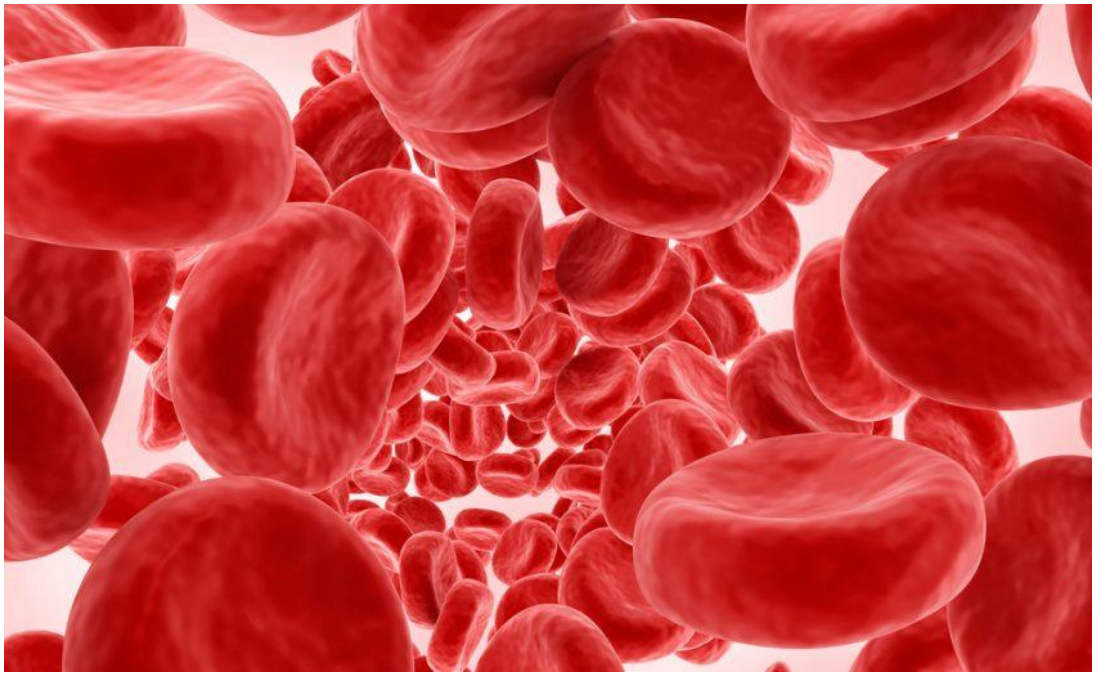


The Mysteries of Kryptopyrroluria
Part 2, 20th Nov. 2024

Gilian Crowther MA (Oxon), FBANT, mNNA, mANP, CNHC reg.

AONM Director of Research

Agenda

- **Brief recap: What is Kryptopyrroluria?**
- Testing
- Therapies
  - Substituting the deficient nutrients
  - Detoxifying the tissues
  - Giving the organism access to bioavailable copper
  - Factoring in mitochondrial support
- Other resources

What does the word “Kryptopyrroluria” mean?

Krypto = hidden, invisible
Pyrrole = a chemical substance involved in the formation of heme
Uria = excreted in the urine

“undetected, abnormally increased excretion of pyrroles in the urine”

Different terms used over the years: KPU, HPU*, Pyrroluria, Pyroluria, “The Mauve Factor”, Malvaria

* While HPU is characterized by a disorder in the production of heme, KPU is characterized by a disorder in the breakdown of heme. In HPU, the urine is analyzed for the presence of the hemopyrrolactam complex (HPL). In the case of KPU, the total pyrrole compounds found in urine are measured.

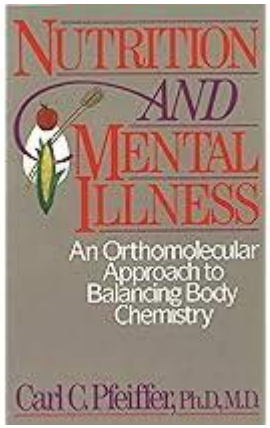
Discovery of the “Mauve Factor” in the early 1960s

Kryptopyrroluria is a condition that was discovered back in the early 1960s, when Drs. Abram Hoffer, Donald Irvine and Carl C. Pfeiffer detected a compound in the urine of psychiatric patients that Hoffer termed the “Mauve factor” due to its appearance on the chromatograms used in its analysis.

Dr. Pfeiffer found that a considerable percentage of patients labelled schizophrenic were suffering from an excess of this mauve factor in their urine, also termed Kryptopyrroles

In Pyrroluria, pyrroles bind with B_6 and then with zinc, thus depleting these nutrients, and often others too, especially manganese

“Approximately 15-30% of "schizophrenics" have pyroluria.” *(Quotation from Nutrition and Mental Illness by Curt C. Pfeiffer)*



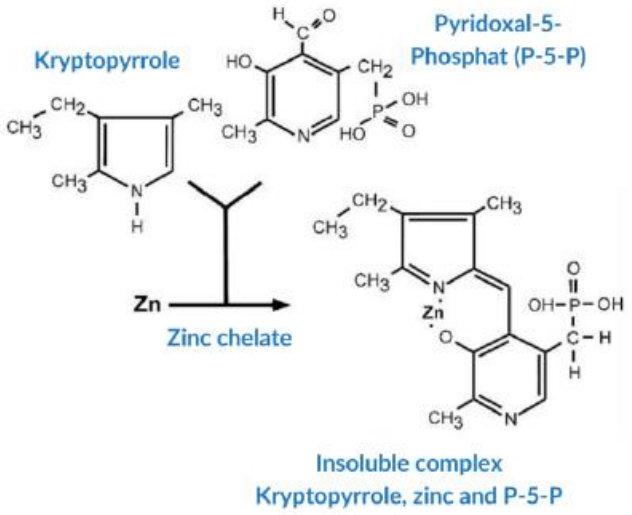
Source: Hoffer A. The discovery of kryptopyrrole and its importance in diagnosis of biochemical imbalances in schizophrenia and in criminal behavior . *J Orthomol Med*. 1995;10 (1):3-6; McGinnis WR, Audhya T, Walsh WJ, Jackson JA, McLaren-Howard J, Lewis A, Lauda PH, Bibus DM, Jurnak F, Lietha R, Hoffer A. Discerning the Mauve Factor, Part 1. Altern Ther Health Med. 2008 Mar-Apr;14(2):40-50; https://www.walshinstitute.org/uploads/1/7/9/9/17997321/discerning-mauve-factor-part-1-galley-feb-2008.pdf; https://psychrights.org/Articles/29medicalcausesofsz.htm; https://isom.ca/wp-content/uploads/2020/01/JOM_1974_03_4_11_Treatment_of_Pyroluric_Schizophrenia_Malvaria.pdf

The laboratory explanation of what they find

"2,4 dimethyl-3-ethylpyrrole is a byproduct of haemoglobin synthesis. It has been found that circulating kryptopyrrole forms a Schiff base with the aldehyde form of vitamin B6 (pyridoxal 5 phosphate) in the blood. This combination then binds with zinc and builds an insoluble complex. **As large amounts of kryptopyrroles are excreted in the urine, it depletes the blood of vitamin B6 and zinc."**[2]

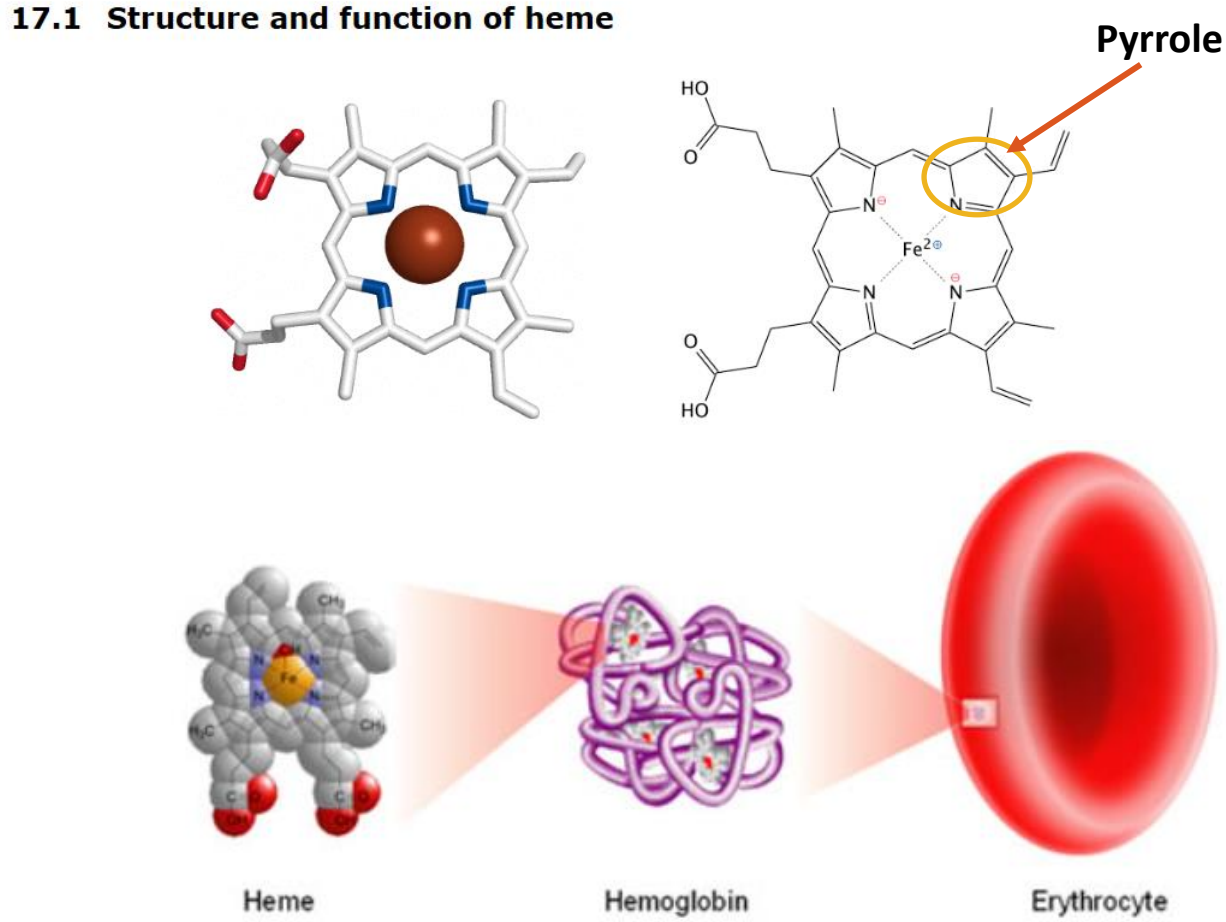
.

