Deutenomics in peer reviewed medical literature with original data

Below is a partial list of papers as they appear and provide scientific evidence regarding deutenomics in the peer reviewed clinical and translational medical literature. If you find any new paper(s) with original data (no reviews included) that could be attached to this list please email me with the citation at contact@laszlogboros.com:

1)
Metabolomics 12, 58 (2016)
Temporal characterization of serum metabolite signatures in lung cancer patients undergoing treatment

Hao, D. et al.

https://link.springer.com/article/10.1007/s11306-016-0961-5

Deutenomics quotation(s) from this paper:

"one possible explanation for the segregation of metabolite pools between those prognostic for survival and those indicative of progression may lie in compartmentalization of biochemical processing and possible mitochondrial dysfunction"

"metabolites from our study related to survival … are long chain fatty alcohols which may result from oxidative processing in peroxisomes or from dietary sources
these are ketogenic substrates which are lower in deuterium content …"

2)
International Journal of Molecular Sciences 20(20), 4984 (2019)
Personalized treatment response assessment for rare childhood tumors using microcalorimetry–exemplified by use of carbonic anhydrase IX and aquaporin 1 inhibitors

Gros, S. J. et al.

https://doi.org/10.3390/ijms20204984

Deutenomics quotation(s) from this paper:

"Boros et al. have proposed that mechanisms similar to the inhibition of carbonic anhydrase can inhibit growth of tumor cells by limiting uptake of deuterated water into cells"

"these authors further suggest that these mechanisms might result in metabolic changes of translational impact"

3)
Scientific Reports 10, 5955 (2020)
Network-based metabolic characterization of renal cell carcinoma

Pandey, N. et al.

https://doi.org/10.1038/s41598-020-62853-8

Deutenomics quotation(s) from this paper:

"Renal cell carcinoma is caused by defective mitochondria that can impose tumor transformation by deuterium oncoisotope accumulation. Therefore, deuterium depletion (deupletion) upon deuterium depleted substrate oxidation can provide a low deuterium metabolic water as therapeutic adjuvant. Such metabolic intervention can be initiated and maintained via diet and potables in integrative therapeutic settings"

4)
Molecular Cancer Research 18(6), 883–890 (2020)
Metabolic profiling of formalin-fixed paraffin-embedded tissues discriminates normal colon from colorectal cancer

Arima, K., et al.

https://doi.org/10.1158/1541-7786.MCR-19-1091

Deutenomics quotation(s) from this paper:

"Because these essential ketogenic BCAAs are degraded directly into acetyl-CoA and succinyl-CoA in human mitochondria, their accumulation reiterates mitochondrial dysfunction in tumor cells to completely oxidize ketogenic substrates into carbon dioxide that is accompanied by inherent transfer of protons with less deuterium from nutrients to metabolic matrix water (36, 37). The fundamental mitochondrial function of curtailing deuterium oncoisotope accumulation in intermediary metabolites and nucleotides to prevent cell transformation has been argued as a surrogate marker for predicting response in personalized treatment and as a prognostic marker for patient survival in several clinical cancer studies (38, 39). Our study thus ingeminates again the clinical importance of insufficient mitochondrial deuterium depletion with resulting oncogenic transformation that can be unearthed from paraffin embedded tissue samples via metabolic profiling."

5)
Scientific Reports 11, 3250 (2021)
Indication of high lipid content in epithelial-mesenchymal transitions of breast tissues

Sabtu, S. N., et al.

https://doi.org/10.1038/s41598-021-81426-x

Deutenomics quotation(s) from this paper:

"Attention is drawn to potential links to several original contributions within which deupleting metabolic markers have been demonstrated clinically. These involve lung[76], rare childhood cancers[77], renal cell cancers[78] and colorectal cancers[79], until now lacking evidence in breast cancer. The growing field of what is referred to as deutenomics has consistently shown the increased significance of deuterium depletion via natural cellular ketogenic substrate oxidation. The underlying medical biochemistry mechanisms, described by Boros et al.[80,81], have considered how defective mitochondria with diminished low deuterium ketogenic fatty acid substrate oxidation can hamper recycling of deuterium depleted metabolic water. This is seen to be performed by tricarboxylic acid cycle (TCA cycle) hydratase reactions[82]. Such mechanism could preserve normal epithelial cellular mesenchymal phenotype in breast to prevent or reverse cancer formation."

