Do Food Electrons Impart a Quantum Effect?

READERS SUMMARY:

1. What could happen when you ask a supposed "dumb" question to a smart paleo guy?
2. Sleeping stimulates neurogenesis and learning?
3. What is a ketogenic diet?
4. Does the ketogenic diet show one macronutrient matters more than another for brain metabolism?
5. Are the electrons from different sources treated differently by the brain?

On the plane home from the AHS at UCLA I was reading a series of physics papers that I had mentioned to "The Kracken" while at the AHS. I asked Matt a rather jumbled question this weekend I had from this paper about a chemistry and electron transport and unusual physical effects in relation to oxidative phosphorylation that occurs at the mitochondrial level when we eat. He looked at me like I was nuts, and he tried to rephrase my question to answer it based upon what he thought I meant. My question was worded poorly, because I really had not thought through what and why I wanted to know about this issue fully. His answer, however, told me what I was looking for. His answer told me how "paleo thinks" about electrons. If our thinking is not clear its tough to specify it in a question. I realized then I had to explain to him better what I was really asking and share the papers with him.

Electrons are important, because they give chemicals or macronutrients their special and specific chemistry. It is not the protons or neutrons that do it in any substance of matter including food. That is a well known fact in all branches of chemistry. On the plane ride home as I slept, however, I woke up with a sudden burst of insight on how I may

not only phrase the question better, but how I might have found the answer myself before in something I read in residency. That answer maybe buried in the bio-energenic literature I reviewed while a resident at LSU for brain energy transport. I recalled reading about the effects of the ketogenic diet on pediatric brain tumor patients and on patients with neurodegenerative disorders in the mid 1990s. I had to put together a talk on this back in 1995. When I got home I opened up some books and Pubmed searched a bit. I think that nap might have been what I have been looking for. You have got to love autophagy from sleep! It surely does stimulate neurogenesis so we can learn!

First, let's talk a little bit about what a ketogenic diet is and what it does for certain peoples' brains. It is a current mainstream treatment for epilepsy and neurosurgical pathology today but it is rarely used often enough in my opinion. The reason it is not used is because antiepileptic drugs are now considered first lines of therapy these days. Conventional medicine wisdom exists even in neurology and neurosurgery I am afraid. The treatment actually dates back to the early Greek civilization around 350-400 BC. They used fasting as a way to improve the symptoms of epilepsy. I remember reading back then the reason the treatment often failed is because the patients got quite hungry after a week of this. So it was not a sustainable long term treatment. The medical community re-discovered fasting at the turn of the 20th century in Europe. A study was even undertaken in France to show its efficacy. It showed much promise but again compliance was the rate limiting factor. The idea then traveled across the pond to the USA and several physicians came up with a "***modified water diet***" that **had ten percent food and 90% water as its backbone.** The American trials showed promise, but again were limited by hunger compliance. As the blog goes on, you are going to find out that **water electrons are a lot more important than any other source of electrons**. Understanding the ketogenic diet is going to help that understanding. Few in healthcare still

know that. Consider the following story about the ketogenic diet's history.

HOW THE KETOGENIC DIET WAS DISCOVERED:

Interestingly enough, one of the patients was boy who father was a rich NYC landlord who donated some money for further research into how this "**water diet**" actually worked. The money went to Dr. Lennox and Dr. Cobb at Johns Hopkins, who later became famous. From those studies we found out that fasting induced the formation of ketone bodies. ***All three ketone bodies were found with that grant.*** Once this occurred the Mayo Clinic researchers joined the party and actually named the diet the "***ketogenic diet***". They actually worked out the macronutrient ratios for the diet to be used in 1924. They found children needed one gram of protein per KG of weight, no more than 15 grams of carbohydrates per day, and the rest of dietary calories had to come from fat. Once this was done it was used extensively in children with great success. It met with limited success in adults and interestingly enough, this is why the diet was abandoned and antiepileptic medications became first line drugs back then. This is where my residency recall ended of the papers I had read for my talk. I knew, even today, that in difficult seizure cases where all medications fail, like Lennox-Gastaut syndrome, that the ketogenic diet is still used. I have used it myself as a neurosurgeon for patients with difficult seizure control who harbor brain tumors. Ketogenic diets are very helpful in cases or neuropathology of the brain or the immune system.