"You are peeing out an improperly synthesized heme molecule" *Dr. Dietrich Klinghardt**



Source: KPU/HPU häufige, aber verkannte Mitochondrienstörungen, 3rd edition 2018, Kyra Kauffmann, Sascha Kauffmann;
2. https://www.immundiagnostik.com/en/portfolio/testkits/kr7823/method:others; * https://www.youtube.com/watch?v=THZhANfFnyY

Pyrroles form the “scaffolding” of heme



One typical red blood cell contains about 270 million hemoglobin molecules, each carrying four heme groups, each with four pyrroles*

Source: 1. https://www.sciencedirect.com/topics/chemical-engineering/porphyrin#:~:text=Porphyrins%20are%20a%20class%20of, regions%20of%20the%20electromagnetic%20spectrum; 2. **http://watcut.uwaterloo.ca/webnotes/Metabolism/Iron.html; ***https://bionumbers.hms.harvard.edu/bionumber.aspx?s=n&v=8&id=102740#:~:text=A%20typical%20erythrocyte% 20contains%20about,each%20carrying%20four%20heme%20groups; 2. http://watcut.uwaterloo.ca/webnotes/Metabolism/Iron.html; 3. https://www.ncbi.nlm.nih.gov/books/NBK2263/#:~:text=Every%20second%2C%202%2D3%20million,containing%204%2D6%20million%20cells.

KPU can cause so many knock-on effects: appearance/ energy/detoxification (just a selection of examples*)

► **Physical appearance:** Pale, sallow skin, pale lips, "China doll face" ("Indigo child"), pruritis either in certain areas or all over (anal pruritis is particularly prevalent in children); light intolerance, rash in sunlight, yellowish-brown pigmentation after being in the sun, slight puffiness of the face, especially around the cheeks and eyes. Dark rings around the eyes, eyes sunk deep into their sockets; soft gums; striae on the skin similar to stretch marks; white spots on the nails (leukodynia), sometimes hair loss, acne, eczema and dandruff; poor tooth enamel

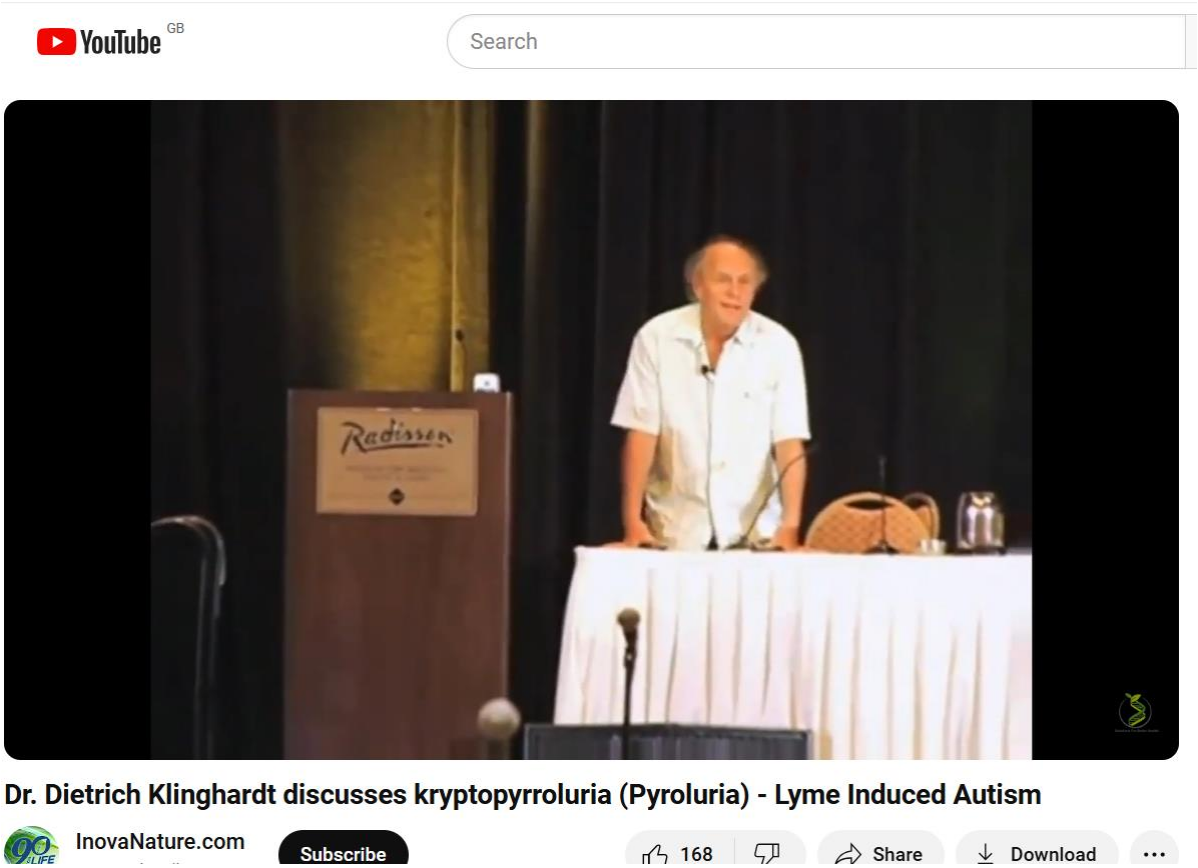
► **Impaired energy production:** Fatigue, may be severe – M.E., fibromyalgia, and all the further downstream effects of hypoxia, including **anaemia**

► **Detoxification issues** because Cytochrome P450 mono-oxygenases in Phase 1 also contain heme. Environmental toxins build up as a result, medications cannot be properly metabolised, etc. Common result: multiple chemical sensitivity (MCS) and medication intolerances.

- **Please see Part 1 for further details: https://aonm.org/kpu-webinar/**

Source: Strienz, Joachim: Leben mit KPU – *Kryptopyrrolurie, Ein Ratgeber für Patienten,* Germe-ring/München 2011 (Living with KPU –Kryptopyrroluria, in German); KPU/HPU häufige, aber verkannte Mitochondrienstörungen, 3rd edition 2018, Kyra Kauffmann, Sascha Kauffmann

Excellent Youtube video of Dr. Klinghardt's on this topic



"I suspect that more than 80% of kids have this condition, and should be treated for it properly"

Source: https://www.youtube.com/watch?v=THZhANfFnyY

Extensive article on KPU by Dr. Klinghardt and Scott Forsgren, in the Townsend Newsletter

TOWNSEND LETTER

The Examiner of Alternative Medicine

HOME E-LETTER PRINT ISSUES TOWNSEND LETTER BLOG INDEX CALENDAR OF EVENTS

Kryptopyrroluria (aka Hemopyrrollactamuria) 2017 A Major Piece of the Puzzle in Overcoming Chronic Lyme Disease

Subscribe to our FREE e-letter

CLICK HERE to request the e-Letter!

Click here to donate and support the e-Letter

by Scott Forsgren, FDN-P and Dietrich Klinghardt, MD, PhD

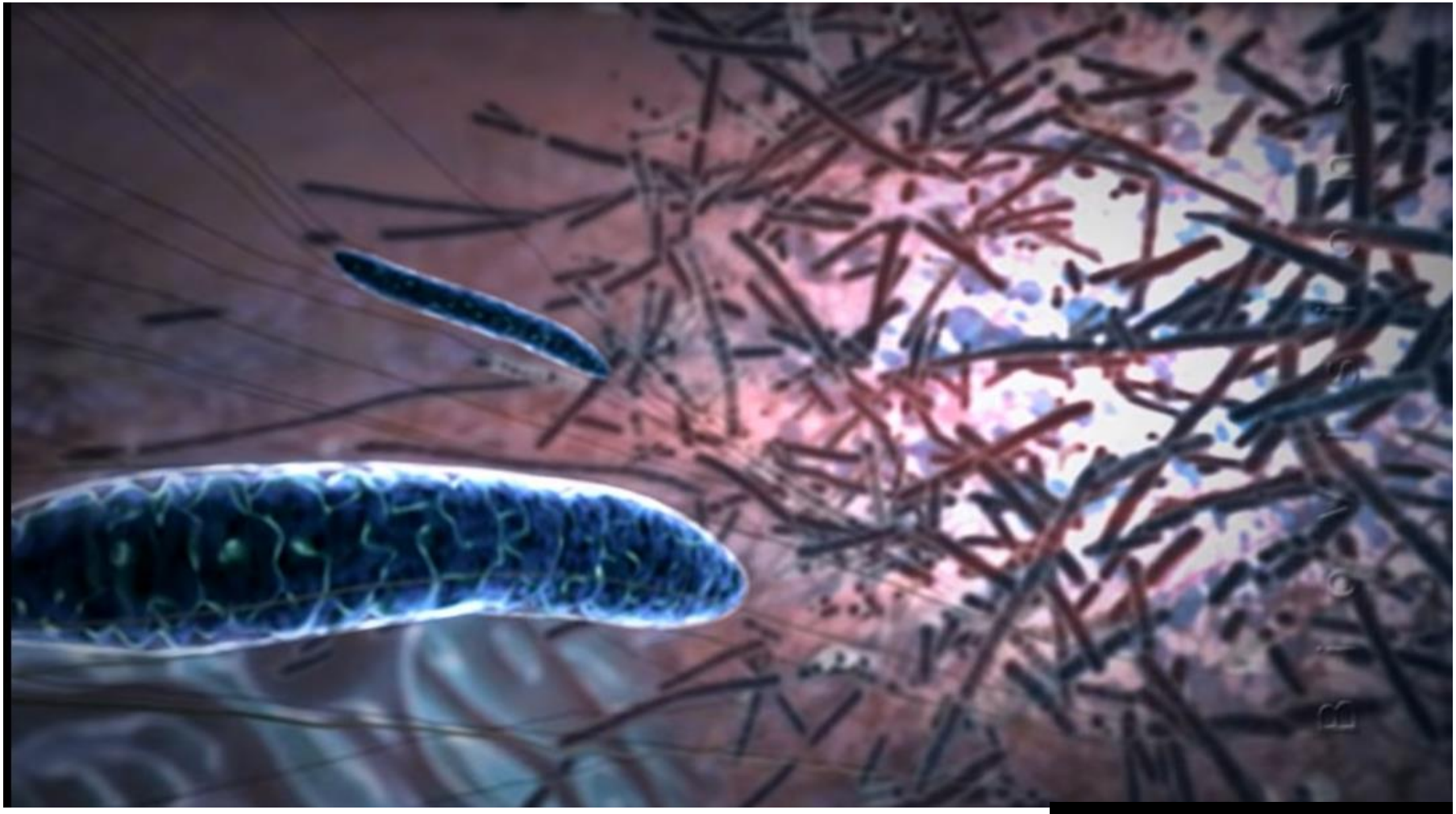
Dietrich Klinghardt, MD, PhD, is a practicing physician with a focus on the treatment of chronic neurological conditions such as Lyme disease, autism, and CFIDS. In the years that he has treated patients with chronic

Subscribe to the Townsend Letter

"Dr. Klinghardt has found **the incidence of KPU in Lyme disease to be 80% or higher**; in patients with heavy metal toxicity (lead, mercury, aluminum, cadmium, and others) over 75%; and in children with autism over 80%. These are very significant percentages of the patient population with chronic illness that may benefit from a treatment program that addresses KPU. Healthy controls do not test positive for KPU."

