

Dear Functional Medicine Discussion Group Members:

We had a fascinating Functional Medicine Discussion Group meeting on June 29, 2017 with Dr. Laszlo Boros, Dr. Que Collins, and Dr. Anne Cooper on Deuterium and Health. If you were not able to attend, here's the video: <https://youtu.be/1V4cJvogjVY>. We thank Metagenics, once again, for sponsoring the food and the venue, and for having supported our group since we started. Thanks to all our members who participated in the meeting. Our next meeting will be **Thursday, July 27** at 6:30 pm at the Santa Monica Library at 601 Santa Monica Blvd. and **Dr. Mike Carragher and Dr. Jill Stocker** will lead a discussion on **Female Hormones**. Please email me if you will be able to attend and place **Female Hormones RSVP** in the subject line. I will send out the official invite later this week. If you are not already a member, please join our closed Facebook page, Functional Medicine Discussion Group of Santa Monica. Also, please check out my podcast, **Rational Wellness**, on Itunes <https://itunes.apple.com/us/podcast/rational-wellness-podcast/id1191232372?mt=2> or Youtube https://youtu.be/eUOb_POEHLg

I then introduced our guest speakers and asked the first question, **What the hell is deuterium and why should we care about it?** Dr. Boros started by explaining that deuterium is a form of hydrogen that is twice as heavy because it has two neutrons. While hydrogen weighs one Dalton, deuterium weighs two Daltons. Living creatures don't deal as well with deuterium as they do with hydrogen. Hydrogen is very active in our bodies including in hydrogen bonding in DNA and hydrogen is involved in energy production, which we call ATP synthase. Here is the actual chemical equation and you can see that hydrogen is very involved: $ADP + P_i + H^+_{out} \rightleftharpoons ATP + H_2O + H^+_{in}$. There are little nanomotors that spin at 9000 rotations per minute to produce ATP and the hydrogen atoms pass through these. Here is a video depicting this nanomotor: <https://youtu.be/W3KxU63gcF4>. According to Dr. Boros, when you have deuterium, it breaks this nanomotor. The natural hydrogen:deuterium ratio is very important to understand our biochemistry. The most abundant source of deuterium is in the ocean, and out of 1 million hydrogen atoms, you have 155 deuterium atoms. It's not a large number, but if you think about how fast these nanomotors are spinning and they process 1500 hydrogen molecules per second, and if deuterium breaks these, then we have to control our deuterium levels, Dr. Boros explained. Normal levels in our bodies are 130 deuterium per 1 million hydrogen atoms. By breaking these nanomotors in our mitochondria, we believe that this leads to fatigue, cancer, and chronic diseases.

Photosynthesis from plants helps to reduce deuterium levels because it brings water from the ground and uses the energy from the sun to produce more hydrogen and less deuterium. This hydrogen attaches to carbon dioxide, which is how organic materials are synthesized. The plants are eaten by animals and humans eat animals, and we get exposed to their deuterium levels when we burn their food back into water, we are exposed to deuterium. Metabolic water is the product of hydrogen from the food and the oxygen that we breathe in. Dr. Boros explained that humans take in oxygen in order to produce water. The mitochondria has its own water pool that is referred to as metabolic or matrix water, which results from biological oxidation. Photosynthesis breaks water and biological oxidation restores water that is deuterium depleted.

I asked what things could be done to affect deuterium levels and Dr. Collins answered that the foods that we eat have the biggest effect. Eating green plants are deuterium depleted, which is why vegetarian diets can be helpful. **Ketogenic diets also reduce deuterium levels because fat is naturally deuterium depleted.** Fats are deuterium depleted for two reasons: 1. Because fat contains carbons and hydrogens that are bonded together and 2. Because if the animal was grass fed, then it will have lower deuterium levels. **Sleep is important because during REM sleep, you get rid of deuterium.**

I asked about testing for deuterium levels and Dr. Collins and Dr. Boros have developed several different forms of clinical testing, including ways to test for deuterium levels in tissues, in bodily fluids, in DNA, in your cholesterol, etc.. If you find someone who has a lot of deuterium in their cholesterol, they will not be able to make vitamin D or hormones from their cholesterol. Dr. Collins explained that they have developed methods to measure deuterium levels from blood, urine, saliva, and tears. The newest method is the breath test, which most closely represents deuterium levels in the breath, which comes from the lungs and the heart. This more closely represents deuterium levels in the tissues. We can also measure deuterium levels in cholesterol. If your cholesterol levels are high and you have a lot of deuterium in your cholesterol, your body can't break down this cholesterol, so it tends to build up in your body. If your cholesterol can't be broken down, it can't be sulfonated, which means it can't be made water soluble. Therefore, your cholesterol will continue to be carried around your body.

Foods that are lower in sugar and carbohydrates tend to be lower in deuterium levels. Even fruit is problematic because it is so high in sugar and therefore it is also high in deuterium. Fruit is not meant to be eaten except during certain seasons and not all the time. Nature takes care of the fruit problem because fruits are only available during certain seasons and when fruit gets too ripe it falls from the tree and gets eaten by birds and insects and bacteria. Dr. Boros said that you need to get your deuterium levels below 130 ppm. If you do this, you have a much better chance of dealing with degenerative diseases and biochemical and metabolic conditions like cancer. Dr. Boros argues for a paleo or ancestral type of nutritional approach that is lower in sugar and higher in fat, since it matches our biological instinct and results in lower deuterium levels.