The diet came back to life while I was in residency because another famous NY TV person had a son who went on the diet and did quite well. They even made a TV show about the child's case. A multicenter trial was begun and the results released as I was finishing my training in Neurosurgery. Today most epilepsy centers offer ketogenic diets as mainstream therapy for drug resistant seizure disorders. It is even covered by all US insurance carriers as of 2011. Interestingly, the

literature is bare with a mechanism of action. I can hear you saying this to me now, Doc, where is this all heading? Why should I care?

Well, in the paleo blogosphere there are so many arguments about macro and micronutirents ratios and levels and what is optimal and what is not. There are constant questions to many podcasters asking about metabolic typing and related topics. I think the ketogenic diet firmly answers the question whether or not specific macronutrient levels can have a direct effect on metabolism in a measurable way. Remember most current low carb paleo diets are direct ketogenic diets as well, but they are missing the most important ingredient to the diet's success, water. Here comes your relevance.

The ketogenic diet of today is loaded with MCTs usually from coconut oil. MCT are metabolized quite differently than other fats. The low carb paleo diet is heavily steeped in MCT oils as well, but not in water. The carb content is usually kept below 100 grams but the range most use is even lower than that. Mind you, I don't advocate this across the board for everyone.

I myself eat a high percentage of calories of fat and protein **with copius amounts of non fluoridated hard water** based upon my own testing and results. This puts the patient in sustained ketosis and is a successful way to reverse metabolic syndrome and lose weight. **Low carb ketotic diets without water do not work well in my experience**. But it confers a much bigger advantage that previously has gone unrecognized until now. What is that advantage? OK…….this part is going to hurt your brain because it has a lot of cerebral physiology but I promise the pay off is worth it.

In neurosurgery, we have hundreds of thousands of studies done on the coupling of cerebral blood flow (CBF) to cerebral metabolic rate of oxygen consumption (CMRO2). Neurosurgeons are experts in managing CBF and CMRO2 in neurologic injury or

in pathologic states to navigate patients back to health. We spent seven years learning how to alter this simple equation to provide the best outcomes to patients. We need to control CBF often because, if it increases indiscriminately, the patient will die because the brain swells and it is located in a fixed closed compartment. This is commonly how one becomes brain dead in case you are wondering. The brain controls its own CBF by a process called autoregulation. In simple terms, the metabolic activity of the neurons determines how much blood flow a certain region of the brain gets. The only way to uncouple CBF from metabolism and keeping the patient alive is inducing general anesthesia. Uncoupling or losing autoregulatory control does occur in many neurologic diseases. For example , when we do dynamic cerebral blood flow studies in the brain we can tell the difference between patients with Alzheimer's disease (AD) and vascular dementia by testing their metabolic consumption of oxygen. The difference lies in how the CBF looks in each disease.

In vascular dementia (chronic TIA's) the problem is a poor blood supply to the neurons. **Dehydration robs the brain water and it slows energy production because water is found in the mitochondria and makes up 70% of the molecules found in the brain.** This starves the brain slowly of oxygen causing long standing neuronal cell death and leads to a dementia. The neurons are completely normal—just starved for air and water. Autoregulation however is completely intact. In AD, the neurons are diseased from protein folding defects but the blood vessels can deliver a normal cerebral perfusion pressure. Protein folding is a key early problem in all neurodegenerative diseases. This means oxygen flow is intact in the AD patients' brain.