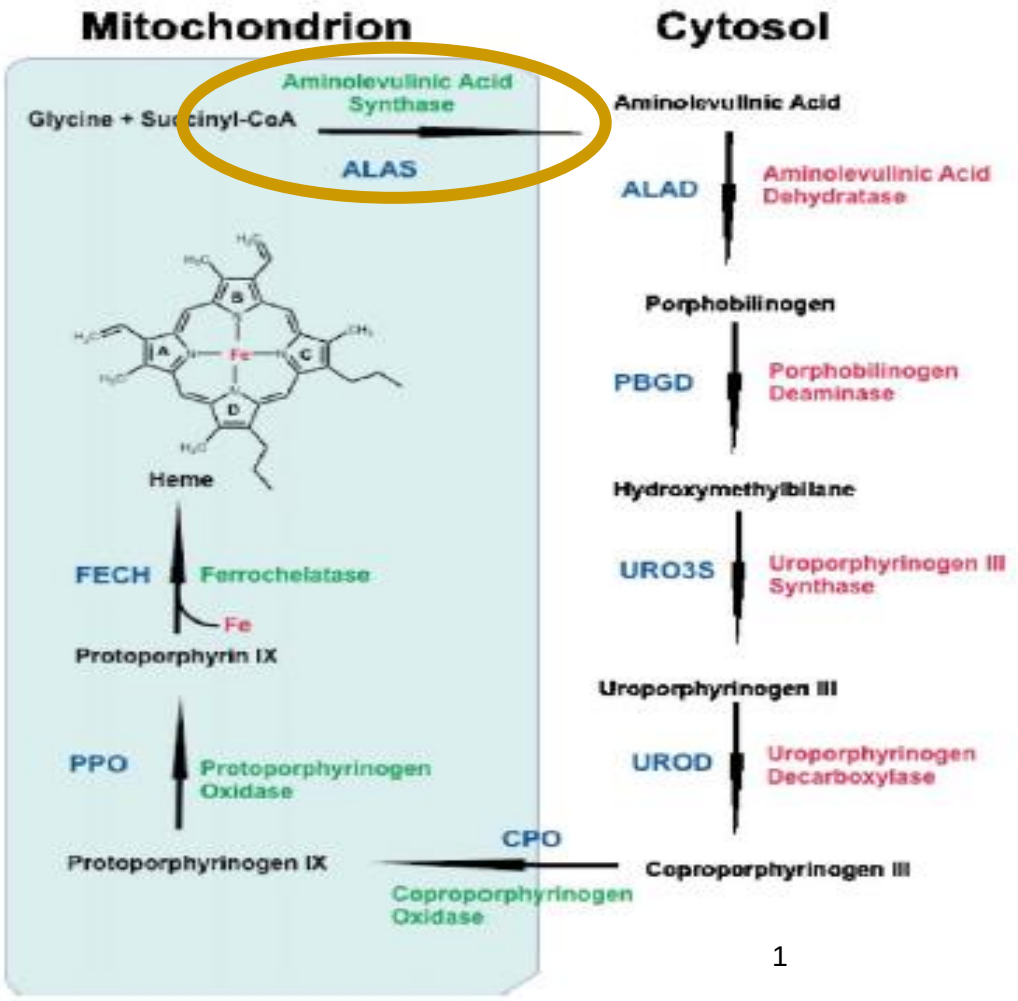
Source: Kryptopyrroluria (aka Hemopyrrollactamuria) 2017: A Major Piece of the Puzzle in Overcoming Chronic Lyme Disease *by Scott Forsgren, FDN-P and Dietrich Klinghardt, MD, PhD, https://www.townsendletter.com/July2017/krypto0717.html; http://cinak.com/editions/articles_eng/hpu%202009.pdf*

Key steps in the synthesis of heme take place in our mitochondria ...



Biovisions Powering the Cell, Mitochondria, biovisions.mcb.harvard.edu
https://www.youtube.com/watch?v=RrS2uROUjK4

… the synthesis of Aminolevulinic acid is the first



1

"Heme biosynthesis starts in mitochondria with the condensation of succinyl Co-A from the citric acid cycle and an amino acid glycine. They combine to produce a key heme intermediate, 5'-aminolevulinic acid (ALA) in mitochondria **catalyzed by the pyridoxal phosphate-requiring (vitamin B6) enzyme**, aminolevulinic acid synthase (ALAS). This reaction is the rate-limiting step in the pathway."[2]

Source: 1. Ajioka, RS et al, The Biosynthesis of Heme in Mammals. Biochimica et Biophysica Acta 1763 (2006) 723–736; Kuklinski, B. Cryptopyrroluria, nitrosative stress and mitochondrial disease; 2. https://www.ncbi.nlm.nih.gov/books/NBK537329/

Found in families; both a primary and a secondary form exist

Primary: Can be inherited – watch for it in families
Genetic as the primary form
Secondary: Secondary acquired KPU[1]

Therapists report finding it more commonly in women and children than in males[2]

"The physician Carl Pfeiffer, MD, the discoverer of KPU, estimated that more than 10% of the population is affected by KPU."[3] *(Quotation Dr. Curt C. Pfeiffer – many years ago so may be higher now for reasons that will be explained)*

Source: 1. KPU/HPU häufige, aber verkannte Mitochondrienstörungen, 3rd edition 2018, Kyra Kauffmann, Sascha Kauffmann; 2. https://www.drcarrierigoni.com.au/blog/pyrroles-disorder; 3. https://www.galaxus.de/en/s12/product/kpuhpu-common-but-unrecognized-mitochondrial-disorders-kyra-kauffmann-sascha-kauffmann-german-refere-8221719; https://www.drlamcoaching.com/adrenal-fatigue/complications/pyroluria-afs/

Agenda

- Brief recap: What is Kryptopyrroluria?
- **Testing**
- Therapies
  - Substituting the deficient nutrients
  - Detoxifying the tissues
  - Giving the organism access to bioavailable copper
  - Factoring in mitochondrial support
- Other resources

Simple urine collection

First morning urine is the test producer's suggestion

The test producer does not specify that one should stop taking the minerals/ vitamins one may be deficient in, but if you can, it would be best to discontinue them for a period of time if you can – Dr. Klinghardt suggests 5 days*

* https://www.youtube.com/watch?v=THZhANfFnyY

Extensive lab report with 7 pages

ACADEMY OF NUTRITIONAL MEDICINE

Kryptopyrroluria

Lab Report

Your lab result

As requested, we have analysed the kryptopyrroles in your urine sample for possible kryptopyrroluria (KPU). Below you will find your result and important information to help you better understand your health and take corrective measures if necessary.

NAME:

ANALYSIS	RESULT
Kryptopyrroles in urine	325,3 ng/ml

Interpretation: The concentration of kryptopyrroles in your urine is ***elevated***

Kryptopyrroles in urine < 150 ng/ml = normal

Kryptopyrroles in urine ≥ 150 ng/ml = elevated

Symptoms

The symptoms associated with KPU can vary among individuals and may be nonspecific, but common symptoms may include:

- **Neurological symptoms**
  - Memory issues and difficulty concentrating
  - Brain fog or mental confusion
  - Mood swings, anxiety, and depression
  - Irritability and emotional instability
  - Sleep disturbances and insomnia
- **Digestive issues**
  - Abdominal pain or discomfort
  - Nausea and vomiting
  - Diarrhea or constipation
  - Poor appetite or food sensitivities
- **Fatigue and weakness**
  - Chronic fatigue and low energy levels
  - Muscle weakness and reduced stamina
- **Skin problems**
  - Sensitivity to sunlight (photosensitivity)
  - Skin rashes or acne
  - Dry or itchy skin
- **Musculoskeletal symptoms**
  - Joint pain and stiffness
  - Muscle pain and cramps
- **Immune system disturbances**
  - Frequent infections or weakened immune response
- **Sensitivity to sensory stimuli**
  - Sensitivity to light, noise, or odours

Note: It's important to note that these symptoms are not specific to KPU and can overlap with various other medical conditions. Additionally, not everyone with KPU will experience all of these symptoms, and the severity can vary significantly among individuals.