6)
Vaccines 10(5), 790 (2022)
Targeting membrane trafficking as a strategy for cancer treatment

Tejeda-Muñoz, N., et al.

https://doi.org/10.3390/vaccines10050790

Deutenomics quotation(s) from this paper:

"Vacuolar-ATPase (V-ATPase), initially identified in Saccharomyces cerevisiae and plant vacuoles, is an 830 kDa multi-subunit transmembrane complex. V-ATPases have a similar structure and mechanism of action to mitochondrial F-ATPase (F-type), and several of their subunits evolved from common ancestors. V-ATPase serves to pump protons into the lumen of different endosomal compartments and contribute to endosomal acidification [30] via deuterium discrimination [31] (Figure 3), whereas F-ATPase synthesizes most of the ATP and deuterium-depleted metabolic water in the matrix of mitochondria using an electrochemical proton gradient and oxygen in complex IV [32]."

7)
Scientific Reports 13, 12136 (2023)
Identification of metabolic pathways contributing to ER+ breast cancer disparities using a machine-learning pipeline

Santaliz-Casiano, A., et al.

https://doi.org/10.1038/s41598-023-39215-1

Deutenomics quotation(s) from this paper:

"Consistently, other studies also reported a role for free fatty acids in other cancer types including lung64 childhood tumors65, and colon cancer66. Recent studies using biological deuterium fractionation and discrimination points out diet as the main source of increased fatty acid pool in plasma, which is delivered to cells via circulation. Thus, fatty acids act as the intermediate proton carrying carbon source for mitochondrial respiration. Further, generation of ketones using these deuterium-depleted fatty acids might explain benefit of ketogenic diets. Food insecurity and inequality in food quality and availability resulting in metabolic inefficiency might contribute to differential fatty acid profiles in AA vs. NHW women and breast cancer disparities."

8)
Nutrients 15(20), 4360 (2023)
Regulation of tumor apoptosis of poriae cutis-derived lanostane triterpenes by AKT/PI3K and MAPK signaling pathways *in vitro*

Yue, S., et al.

https://doi.org/10.3390/nu15204360

Deutenomics quotation(s) from this paper:

"Moreover, the triterpenoids consist of six isoprenoid (2-methyl-1,3-butadiene) ketone units, whose highly saturated carbon skeleton provides a large number of protons for the production of deuterium-depleted metabolic water by mitochondria. Natural triterpenoids can be used as ketogenic substrates by cells with lower deuterium content than cytoplasmic water, thus aiding mitochondrial NADPH-dependent macromolecular synthesis, including DNA [82]. In fact, it has been demonstrated that deuterium-depleted water inhibits lung tumor growth in vivo by lowering proliferation in the A549 cell line, while enhancing apoptosis [83]. Deutenomics research has also been used to study colorectal cancer. Essential ketogenic branched-chain amino acids are directly converted to succinyl-CoA and acetyl-CoA in mitochondria, where deuterium-depleted proton transfer from nutrients to metabolic substrate water is provided by natural ketogenic substrates. Depletion of deuterium isoforms in nucleotides prevents transformation of colon cells due to cycle arrest [84]. Deuterium depletion caused by the oxidation of natural cellular ketogenic substrates can prevent or reverse the development of breast cancer and is of increasing importance [85]. Studies of biological deuterium fractionation and identification techniques have indicated that

deuterium-depleted fatty acids enter cells through the circulation and act as an intermediate proton carrying carbon source for mitochondrial respiration [86]. Extracellular deuterium depletion may serve as a metabolic therapeutic adjuvant that can be initiated by a diet with depleted water drinking [86,87]. In these subsequent investigations, triterpenes were further examined in vivo for their effect on cancer metabolism-related multiple metabolites and to evaluate the deuterium depletion potential of PAA and PAB during metabolic water formation."