The neurons however on the dynamic PET/SPECT scans show major hypo-metabolism and hypo-perfusions in the frontal and temporal lobes. Autoregulation is clearly uncoupled in AD and

it is 100% tied to a loss of energy. Remember the only way we have to uncouple CBF from CRMO2 and keep the patient alive is anesthetic drugs. This begs the question…when we put a person with AD under a general anesthetic do they react differently since their neurons cannot control their own perfusion do to the formation of neurofibrillary tangles? The anesthesia literature says this is a true statement. So then, why is it that a ketogenic diet, high in fat or MCT oils, is very helpful in improving cognitive function in AD? Here is where it gets real interesting.

The brain is an amazing organ of evolution. It makes up 2% of our body weight but draws 20% of our cardiac output. This means it is the ultimate energy hog. But one would expect that because of the amount of energy it uses to run the entire human body. Moreover, as humans evolved the neocortex (human parts of our brain) it increased the demand for energy to greater degree than primates. There is a huge difference in primate brains and human brains as you will find out in future blogs like Brain gut 3, 4, 5, and Energy and Epigenetics 1.

More brain tissue evolved, means more oxygen is needed. This is why primates pound for pound are stronger than us. Their lineage chose muscle-skeletal strength to climb trees while we evolved brains to increase our thinking ability. But this decision was more based upon longevity. This story is told via the evolution of MHC1 gene in hominids. This allowed us to forage for food with more diversity because we could think to find ways to forage better than we had. Forming social networks to use collective knowledge is an example. But this huge evolutionary advantage also came with a cost. A human can live without food for **30 days**. They can survive for **without water for seven days**. But the human brain cannot do without oxygen for **4 minutes or it dies**. It is clear water and oxygen are the fuel sources for the brain somehow. This linkage comes into play in their mitochondrial efficiency and

capacity.

Because of the brain's high metabolic demands, when humans think or do any mental activity they can only activate about 2% of the total neurons in their brain to carry out the task when they are using glucose as a source of fuel. Primates only eat 5% fat or protein in their diets, so their brain growth is stunted by their dietary choices from an evolutionary prospective. This has been shown by PET scan studies and more recently in fMRI studies using CRMO2 as the major variable. This limits our ability to use multiple systems at once. If we did we would pass out from the lack of oxygen due to the heightened CRMO2 by the neurons actively engaged. Remember that oxygen consumption in the brain is directly coupled to blood flow. When the human brain is running on a ketogenic diet as its primary source of fuel the ketone bodies directly down regulates genes that allow glucose to be utilized in neurons. Moreover, the ketone bodies allow us to use between 35 ~100% more total neurons than we could with the isocaloric dose of glucose as fuel. This means we can activate and use more neurons using less oxygen! That provides a huge macronutrient advantage for ketosis. It appears that the real advantage of ketosis from the brain's perspective is an increase function and cognition. This is pretty amazing and in fact has been shown in many patients with neurodegenerative disorders like Alzheimer's disease.

Remember my original point about how the brain works normally. Neurons determine how much CBF it needs based upon its own metabolic demands. CBF is tightly coupled to CMRO2 given the wide variations in blood pressures. BP is a function of plasma water content. A ketogenic diet works by uncoupling CBF from CMRO2! This means that eating a ketogenic diet allows a higher CBF while have a lower resting cerebral metabolism. **Carbohydrates and proteins have never shown this benefit in any study I know of testing cerebral autoregulation**. This

means that a low carb, high MCT fat diet confers a significant metabolic advantages to the brain because it improves mitochondrial efficiency by generating a lot of energy from splitting water.

ENERGY FROM FORMATION OF ONLY ONE MOLE OF WATER

CO2 1/2 O2 = one mole H2O (~18 grams water = 3.5 teaspoons) = 286 kJ

When one mole of H2O is created from one H2 (hydrogen) and half O2 (oxygen), 286 kJ of power are released to the cell to do work. That is an astounding amount of energy. This is just from water. For your reference, a small tuber has only 68 kcal with in it. This raises the question, is food really more important than water when you are a mammal and have a mitochondria crafted by a unique set of environmental circumstances?