Webpage on the AONM website with all the details

https://aonm.org/kryptopyrroluria-testing/

kiweno

TEST REQUISITION

Kryptopyrroluria (KPU) Testing

ACADEMY of NUTRITIONAL MEDICINE

PATIENT INFORMATION		BARCODE (Lab use only)	Please send results to: ☐ myself ☐ my practitioner
Patient FIRST NAME*:			**PRACTITIONER INFORMATION**
Patient SURNAME*:			Dr. / Practitioner name:
DATE OF BIRTH (DD/MM/YYYY)*:		Time sample taken*:	Clinic:
Sex* (please circle): male female		Date sample taken (DD/MM)*:	Street Address:
Street Address:		Material/Quantity ☐ Urine	
Postcode:	City:		Postcode: City:
County:	Country:		County: Country:
Tel no:		**AONM HELPLINE: +44 (0) 3331 210 305**	Tel no:
Email*:			Email:

TEST NUMBER	NAME	SAMPLE TYPE	PRICE
☐ KPU1	Kryptopyrrole Test	Urine	£98

Agenda

- Brief recap: What is Kryptopyrroluria?
- Testing
- **Therapies**
  - **Substituting the deficient nutrients**
  - **Detoxifying the tissues**
  - **Giving the organism access to bioavailable copper**
  - **Factoring in mitochondrial support**
- Other resources

Lots of food sources of course, too – but difficult to reach supraphysiological doses with foods

Box 2: Food sources of B6, zinc and manganese

Some good sources of B6:

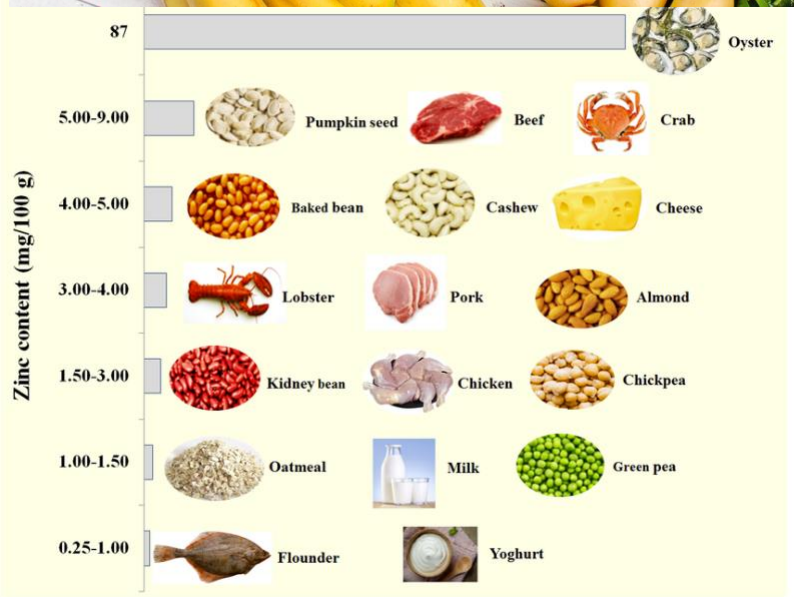
Chicken	Hazelnuts	Potatoes
Tuna	Pinto beans	Sardines
Walnuts	Halibut	Brussel sprouts
Salmon	Avocados	Cod
Lentils	Chestnuts	Sweet potatoes
Lima beans	Kale	Cauliflower
Blackeyed peas	Whole grain rye	Red cabbage
Brown rice	Spinach	Leeks

Some rich food sources of zinc:

Oysters	Lima beans	Shrimp
Ginger roots	Almonds	Turnips
Pecans	Walnuts	Black pepper
Split peas	Clams	Paprika
Whole grain wheat	Tuna	Chili powder
Whole grain rye	Haddock	Thyme
Whole grain oats	Green peas	Cinnamon

Some food sources of manganese:

Wheat germ	Brussel sprouts	Grapefruit
Green leafy vegetables	Blueberries	Apricots
Spinach	Oranges	Kelp



https://aonm.org/kryptopyrroluria-the-elephant-in-the-room/; https://nutritionsource.hsph.harvard.edu/vitamin-b6/; https://www.researchgate.net/figure/Examples-of-foods-rich-in-zinc-data-obtained-from-NIH2021_fig1_363278687

Various KPU remedy combinations have been formulated

Source: https://www.kiscience.com/?s=CORE&post_type=product&product_cat=0; *:* https://naturaldispensary.co.uk/products/Pro_Krypto_Balance_60_s-9999374-0.html

The bioflavonoid Quercetin acts as an ionophore

"In addition to all of these impressive supportive functions and applications, quercetin's most impressive quality may be its established zinc ionophore activity. As mentioned, an ionophore is a compound that can transport ions like zinc across cell membranes. As zinc regulates immune cell function, this may be able to decrease the replication of RNA viruses."*

Sophora Japonica: high in quercetin

*Source: * https://www.avivahealth.com/blogs/articles/ionophores; https://www.kiscience.com/product/broccoli-synergy-powders/*

Symptoms: Neurological/neuropsychiatric, thyroid, immune

► **Neurological issues**, often labelled psychiatric: Memory and concentration difficulties, problems with short-term memory, "brain fog", poor dream recall (B 6 dependent!), low mood, fear, panic attacks, withdrawal from social activities, hallucinations, apparent schizophrenia/ psychosis, ADHD, due partly to lack of B6 and zinc metabolism causing low serotonin, adrenalin and dopamine levels. Animal experiments have also shown that injecting rats, cats and guinea pigs with free pyrroles leads to severe neurological disorders.

Neurological support?

► **Hyperactivity, behavioural disorders** – typical signs of KPU crossover with PANS/PANDAS

► **Thyroid disorders:** Hypothyroidism, Hashimoto's thyroiditis (oxygen and zinc deficiency)

Thyroid support?

► **Immune disorders** as the synthesis of proteins is B6-dependent, which even means you cannot form antibodies properly because they are formed from amino acids

Immune support?

Source: Strienz, Joachim: Leben mit KPU – *Kryptopyrrolurie, Ein Ratgeber für Patienten,* Germe-ring/München 2011 (Living with KPU – Kryptopyrroluria, in German); KPU/HPU häufige, aber verkannte Mitochondrienstörungen, 3rd edition 2018, Kyra Kauffmann, Sascha Kauffmann; Cutler MG, Douglas JM, Graham DJM, Moore MR. The mauve factor of porphyria, 3-ethyl-5-hydroxy-4, 5-dimethyl-delta-3-pyrroline-2-one: Effects on behaviour of rats and mice. *BCPT (Basic & Clinical Pharmacology & Toxicology.* 1990;**66**(1):66–68.

If psychiatric symptoms, niacin/niacinamide is sometimes added …

► **KPU can cause neurological issues**, often labelled psychiatric: Memory and concentration difficulties, problems with short-term memory, "brain fog", poor dream recall (B6 dependent!), low mood, fear, panic attacks, withdrawal from social activities, hallucinations, apparent schizophrenia/ psychosis, ADHD, due partly to lack of B6 and zinc metabolism causing low serotonin, adrenalin and dopamine levels. Animal experiments have also shown that injecting rats, cats and guinea pigs with free pyrroles leads to severe neurological disorders.[1]

tryptophan=======(B6 + Zinc)=========>>>serotonin

The precursor of serotonin is the amino acid L-Tryphophan. Tryptophan needs to metabolised in the stomach by stomach acid (HCl), which also requires B6 and zinc, as well as B3 (niacin/niacinamide)

Source: 1. Cutler MG, Douglas JM, Graham DJM, Moore MR. The mauve factor of porphyria, 3-ethyl-5-hydroxy-4, 5-dimethyl-delta-3-pyrroline-2-one: Effects on behaviour of rats and mice. *BCPT (Basic & Clinical Pharmacology & Toxicology.* 1990;**66**(1):66–68; https://www.drjamiedougall.com/2019/01/07/serotonin-synthesis;

… GABA* too

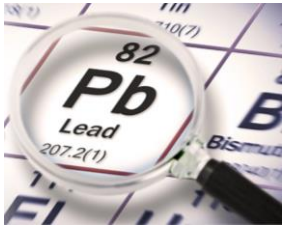
L-glutamine is the precursor to glutamate, which is converted to GABA. However L-glutamine needs B6 for conversion in the stomach via HCl, as well as zinc
Glutamate decarboxylase is needed for conversion of glutamate to GABA, and this also requires B6

* gamma-aminobutyric acid

Heavy metal detox is crucial

Over 300 enzymes in the body are zinc-dependent
When Zn is being excreted so that the organism is close to Zn-free, other bivalent metals are used in their place:
Cadmium
Lead
Aluminium
Mercury
When you start resubstituting Zn, these heavy metals are knocked off and the KPU sufferer can become acutely toxic

So it is very important to prepare a really effective detox strategy



Source: https://www.youtube.com/watch?v=THZhANfFnyY

Support the kidneys, already doing such a heavy job excreting the pyrroles (1/2)

Parsley: An Impressive Herb With Health Benefits

Nutrition | Blood Sugar | Heart Health | Kidney Health | Other Benefits | Uses | Storage | Bottom Line

Parsley is rich in antioxidants and vitamins A, K, and C. It helps keep blood sugar steady and supports cardiovascular, renal, and skeletal health.

Petroselinum

Organic Juniper -

Juniper supports kidney health by acting as a natural diuretic, which can help increase urine output and remove excess fluid from the body. It also contains natural compounds that have been shown to help flush toxins out of the body.

Organic Horsetail -

Horsetail has been traditionally used to support kidney health due to its diuretic properties, which can help increase urine output and flush out toxins from the body. This herb is also rich in minerals like silicon, potassium, and magnesium, which are essential for maintaining healthy kidney function.

Organic Hydrangea -

Hydrangea helps to dissolve and flush out mineral deposits that can accumulate in the kidneys and urinary tract. It contains natural compounds that help break down these deposits and make them easier to eliminate from the body.

Source: https://lifeoptions.org/learn-about-kidney-disease/slowing-kidney-disease/?gad_source=1&gclid=Cj0KCQjwsc24BhDPARIsAFXqAB2s92YS1yHLGI-PibrFLnPt1ygM74bebySVFRtsljercGdY62yyutMaAoZEEALw_wcB; https://globalhealing.com/products/kidney-health?srsltid=AfmBOoqiaVszExYtfZOAM1Y6vTB1lb7t2KuhmuaoaVQlmW6YcUUqZqaB; https://www.healthline.com/nutrition/parsley; https://www.kiscience.com/product/petroselinum-support-powder/

Support the kidneys, already doing such a heavy job excreting the pyrroles (2/2)

How does wild garlic detoxify?

Wild garlic is very often part of detoxification cures. The combination of vitamin C, chlorophyll, sulphur and many other plant substances typical of wild garlic has a detoxifying effect. They all support the elimination of toxins, heavy metals and carcinogens.

In alternative medicine, the plant plays a major role, especially in detoxification according to Dr. Klinghardt. In the protocol developed by the German doctor, it is used in combination with coriander and chlorella algae to detoxify heavy metals (and here especially mercury). (*F (13)

According to Dr. Klinghardt, the plant can dissolve heavy metals (and other toxins) from the connective tissue, so that they can then be excreted via the kidneys. Chlorella algae also dissolve toxins and then bind them in the intestine.