Dr. Collins explained that deuterium is what ages you and is your biological clock. He also argued that you can drink deuterium depleted water for a limited period of time such as a month can lower your deuterium levels and along with a lower carb diet, you can maintain these lower deuterium levels. Dr. Suzan Starler then asked how we can order the deuterium tests, how much do they cost, how do we get the results, and what can we recommend to our patients if they have high deuterium levels? In other words, how do we help people with this information? Dr. Cooper answered that after the patients are tested, the protocol involves the ketogenic diet, deuterium depleted water that is from Europe, making sure patients are sleeping well, and breathing techniques that they teach their patients. She said that she was having a lot of fatigue and drank the deuterium depleted water and her energy was restored and her basal metabolic rate went up 40%. She also mentioned that they offer educational lectures at their office in Santa Monica for those who want to learn more.

Dr. Collins mentioned that they have treated over 3000 patients with cancer over the last 20 years and over 70 publications. He said that this is being used by several different universities. I mentioned that when I looked at some of their published papers, they appeared to take cancer patients and add deuterium depleted water to the rest of the treatment protocol. And none of these studies that I was able to retrieve were blinded or had a placebo group. (<https://www.signaturehealth.com/wp-content/uploads/2017/05/JCT-2011.pdf> , https://www.signaturehealth.com/wp-content/uploads/2017/05/Integrative-Cancer-Therapy_A-Retrospective-Evaluation-2-2008.pdf , <https://www.signaturehealth.com/wp-content/uploads/2017/05/JCRT13-10006.pdf>)

Dr. Boros asked how much (by weight) do you turn over ATP in the course of a day? The answer is: One ton of ATP. In a marathon, you turn over 60 kilograms of ATP. When you consider that it takes 3 hydrogen atoms to make one ATP, you can triple this number and then you can understand how important deuterium is.

Dr. Collins and Dr. Boros mentioned that they have been working with some world class and Olympic athletes and reducing deuterium levels is very beneficial. When you deplete deuterium levels, you can produce more ATP and this is obviously beneficial for exercise.

I asked if there is enough data at this point to say if you have high deuterium levels, you are at increased risk for a particular disease? Dr. Collins said that you can't have deuterium levels below 130 ppm and have cancer. [That is a very provocative statement to make!—my editorial] Dr. Collins also said he felt very confident in the relationship between deuterium levels and diabetes and human performance. Dr. Boros, who teaches at UCLA, made more cautious statements and said that he would not say if you have high deuterium levels that you are at risk for any particular disease. But he did explain that deuterium is an inorganic element in the body in the largest quantity, indicating its potential importance to our health. Dr. Boros explained that deuterium makes cells grow, so it will tend to promote cancer growth. Infants also naturally have higher deuterium levels. Higher deuterium levels will tend to promote muscle growth, but lower deuterium levels are better for performance levels. This is a bit of a conundrum that is difficult to sort out?

Dr. Collins also compared deuterium levels with blood glucose levels and the knowledge that it is bad if it's high for a number of reasons. Someone asked about the cost of the testing and the deuterium depleted water. The cost of the testing is in the \$100-\$250 range, depending upon the test and the cost of the water is between \$12 and \$18 per day for the patient. He recommended testing pre and post treatment. He also mentioned that spring water has deuterium levels between 147 and 149. Distillation reduces deuterium levels by 4% and distilling it multiple times can reduce deuterium levels further. Dr. Tucker asked if he should sell his beach house, since deuterium levels were so high in the ocean. Dr. Boros said that at the beach you are exposed to sunlight and your cholesterol and fatty acid hydrogens resonate better, so they are carrying this red light energy to your mitochondria, which makes your interstitial water less viscous. So your ATP synthase is always adjusted to your environment.???

Dr. Cooper talked about various therapeutic modalities that help reduce deuterium levels, including the ketogenic diet, acupuncture, laser, deep tissue massage, the Buteyko breathing technique, including a special patented mask that helps to deplete deuterium levels. She will also send patients for sleep studies to look for sleep apnea.

Dr. Boros said that he had a twin brother who died of esophageal cancer and he was diagnosed with esophageal metaplasia, so he started to drink the deuterium depleted water and he is fine. He mentioned several patients with prostate cancer who followed a ketogenic diet and used deuterium depleted water and they improved (lowered their PSA) and are back to work. He also mentioned a patient with pancreatic cancer who was given 3 months and with deuterium depleted program, they lived at least 40 months. They did a trial with 32 inoperable patients with pancreatic cancer and 14 of them are still alive. He also said they had cancer patients who were going through radiation and the radiation worked better due to the deuterium depletion protocol.

Dr. Boros, Dr. Collins, and Dr. Cooper can be reached at Cignature Health in Santa Monica, California at 800.208.0280 or <http://www.cignaturehealth.com/> to order testing or deuterium depleted water to learn more. See you next month July 27 for a discussion of Female Hormones!