Please remember the human brain is made up predominantly of lipid and water and surrounded by water and has water within its ventricular system. The brain directly controls all efferent and afferent pathways of metabolism via leptin. The implications are big. Remember that food is thought to be "our only" substrate source of electrons for our mitochondria's electron transport chain in organic chemistry terms. This also means that somehow the electrons that come from these ketone bodies affects the neuronal ATP requirement of cerebral mitochondria. Is it possible they come from elsewhere, or does the electrons from food have a quantum effect? This was the essence of the question that I asked "The Kracken" at AHS. **I asked him if all electrons are created equal?**

On the surface this sounds like an "ignorant question" until one thinks about the implications of these findings in the pathologic brain. Something has to allow for this metabolic advantage. So what is it? That is open for debate, but I think I have a solid answer. But this is where the physics

papers come in to play that I was talking to Matt about. This physics data says that can not be true. And if your experiment does not equal your belief, it implies that your dogma is wrong about diets and food. And today we know it is not. Humans get many electrons from water and from sunlight too and evolution has figured out how to harness their energy in our mitochondria.

We know experimentally that CMRO2 (cerebral metabolism) is tied directly to microtubule function and mitochondrial ATP production in the brain. The only way we have as neurosurgeons to uncouple neuronal oxygen consumption from cerebral blood flow and not kill neurons is inducing anesthesia. Today we don't know precisely how anesthesia works, but Stuart Hameroff, MD (an Anesthesiologist at Univ of AZ) believes he does. His work is pretty amazing and I have been reading it for sometime. I just never put metabolism and physics together until today's trip home. We know that volatile anesthetic gases act by Van deer Waals (London Convention) forces in hydrophobic pockets of select brain proteins to ablate consciousness. **It's called the induction of gamma coherence of neuronal microtubules.** The quantum field theory mathematics and physics are quirky, but I think the answer to many unknown biologic forces will come back to Einstein's core principles he laid out in 1905 and in subsequent papers. Most of you know that quantum mechanics deals with the physics , chemistry and biology at a subatomic particle level. Well, electrons from all types of sources and from foods, fit that bill.

The real question is do electrons from different macronutrients have specific quantum biologic effects? Many of the things that have been mathematically predicted by Einstein's quantum mechanical theory have been proven true by science today. For example, the presence of a black hole, a quasar, or the fact that time bends at the speed of light. When he first made the predictions he was mocked. He predicted

a quasar and a black hole in the 20's and until the Hubble telescope was deployed recently, we did not know for sure. We now know he was correct. **Einstein's mathematics** also says that things that are of the same origin always remain connected in some fashion no matter how far apart they may exist in space or in time. This is his theory of non locality. **I have been an Einstein freak my whole life**. And I have been wondering for 15 years whether an electron from carbs, fat or protein, or somewhere else is somehow categorized differently than one another by metabolism. If so this could have major implications for a new understanding of all the biologic pathways in metabolism and in aging.

I can hear you thinking, I am drinking the woo woo now! No, I can promise you I am not. The reason I have been thinking about gamma coherence and "if" all electrons are really equal is because of this seemingly incongruent experimental effect of the ketogenic diet on brain metabolism. **The real data implies something else is behind energy transfer in the brain.** It clearly is different in the brain as I have laid out here. So would evolution select the brain about differently than any other organ in our body? I don't doubt it, because evolutionary biology uses a strict fractal geometrical framework for evolutionary progression. I think the answer is in water. This post likely will stimulate the debate in the blogosphere about the real differences in macronutrients effects upon metabolism. At least, I hope it would.

I'm wondering out loud about how far reaching this effect may reach. But I now have a more complex puzzle to solve. Why does this happen with only a ketogenic diet? **Why are carbs and protein afforded no such benefits?** This needs to be asked don't you think? And now you have the essence of what I was trying to ask "The Chemistry Kracken".

Are all electrons really created equal or does our body account for the types of foods that certain electrons come from? I honestly think I know this answer, but I wanted to

ask the smartest man in paleo; but I can not get away from why would a ketogenic diet high in MCT do something radically different to brain metabolism and CBF that carbs and protein do not. I think its a question that needs an answer. Remain curious folks!!!

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