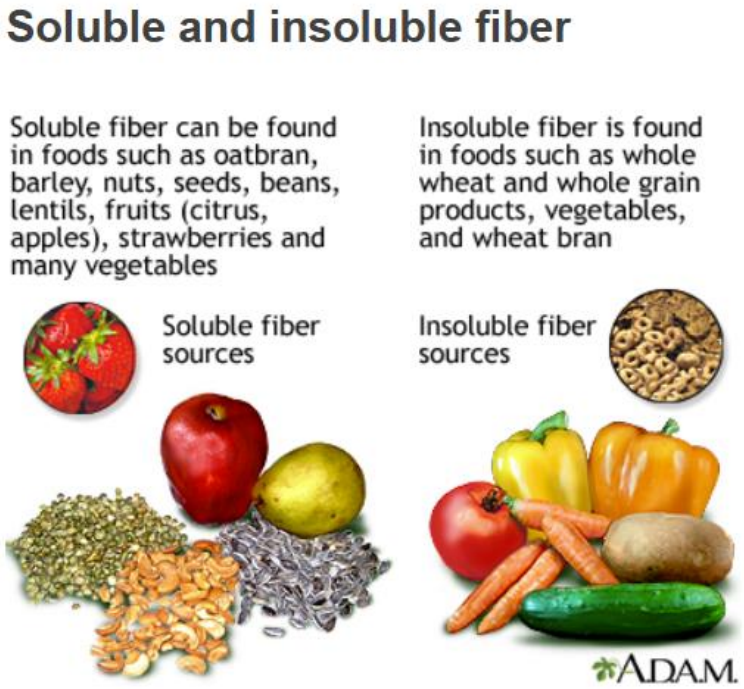
Wild garlic and chlorella form the basic therapy for detoxification according to Dr. Klinghardt. Only when the connective tissue has been detoxified with wild garlic and chlorella (which can take years) should coriander be integrated, which in turn should be able to detoxify the central nervous system and even the bones.

Source: https://www.zentrum-der-gesundheit.de/ernaehrung/lebensmittel/kraeuter /baerlauch#wann_kann_man_brlauch_ernten; https://www.kiscience.com/product/renolo/

Use binders/fibre to make sure the heavy metal detox is via the stool and not the kidneys

Chlorella
Zeolite
Modified Citrus Pectin/Alginates

Plentiful sources of fibre:



Source: https://www.kiscience.com/?s=Chlorella&post_type=product&product_cat=0; https://www.kiscience.com/?s=Zeolite&post_type=product&product_cat=0; https://medlineplus.gov/ency/imagepages/19531.htm

Chlorella and metal binding

Cadmium

Hagino et al.: Effect of chlorella on fecal and urinary cadmium excretion in Itai-itai. Jap. J. Hyg. 30: 77, 4/1975

Nagano, T./Suketa, Y., et al.: Absorption and excretion of chlorella ellipsoidea cadmium-binding protein and inorganic cadmium in rats. Jpn. J. Hyg., 38: 741-747, 1983

Carr, H.P., Carino, F.A., et al.: Characterization of the cadmium-binding capacity of chlorella vulgaris. Bull. Environ. Contam. Toxicol., 60: 433-440, 1998

Uranium

Horikoshi, T./ Nakajima, A., et al.: Uptake of uranium by various cell fractions of chlorella vulgaris. Radioisotopes 28: 485-488, 1979

Nakajima, A; Horikoshi, T; Sakagushi, T.: Recovery of uranium by immobilised micro-organisms. Evr. J. Appl. Microbiol. Biotech, 16: 88-91, 1982.

Lead

Protective effects of chlorella vulgaris in lead exposed mice infected with Listeria monocytogenes M.Queiroz et al International Immunopharmacology 3 (2003) 889-900

Mercury

Shieh, Y.J.; Barger, J: Uptake of mercury by chlorella and its effect on potassium regulation. Planta, 109: 49-60, 1973

Klinghardt,D. :Algenpraeparat hilfreich bei der Amalgamausleitung Erfahrungsheilkunde Band 48, Heft 7, Juli 1999

D.Klinghardt and J. Mercola: Mercury toxicity and systemic elimination agents D.Klinghardt and J. Mercola, J of Nutritional and environmental Medicine (2001) 11, 53-62

Parachlorella beyerinckii CK-5 is found to accelerate excretion of methyl-mercury both into feces and urine: "Japan Society for Bioscience, Biotechnology and Agro-chemistry"(JSBBA: http://www.jsbba.or.jp) Meeting in Nagoya City, Japan, March 29~30, 2008 .

Source: https://www.youtube.com/watch?v=THZhANfFnyY

Both Salvia sclarea and Salvia officinalis (Sage) have protective mechanisms against Cadmium

ELSEVIER

Ecotoxicology and Environmental Safety

Volume 209, February 2021, 111851

Cadmium toxicity in *Salvia sclarea* L.: An integrative response of element uptake, oxidative stress markers, leaf structure and photosynthesis

Anelia G. Dobrikova [a], Emilia L. Apostolova [a], Anetta Hanć [b], Ekaterina Yotsova [a], Preslava Borisova [a], Ilektra Sperdouli [c], Ioannis-Dimosthenis S. Adamakis [d], Michael Moustakas [e]

Show more

> Environ Sci Pollut Res Int. 2021 Dec;28(48):68498-68512. doi: 10.1007/s11356-021-15407-y. Epub 2021 Jul 17.

Bioactive phytochemicals from Salvia officinalis attenuate cadmium-induced oxidative damage and genotoxicity in rats

Hanan M Rashwan [1], Hagar E Mohammed [1], Aziza A El-Nekeety [2], Zeinab K Hamza [2], Sekena H Abdel-Aziem [3], Nabila S Hassan [4], Mosaad A Abdel-Wahhab [5]

Affiliations + expand

PMID: 34275073 DOI: 10.1007/s11356-021-15407-y

Abstract

This study was conducted to identify the bioactive phytochemicals in Salvia officinalis essential oil, to determine the polyphenols in the aqueous extract (SOE), and to evaluate their protective role against cadmium (Cd)-induced oxidative damage and genotoxicity in rats. Six groups of female rats were

"It could be concluded that S. officinalis is a promising source for bioactive compounds with therapeutic benefits against environmental toxicants."[2]

Source: 1. Dobrikova AG et al. Cadmium toxicity in Salvia sclarea L.: An integrative response of element uptake, oxidative stress markers, leaf structure and photosynthesis. Ecotoxicol Environ Saf. 2021 Feb;209:111851; 2. Rashwan HM, Mohammed HE, et al Bioactive phytochemicals from Salvia officinalis attenuate cadmium-induced oxidative damage and genotoxicity in rats. Environ Sci Pollut Res Int. 2021 Dec;28(48):68498-68512. .

Melatonin can help prevent cadmium-induced toxicity

› Commun Biol. 2023 Feb 8;6(1):157. doi: 10.1038/s42003-023-04533-7.

Melatonin protects against cadmium-induced oxidative stress via mitochondrial STAT3 signaling in human prostate stromal cells

Moonjung Hyun [# 1], Hyejin Kim [# 1], Jehein Kim [1], Juhong Lee [1], Ho Jeong Lee [1], Laxmi Rathor [2], Jeremy Meier [3], Andrew Larner [4], Seon Min Lee [1], Yeongyu Moon [1], Jungil Choi [1], Sung Min Han [5], Jeong-Doo Heo [6]

Affiliations + expand

PMID: 36750754 PMCID: PMC9905543 DOI: 10.1038/s42003-023-04533-7

Abstract

Melatonin protects against Cadmium (Cd)-induced toxicity, a ubiquitous environmental toxicant that causes adverse health effects by increasing reactive oxygen species (ROS) production and mitochondrial dysfunction. However, the underlying mechanism remains unclear. Here, we demonstrate that Cd exposure reduces the levels of mitochondrially-localized signal transducer and activator of transcription 3 (mitoSTAT3) using human prostate stromal cells and mouse embryonic fibroblasts. Melatonin enhances mitoSTAT3 abundance following Cd exposure, which is required to attenuate ROS damage, mitochondrial dysfunction, and cell death caused by Cd exposure. Moreover, melatonin increases mitochondrial levels of GRIM-19, an electron transport chain component that mediates STAT3 import into mitochondria, which are downregulated by Cd. In vivo, melatonin reverses

"Melatonin can help prevent cadmium-induced toxicity by increasing the levels of mitoSTAT3 and GRIM-19 in mitochondria. These proteins help to reduce mitochondrial dysfunction, reactive oxygen species (ROS) damage, and cell death."

Source: Hyun M, Kim H, Kim J, Lee J, Lee HJ, Rathor L, Meier J, Larner A, Lee SM, Moon Y, Choi J, Han SM, Heo JD. Melatonin protects against cadmium-induced oxidative stress via mitochondrial STAT3 signaling in human prostate stromal cells. Commun Biol. 2023 Feb 8;6(1):157.

Alginates are able to trap certain metal ions in an "egg box" structure

Forschende Komplementärmedizin
Wissenschaft • Praxis • Perspektiven

Case Report · Falldarstellung

Forsch Komplementärmed 2007;14:358–364
DOI: 10.1159/000109829

Published online: November 2, 2007

Integrative Medicine and the Role of Modified Citrus Pectin/Alginates in Heavy Metal Chelation and Detoxification – Five Case Reports

Isaac Eliaz[a] Elaine Weil[a] Barry Wilk[b]

[a] Amitabha Medical Clinic and Healing Center Sebastopol, CA, USA
[b] EcoNugenics, Inc, Santa Rosa, CA, USA

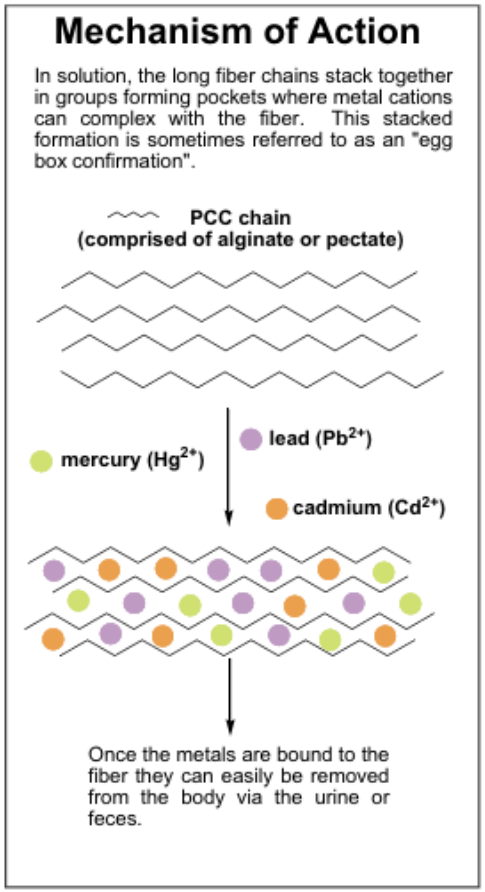
Key Words
Modified citrus pectin · Chelation · Heavy metal · PectaSol® · Alginate

