It changed the way our history developed. It's a technology so pervasive, so invisible, that for a long time we forgot to take it into account when we talked about human evolution. It's cooking.

Cooking is an important technology because it allowed us to produce what brought you here, your big brains.

Your brain is 2-3% of the body's mass, but it uses 25% of the body's total energy.

Cooking affected two organs, the brain and the gut. The brain grew while gut shrank. The gut shrank 60% compared to the primate gut because cooked food is easier to digest.

BDNF

Brain-derived neurotrophic factor, also known as BDNF, has been nicknamed "the miracle protein." In the brain, it is active in the hippocampus, cortex, and basal forebrain. These areas are vital to learning, memory and higher thinking.

Exercise increases the secretion of BDNF. This is why exercise protects us against neurodegenerative diseases such as dementia. Benefits of exercise on brain function also include, increases in grey and white matter in the prefrontal cortex and growth in hippocampal volume. Physical exercise is cognitive chocolate for the brain.

Berserk Behaviors

Common additives such as artificial coloring, preservatives, sweeteners, and flavor enhancers are really the culprits when it comes to children's wild party behaviors. These additives are in most processed foods. The effects of these items in our diet certainly isn't good for behaviors, especially in children. We are just starting to understand the negative consequences on our brains.

Suggestions

- Let's find ways to afford, include and make savory foods that contain omega-3.
- Let's take the foods with non-food ingredients out of the mouths of our future, our children.
- Let's decrease excessive amounts of omega-6, which means ditch the processed foods and cut back on eating out.
- Let's restrict trans fats to less than 1% of calories.

Closing

We need to show children how to build healthy brains...

- Let's model healthy eating. Our modeling is as powerful as any mode of education.
- Let's model exercise. Couch potato college students - after 4 months of 2-3 times per week of an aerobic exercise had an 80-100% cognitive boost. 1 week without aerobic exercise, they were back to couch potato status.
- Let's model getting enough sleep.
- Let's model de-stressing life. Move quickly when you have to, move slowly when you can.
- Finally, let's model the love of cooking. It is what gave us these wonderfully big brains.



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