9)
Cancers 16(3), 480 (2024)
Incorporating novel technologies in precision oncology for colorectal cancer: advancing personalized medicine

Ahluwalia, P., et al.

https://doi.org/10.3390/cancers16030480

Deutenomics quotation(s) from this paper:

"This dysfunction involves multiple molecular factors, including impaired proton transfer to metabolic matrix water, leading to less deuterium content. Healthy mitochondria function involves the fundamental function of inhibiting deuterium oncoisotope accumulation inside the healthy cell. The continuous accumulation of deuterium leads to cancer development and holds promise as a prognostic biomarker in multiple cancer studies [166,167]."

10)
Scientific Reports 14, 9702 (2024)
Metabolic imprinting in beef calves supplemented with creep feeding on performance, reproductive efficiency and metabolome profile

Catussi, B.L.C., et al.

https://www.nature.com/articles/s41598-024-60216-1

Deutenomics quotation(s) from this paper:

"Reviewed by Lech et al. [55], the metabolic effects of different feeding regimes in Holstein–Friesian cows post-calving were evaluated, revealing distinct metabolic adaptations in grass-fed versus grain-fed cows. Grass-fed cows had a ketogenic metabolism characterized by lower deuterium content in fatty acid products, while grain-fed cows exhibit elevated deuterium levels due to carbohydrate and protein-rich diets. The metabolic adaptations observed in grain-fed cows, including increased branched-chain amino acids and odd-chain fatty acids, may contribute to conditions like heart failure, diabetes, and obesity. The findings underscore the importance of understanding the metabolic consequences of different feeding practices, particularly regarding deuterium content, which may have implications for disease prevention and management."

11)
Proceedings of the National Academy of Sciences (PNAS-USA) 121(20), May 14, (2024)
Large enrichments in fatty acid $^{2}H/^{1}H$ ratios distinguish respiration from aerobic fermentation in yeast Saccharomyces cerevisiae

Maloney, A.E., et al.

https://doi.org/10.1073/pnas.2310771121

Deutenomics quotation(s) from this paper:

"Most important are the unique deuterium kinetic isotope effects (dKIEs) of different NADP+-reducing enzymes (SI Appendix, Table S1) and variable fluxes through these enzymes due to the operation of different central metabolic pathways (1, 2). Additional metabolic signals in NADPH can derive from the isotope composition of substrate sources of NADPH hydrogen (5), and enzyme-catalyzed exchange of hydrogen on NADPH with that in water and with nicotinamide adenine dinucleotide (NADH) (24–29) (SI Appendix, SI Discussion 1)."

12)
Metabolites 14(11), 600, (2024)
Metabolomics of Papanicolaou tests for the discovery of ovarian cancer biomarkers

Sah, S., et al.

https://doi.org/10.3390/metabo14110600

Deutenomics quotation(s) from this paper:

"Another emerging hallmark of cancer development, including breast, lung, and colorectal cancers, is mitochondrial dysfunction related to perturbations in the concentrations of deuterium in metabolic matrix water [26,27,28]. Previous work carried out by Arima et al. identified dysregulated metabolic pathways via the reduction in levels of alpha-ketoglutarate as well as the elevated concentrations of branched amino acids, including leucine and isoleucine, all in colorectal tumor tissues [27]. The elevations of these amino acids and their degraded metabolites of acetyl-CoA and succinyl-CoA point to mitochondrial dysfunction and hindered the transfer of protons to metabolic matrix water [29]. This lack of deuterium transfer to the metabolic matrix water leads to the continuous accumulation of deuterium within cells, which has been found to lead to cancer development [29]."