Schlüsselwörter
Modifiziertes Zitruspektin · Chelatbildung · Schwermetall · PectaSol® · Alginate

Summary
Heavy metal body burden can contribute to chronic disease, as well as interfere with the body's capacity to recover from illness. The five case studies presented here show that reduction in toxic heavy metals (74% average decrease) was achieved without side effects, with the use of PectaSol® modified citrus pectin (MCP) (EcoNugenics; Santa Rosa, CA, USA) alone or with an MCP/alginates combination. The gradual decrease of total body heavy metal burden is believed to have played an important role in each patient's recovery and health maintenance. This is the first known documentation of evidence of such results in a clinical report of case studies with pos-

Zusammenfassung
Eine Schwermetallbelastung des Körpers kann zu chronischen Erkrankungen führen und die Fähigkeit, sich von Krankheiten zu erholen, beeinträchtigen. Die hier präsentierten fünf Fallstudien zeigen, dass durch den Einsatz von PectaSol®– modifiziertem Zitruspektin (MCP) (EcoNugenics; Santa Rosa, CA, USA) alleine oder in einer MCP-Alginat-Kombination eine Reduzierung toxischer Schwermetalle (um durchschnittlich 74%) ohne Nebenwirkungen erreicht wurde. Es wird angenommen, dass die graduelle Reduzierung der Schwermetallbelastung des Körpers eine große Rolle bei der Gesundung und Gesunderhaltung der Patienten spielt. Der vorlie-

Fig. 2. Polyuronides form stacks in solution in what is known as an 'egg box' structure. Each pocket of the 'egg carton' contains a positively charged ion to balance the negatively charged chains. Normally, the positive ions are sodium and potassium. However, toxic metals especially lead, mercury, cadmium, and radioactive metals have a higher affinity for polyuronides than the essential ions like calcium, magnesium, and potassium. Toxic metal ions become trapped in the 'egg box' structure and are eliminated from the body.



Source: Eliaz I, Weil E, Wilk B. Integrative medicine and the role of modified citrus pectin/alginates in heavy metal chelation and detoxification--five case reports. Forsch Komplementmed. 2007 Dec;14(6):358-64. ; http://tang-thorkil.dk/chelationstudy.pdf

Coriander/Cilantro for the Hg and other heavy metals, and a mix of horsetail and specific herbs especially for aluminium

Inula Helenium (Elecampane), Acorus Calamus (sweet flag), Equisetum Arvense (horsetail), Arctium Lappa (Burdock), Coriandrum Sativum, Ligusticum Porteri (wild celery)

Source: https://www.kiscience.com/product/coriandolo-plus/; https://www.kiscience.com/?s=Polmolo&post_type=product&product_cat=0

Additionally Epsom salt baths, taurine for the bile, Mg, and test for calcium, which may be being excreted too*

Mg sulphate – Epsom salts twice a week?

Taurine

Magnesium malate

Calcium?

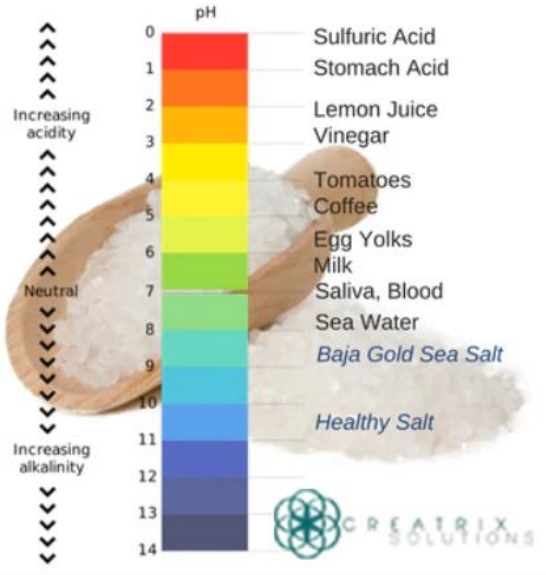
Glutathione precursors NAC, glycine, glutamic acid
(glutamine is a derivative of glutamic acid)

*Source:** https://www.youtube.com/watch?v=THZhANfFnyY

The right form of electrolytes too to support the organism's replacement of trace minerals

"Water-rich foods … carry nutrients like calcium, magnesium, potassium and sodium, which – activated by the electrical charge in water – are then known as electrolytes. What the new science has alerted us to is that water, full of those electrolytes, is also full of electrons that run our electrical function. The quality of our hydration has everything to do with the quality of electrical conduction. Water conducts electricity, and hydration runs our electrical function …. plants hydrate more efficiently than a glass of plain water alone."

(Quench, Dana Cohen, Gina Bria)



Not to forget the importance of salt: sodium provides +vely-charged ions, potassium -vely-charged ones: this combination generates electrical charges in our cell membranes.
Add a pinch of sea salt to a glass of water in the morning.

Omega 6 gets depleted, too

"Due to alterations in the fatty acid pathways, deficiency in arachidonic acid (Omega 6) is most common in pyrolurics."*

Omega 6 – Evening Primose Oil, Borage oil, Blackcurrant oil

4:1 O6 to O3 ratio suggested by e.g. Drs. Ed and Patricia Lane

PNAS VIEW THIS ARTICLE AT PNAS.ORG

Proc Natl Acad Sci U S A. 1993 Nov 1;90(21):10345–10349. doi: 10.1073/pnas.90.21.10345

Modulation of learning, pain thresholds, and thermoregulation in the rat by preparations of free purified alpha-linolenic and linoleic acids: determination of the optimal omega 3-to-omega 6 ratio.

S Yehuda [1], R L Carasso [1]

Author information · Copyright and License information

PMCID: PMC47771 PMID: 7901853

Abstract

Ingested polyunsaturated fatty acids are postulated to lead to changes in central nervous system activity, presumably by altering the lipid composition of neuronal membranes. In support of this hypothesis, we and other investigators have previously demonstrated cognitive effects in rats fed oils that contain both alpha-linolenic acid (18:3 omega 3) and linoleic acid (18:2 omega 6), with the relative content of alpha-linolenic acid being seen as the critical variable. The present study in rats examined the effects of preparations containing different ratios of highly purified free alpha-linolenic acid to linoleic acid (about 25 mg/kg of body weight daily) on learning performance (Morris water tank), pain thresholds (heated plate), and thermoregulatory control of d-amphetamine-induced hypothermia during 4 weeks of treatment. Preparations with omega 3-to-omega 6 ratios ranging from 1:3.5 to 1:5 (specifically a ratio of 1:4) produced significant favorable effects on all of these variables. Although the specific mode of action remains to be elucidated, these results suggest that such preparations of free fatty acids should be evaluated in the treatment of memory disorders and pain conditions.

Source: https://discover.hubpages.com/health/Pyroluria-A-Hidden-Disorder; https://eatfor.life/pyroluria-pyrrole-disorder/; https://bodybio.co.uk/blogs/blog/4-to-1-fatty-acid-ratio-and-thebrain?srsltid=AfmBOoq5Ye7JQBB8buFYHszcFd84QxHtRAGpejXe8hZ2opblNB8_k0dI; http://97.74.184.157/templates/secretbrain/images/bodybiobulletin-phosphatidylcholine.pdf; https://bodybio.co.uk/blogs/blog/4-to-1-fatty-acid-ratio-and-the-brain?srsltid=AfmBOoq41G_uDP_OryD_dRlDr8cM-d4jCDzU6O6wW5dJWmN1lHrg8qux

EMF prevention and support essential (1/2)

Wi-fi disrupts the voltage-gated calcium channels of our cells, leading to the internal mitochondrial production of highly corrosive peroxynitrite, which in turn causes brain fog, memory decline and neurodegeneration.

Essential Protective Measures

Prevention

Eliminating wi-fi routers from indoor spaces is paramount. However, if complete removal isn't feasible, switching off the wi-fi router at night provides a 30% reduction in stressors. Achieving optimal healing often necessitates complete elimination.

Eliminate cordless phones

Internal Protection.

a. Special tinctures are available composed of e.g. Propolis, Rosemary and Gingko: internal cellular shielding against low-frequency wavelength ranges

b. Natural vitamin C a potent antioxidant resource, fortifying our body's natural resilience against oxidative damage caused by wi-fi's impact.

EMF prevention and support essential (2/2)

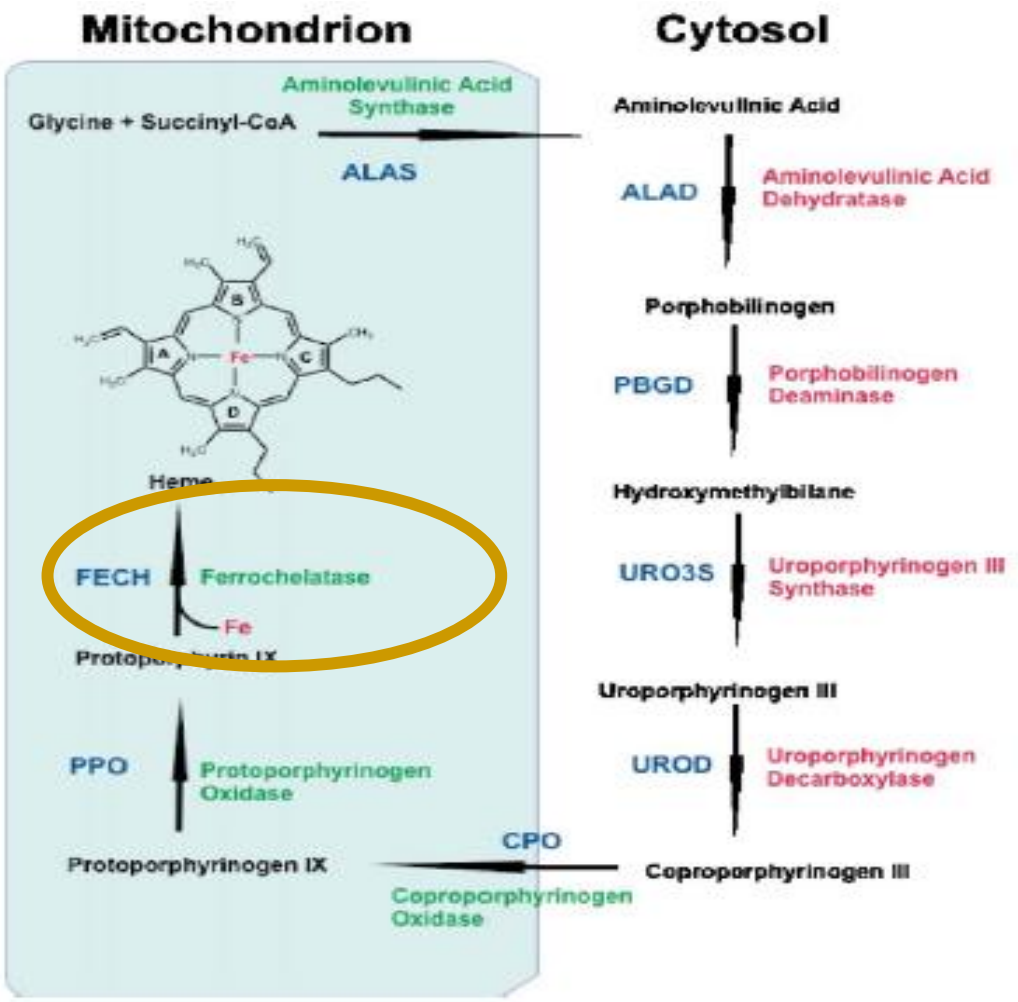
1. **External protection**:

