

Deutenomics, the inherent autonomic discrimination of deuterium by Nature: medical implications

> László G. Boros, M.D. Hirshberg Foundation Seed Grant Awardees Presentations UCLA Faculty Center Sequoia Room September 20, 2019

#### Deuterium - the heavy stable isotope of hydrogen



#### mass: 1 Dalton mass: 2 Daltons

Deuterium is twice as heavy as hydrogen with many undesired biological effects - Deutenomics is to addresses those

#### Deuterium - Hydrogen with extra weight/sizw

#### ✓ It is like you, or your identical twin, but with a heavy

#### backpack.



#### The surface tension of water matters in mitochondria where deuterium makes water molecules to "lump together"

#### **Cohesion of water**



## ATP Synthase: The power plant of the cell

https://youtu.be/XI8m6oogXDY

## **ATPase Nanomotor if Deuterium hits it!**

https://drive.google.com/open?id=12LwtO5nBYPjNmcDguZYPCtGqLD7rPkM3

## Mitochondrial water recycling

#### Mitokondrion



http://high-fat-nutrition.blogspot.com/2012/07/protons-wheres-bias.html

## Peroxisomal water recycling

#### Peroxisome

 $2 H_2 O_2 - 2 H_2 O + O_2$ 



http://flipper.diff.org/app/items/3693

## Deuterium - the bad guy

✓Deuterium is a growth - and transforming factor for mammalian cells with mitochondria. https://www.acam.org/mpage/2018ACAMBoros

✓Life is about recycling protons – the more effectively these move, the more efficient our bodies function

✓Deuterium greatly compromises proton mobility

✓Deuterium is high in processed sugars and GMO products but low in fat

## Mitochondrial dysfunction

- 80% to 95% of all chronic disease is due to mitochondrial dysfunction
- Deuterons break cellular protein nanomotors and disrupt ATP synthesis
- Deuterons in our tissues cause metabolic crowding that affect key mitochondrial energy producing processes
  - Depleting excess deuterium from the body can restore organ functions, increase tissue repair and may revers disease processes

## Mitochondrial dysfunction

## Depleting deuterium is a fundamental process in preserving health

#### Deutenomics

Measures deuterium in breath, saliva and/or urine

✓Delivers clinical and translational interpretations

Addresses disease mechanisms with medical indications regarding cellular energy production

✓Depletes deuterium based on medicinal biochemistry modeling by UCLA physician scientists supported by the Hirshberg Foundation

## Published research (2000-)

✓ 5,000+ citations and 30,000+ downloads of 100+ papers - Harbor-UCLA Medical Center (with Dr. Lee)

✓ Data sets are published in oncology related papers

✓ Excellent review papers: http://doi.org/10.1016/j.mehy.2015.11.016

✓ Influential clinical papers: https://doi.org/10.1093/neuonc/now284

## Current developments

 4<sup>th</sup> International Congress on Deuterium Depletion in Budapest October 17-18 2019 promises to be the largest gathering of scientists on the subject thus far <u>www.deuteriumdepletion.com</u>

Swiss Journal - Molecules - to publish a special edition in 2020

 Titled and entirely devoted to Deutenomics, edited by Dr. László Boros, MD

 <u>https://www.mdpi.com/journal/molecules/special\_issues/Medicinal\_Bi</u> <u>ochemistry\_Deuterium</u>

### Examples

Neuro-Oncology, Volume 19, Issue 4, 1 April 2017, Pages 595-596, <a href="https://doi.org/10.1093/neuonc/now284">https://doi.org/10.1093/neuonc/now284</a>

"..(Deuterium depletion) is important as the deuterium depleted water yield of ketogenic substrates ... may be limited in primary brain tumors ..., whereas deuterium depleted water for cytoplasmic hydrogen exchange reactions needs to be incorporated into dieting protocols to achieve more favorable clinical outcomes based on deuterium depleting biological principles currently entering contemporary medicine."

### Examples

#### Metabolomics. 2016; 12:58. https://doi.org/10.1007/s11306-016-0961-5 (Discussions)

"..Metabolites from our study related to survival, such as tridecan-1-ol and octadecan-1-ol are long chain fatty alcohols... which are lower in deuterium content (105–130 ppm) ... This metabolic water is consequently relatively depleted in deuterium, and this pool is ultimately used for mitochondrial NADPH dependent macromolecular synthesis, including DNA. By this theory, hydrogen bonding in DNA will be differentially impacted in patients who use ketogenic substrates with lower deuterium content due to isotope effects ...



# Deuterium metabolic imaging (DMI) for MRI-based 3D mapping of metabolism in vivo

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