13)

Advances in Colloid and Interface Science 338, (11), 103401, (2025)

The endothelial surface layer-glycocalyx - Universal nano-infrastructure is fundamental to physiology, cell traffic and a complementary neural network

Ninham, B.W., et al.

https://doi.org/10.1016/j.cis.2025.103401

Deutenomics quotation(s) from this paper:

"Some very surprising things pop up. Among these the glycocalyx emerges from its metaphorical chrysalis as a complementary neural network and the trace amounts of deuterium in natural water seem to be a determinant of chirality."

"The GC responds similarly to any changes in local environmental conditions – from salt ion levels, dissolved gas types and concentrations, to deuterium levels to the presence of drugs and/or hormones. These physical changes in structure alter the function of the ESL-GC complex."

"For Nafion, and worthy of notice, the exclusion zone and bulk structure are quite different for deuterium depleted water and natural water (156 ppm deuterium)."

"It also ensures correct functioning of the GC in providing ion transport to propagate electrical impulses required for normal physical and mental function. [3] shows that deuterium levels (156 ppm natural water) affect chirality. They are a critical determinant of the structure of the exclusion zone of the sulphated polymer Nafion. (It is similar to the GC). The same sensitivity, with reduced levels likely to impair function should occur with the GC. This been observed as found in [184] with low levels of deuterium corelated to increased rates of depression, along with other implications. [185]."

"Again, lithium is different. Similarly, there are striking effects that occur with the dye bromothymol blue (it has a sulphonate group) with Na vs Li, with degassing, and very surprisingly with deuterium [66]."

"All figures show strong dependences on deuterium content. That deuterium at such low naturally occurring concentrations has any role is astonishing. This phenomenon together with the ideas of Scolnik on para vs ortho magnetic forms of water may provide the key to the origins of chirality [66,198,199]. It is in any event unexpected that naturally occurring deuterium (156) ppm is essential to the existence of the EZ and ESL-GC complex see also [3,113,184,200,201]."

14)
Advances in Colloid and Interface Science 338, (11), 103401, (2025)
Metabolic Profiling of Distinct TP53-Mutant Esophageal Adenocarcinoma Models Reveals Different Bioenergetic Dependencies

Cataldi-Stagetti, E., et al.

https://doi.org/10.3390/ijms26146869

Deutenomics quotation(s) from this paper:

"The recent literature [41,42,43,44] supports the notion that mitochondrial insufficiency in tumors such as colorectal, lung, and breast cancers is closely linked with dysregulation of deuterium content in metabolic water. In this scenario, the deutenome profiling [45] may serve as a diagnostic strategy, offering a novel tool through which to interpret metabolic changes in epithelial malignancies."

15)
International Journal of Molecular Sciences 26(21), 10626, (2025)
Transcriptomic Insights into Late-Life Depression and the Role of Environmental Drinking Water Composition: A Study on 18-Month-Old Mice

Costa-Nunes, J.P., et al.

https://doi.org/10.3390/ijms262110626

Deutenomics quotation(s) from this paper:

"Deuterium-depleted water (DDW, 90–100 ppm) stabilizes oxidative metabolism and reduces mitochondrial stress, whereas elevated deuterium levels can be harmful [57,58,59]. Differentiated PC12 cells treated with 50–100 ppm DDW prior to hydrogen peroxide exposure showed improved viability, reduced apoptosis, and enhanced antioxidant defenses [60], which was further confirmed in cancer cell lines [61,62,63]. Systemic in vivo studies have revealed the sound anti-diabetic effects of DDW (125 ppm) in rats [64] and DDW (104 ppm) in humans [65]. Deuterium most profoundly affects basic cellular processes, such as membrane fluidity and receptor dynamics, influencing neurotransmitter release and synaptic transmission [52,53]. Increased membrane viscosity may slow neurotransmitter turnover, contributing to MDD [66]. In mice, DDW with the lowest deuterium content available in nature (~90 ppm) reduced behavioral despair and anhedonia and also normalized key factors of MDD development [67,68], improving REM sleep, increasing hippocampal neurogenesis, and SERT expression [47]."