   a. There are creams you can apply that provide a degree of protection against EMFs

   b. **Specialised protective measures**, such as a custom-made "**Sleep Sanctuary**" (silver-coated cloth that works like a Faraday cage) and **wi-fi-repelling/protective clothing**

   c. **Even special soaps**

The last step in the synthesis of heme is Ferrochelatase



It has long been considered that the likely cause of pyrroluria in both primary and secondary KPU is a defect in heme metabolism in the inner mitochondrial membrane[2]

Four of the enzymes are copper-dependent (see next page for Ferrochelatase)

Source: 1. Ajioka, RS et al, The Biosynthesis of Heme in Mammals. Biochimica et Biophysica Acta 1763 (2006) 723–736; Kuklinski, B. Cryptopyrroluria, nitrosative stress and mitochondrial disease; 2. KPU/HPU häufige, aber verkannte Mitochondrienstörungen, 3rd edition 2018, Kyra Kauffmann, Sascha Kauffmann

Might copper be a huge missing piece in the puzzle?

Review > Mol Aspects Med. 2005 Aug-Oct;26(4-5):363-78. doi: 10.1016/j.mam.2005.07.007.

Mineral and vitamin deficiencies can accelerate the mitochondrial decay of aging

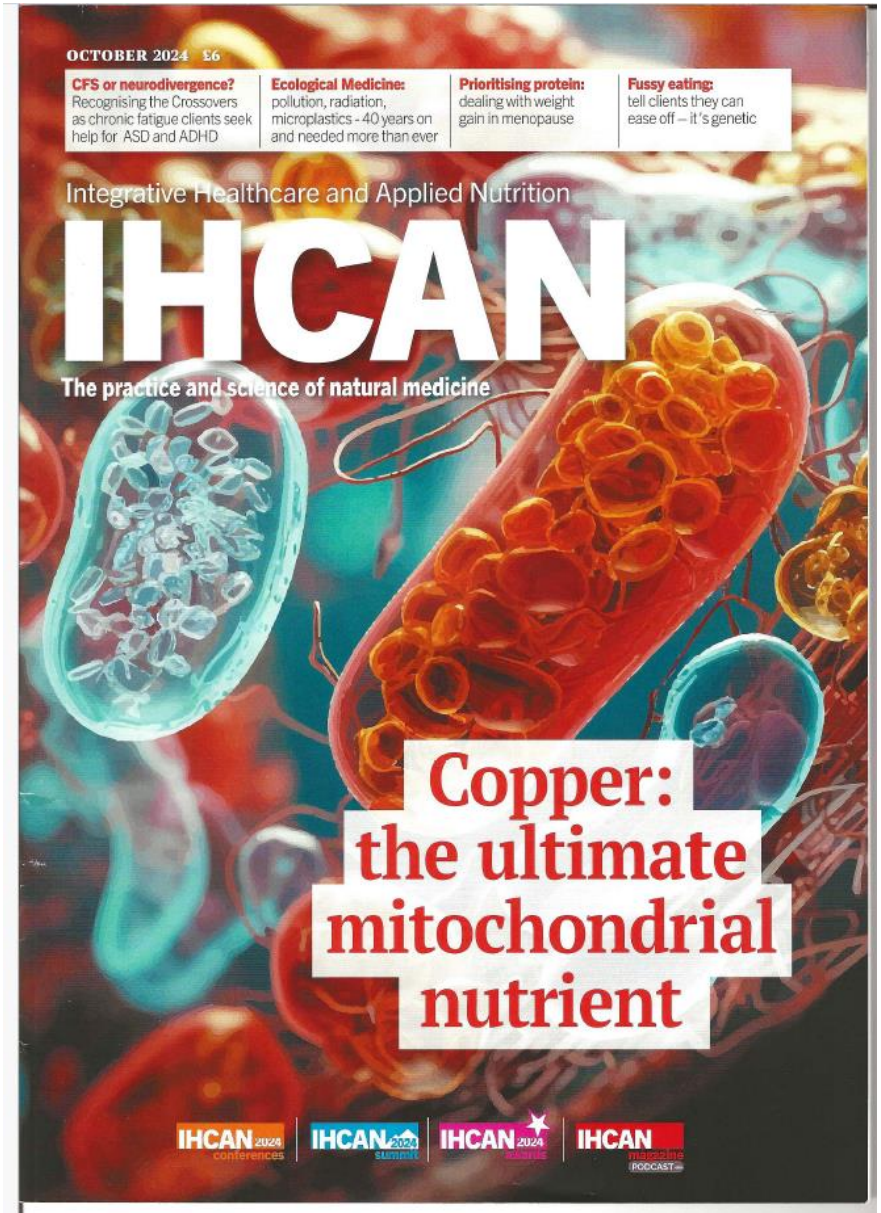
Bruce N Ames [1], Hani Atamna, David W Killilea

Copper plays a role in heme synthesis. A link between copper and iron metabolism has been known since the early studies by Hart and Elvehjem (Hart et al., 2002), in which they showed the requirement of copper for hemoglobin synthesis. Today we know that copper stimulates the activity of ferrochelatase and appears to decrease the Km for iron (Wagner and Tephly, 1975; Keyhani and Keyhani, 1980), therefore copper deficiency inhibits heme synthesis (Williams et al., 1985). Additionally copper reverses the inactivation of ferrochelatase by lead or cobalt (Co) (Wagner and Tephly, 1975). Copper deficiency increases dietary iron absorption (Thomas and Oates, 2003) probably a compensatory mechanism to increase heme production. A rat model for Wilson's disease, a disorder of copper transport, exhibits abnormal heme metabolism (Nakayama et al., 2000), supporting the connection between copper and heme biosynthesis. Hephaestin, a copper-containing protein, also impacts heme synthesis by coordinating copper and iron metabolism at the absorption level (Vulpe et al., 1999).

Ferrochelatase requires copper as a cofactor – is this perhaps a huge missing piece in the Pyrrolia mystery?

Source: Kyra/Wagner GS, Tephly TR. A possible role of copper in the regulation of heme biosynthesis through ferrochelatase. Adv Exp Med Biol. 1975;58(00):343-54; With thanks to Morley Robbins, Root Cause Protocol, https://therootcauseprotocol.com/; https://therootcauseprotocol.com/iron-toxicity-post-75-formerly-itp76/, 1. https://ashpublications.org/blood/article/48/1/77/160532/Role-of-copper-in-mitochondrial-iron-metabolism

... “the ultimate mitochondrial nutrient“



Energy pathway is copper dependent

• “Copper is essential for life processes like energy metabolism, reactive oxygen species detoxification, iron uptake, and signalling in eukaryotic organisms.

“Mitochondria gather copper for the assembly of cuproenzymes such as the respiratory complex IV, cytochrome c oxidase, and the antioxidant enzyme superoxide dismutase. In this regard, copper plays a role in mitochondrial function and signalling involving bioenergetics, dynamics and mitophagy, which affect cell fate by means of metabolic reprogramming” (2).*

The proper assembly and functioning of the ETC [electron transport chain] is copper dependent.

* “Role of Copper on Mitochondrial Function and Metabolism” 2021 https://www.frontiersin.org/articles/10.3389/fmolb.2021.711227/full.

Retinol is the backbone of the multi-copper ferroxidase, caeruloplasmin

"Retinol is the backbone of the ferroxidase enzyme that is so critical for chaperoning iron, and retinol loads copper into ferroxidase. Interestingly, studies of anemia have illus-trated vitamin A's impor-tance.[35] Although we measure anemia via hemoglobin, adding iron does not meaningfully restore normal hemoglobin levels—
but vitamin A does."[1]

Am J Clin Nutr. 1978 May;31(5):876-85. doi: 10.1093/ajcn/31.5.876.

Hematopoietic studies in vitamin A deficiency

R E Hodges, H E Sauberlich, J E Canham, D L Wallace, R B Rucker, L A Mejia, M Mohanram

PMID: 645632 DOI: 10.1093/ajcn/31.5.876

Abstract

Recent studies of experimental vitamin A deficiency in man led the authors to conclude that anemia may result from lack of vitamin A. A review of numerous nutrition surveys in underdeveloped countries enhanced the suspicion that deficiency of vitamin A does contribute to the prevalence of anemia. Preliminary studies of vitamin A-deficient rats confirmed previous observations that anemia may result from lack of this vitamin. The livers of these animals had very low concentrations of vitamin A but normal or increased concentrations of iron. The finding of anemia is in contrast with other reports that vitamin A deficiency may cause elevated values for hemoglobin and hematocrit. The authors suggest that loss of taste and smell as a result of deficiency may account for refusal of experimental animals to eat and drink enough to prevent inanitation and dehydration. The resulting

Studies have shown that adding iron does not meaningfully restore normal hemoglobin levels - but vitamin A does.

3

Source: 1. https://www.westonaprice.org/health-topics/toxic-iron-and-ferroxidase-the-master-antioxidant/, *2.* https://pubmed.ncbi.nlm.nih.gov/3655940/; https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2812036/; www.rcp123.org; *3.* Hodges RE, Sauberlich HE, Canham JE, Wallace DL, Rucker RB, Mejia LA, Mohanram M. Hematopoietic studies in vitamin A deficiency. Am J Clin Nutr. 1978 May; 31(5):876-85, with thanks to the RCP, rcp123.org; https://therootcauseprotocol.com/toxicity-post-69-the-iron-y-of-retinol/

.

Natural sources of bioavailable copper

Copper - Almonds; Avocado; Beans; Broccoli; Buckwheat; Chocolate; Crab; Dried legumes; Lamb; Mushrooms; Oysters; Pecans; Perch; Pork; Prunes; Sunflower seeds; Wholegrain cereals; Water from copper pipes. Synergistic Nutrients - Vitamin B2, B6, B12, D, Amino acids; Ca, B9, Fe, Mn, Se, Zn. Ca and K increase Cu absorption and retention. Fe inhibits Cu uptake[1]

NB Important to first build the caeruloplasmin carrier for bioavailable Cu with its retinol backbone[3]

Home > Biological Trace Element Research > Article

Ceruloplasmin, an Indicator of Copper Status

Published: 13 February 2008

Volume 123, pages 261–269, (2008) Cite this article

"Our in vitro and in vivo studies indicate that, as a mean, there are 5.8 atoms of Cu per Cp molecule"

Source: 1. : Osiecki H (2014) The Nutrient Bible 9th Edition Bio Concepts Publishing Australia; http://www.alfiestrust.com/wp-content/uploads/2017/09/NutrientSourcesVitsMinsAGT.pdf; 2. *https://www.hsph.harvard.edu/nutritionsource/copper/*

Because mitochondrial dysfunction is such a large part of the puzzle, a mitochondrial test alongside may be indicated

XXX
Max-Mustermann Straße 5
xxx Berlin

MMD

MMD GmbH & Co. KG
Breiter Weg 10a
39104 Magdeburg
Prof. Dr. Brigitte König
CEO/ Scientific Director
Prof. Dr. Gerhard Jorch
Medical Director

Tel. office: +49 391 535 37 97
Tel. laboratory: +49 391 611 72 09
Fax: +49 391 535 38 45
E-Mail: info@mmd-web.de
Web: www.mmd-web.de

Patient	AW	Date of birth	01.01.1990
		Entry on	23.07.2021
Order No.:			
Date of sample	22.07.2021	Validated by	Prof. Dr. Brigitte König
Sample type	CPDA vacutainer	Cell type	PBMC
Results status	**Final report**	Results status on	23.07.2021

ATP profile

Test	Result	Unit	Reference range	Result [%]
Total ATP	0.8	fmol/cell		
Mitochondrial ATP capacity	0.4	fmol/cell		50
Glycolytic ATP capacity	0.5	fmol/cell		63
Reserve ATP capacity	0.10	fmol/cell		13

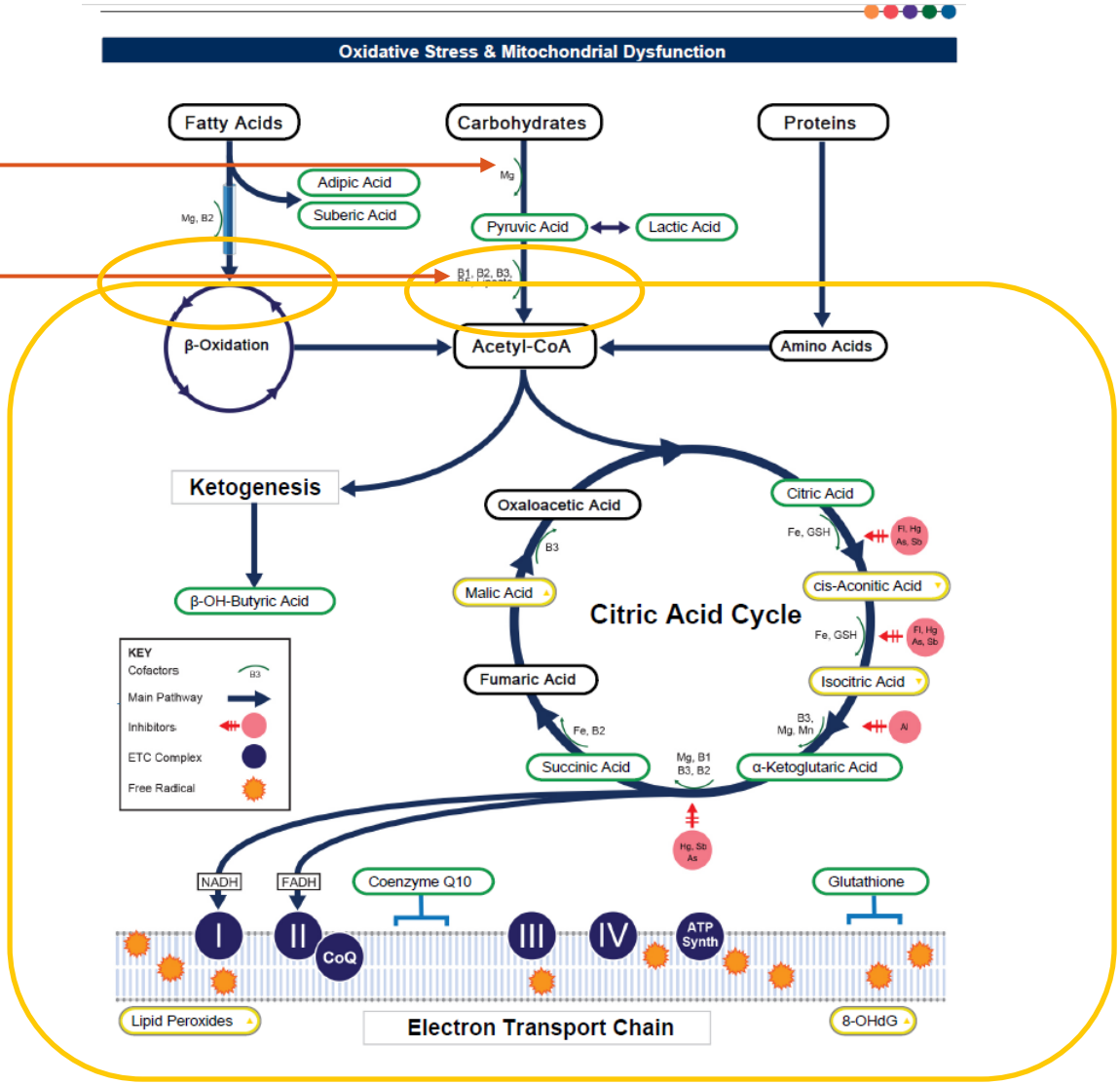
Reference range total ATP fmol/cell	<0.8	0.8 - 1.0	1.0 - 1.2	1.2 - 1.4	1.4 - 1.6	1.6 - 2.0	2.0 - 2.5	2.5 - 3.0	3.0 - 5.0
Reference range mitochondrial ATP capacity fmol/cell	<0.8	0.8 - 1.0	1.0 - 1.2	1.2 - 1.4	>1.4				
Reference range glycolytic ATP capacity fmol/cell	<0.8	0.8 - 1.0	1.0 - 1.2	1.2 - 1.4	>1.4				
Reference range reserve ATP capacity fmol/cell	<0.2	0.2 - 0.3	0.3 - 0.4	0.4 - 0.6	0.6 - 0.9	0.9 - 1.0	1.0 - 1.2	1.2 - 1.5	>1.5

Source: AONM/MMD mitochondrial test results from a patient with K{U, with permission of the patient

Impaired ATP capacity: Cofactors may be lacking to get pyruvic acid into the mitochondria

Magnesium

B1, B2, B3, B5, Alpha lipoic acid



Source: ©Genova Diagnostics ▪ A.L. Peace-Brewer, PhD, D(ABMLI), Lab Director ▪ CLIA Lic. #34D0655571 ▪ Medicare Lic #34-8475 (with permission)

You may have too few mitochondria – or too many

mtDNA:nDNA

Example 2:

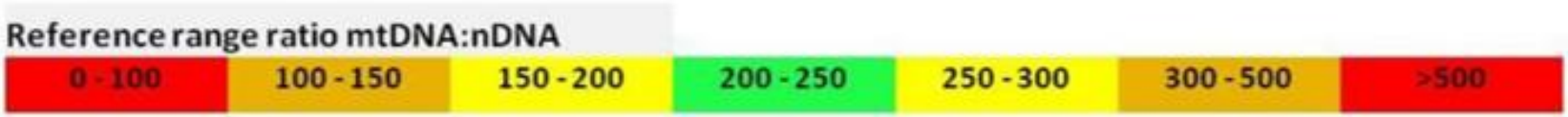
Ratio mtDNA:nDNA 1039

Number of mitochondrial DNA copies per 1 copy of nuclear DNA

Example 3:

ratio mtDNA:nDNA 115

Number of mitochondrial DNA copies per 1 copy of nuclear DNA



Too high (see example 2):
The cell is trying to counteract the lack of energy by increasing the number of mitochondria.

Too low (see example 3):
The cell is unable to counteract the lack of energy by increasing the number of mitochondria.

You may have significant oxidative stress showing in your mitochondria

Oxidative stress

Deletion mutant 4977

Example 1:

Mitochondrial 4977 Deletion mutant (mt4977del) **1.03E+06**

Number of copies of non-mutated mtDNA to 1 copy mt4977del

The mitochondrial deletion mutant mt4977bp is noticeably enhanced. This indicates oxidative stress and damage to mitochondrial DNA.

Among mtDNA deletions, one of the most vital that causes huge destruction of almost one third in length of the mitochondrial genome is the 4977-bp mtDNA deletion ($mDNA^{4977}$). This is one of the best-described large-scale mtDNA deletions, and has been found to accumulate in numerous disorders (literature available upon request). It is often known as a “common deletion” due to the frequency with which it has been reported. The deleted region encodes seven polypeptides essential for the OXPHOS pathway: four for Complex I, one for Complex IV, and two for Complex V. **This can cause complete failure of ATP production in the mitochondria affected.**

Upon entry into cells, viral RNA and proteins localise to the mitochondria

Perspectives | Virus-Host Cell Interactions and the Viral Life Cycle: Basic Science to Therapeutics

Decoding SARS-CoV-2 hijacking of host mitochondria in COVID-19 pathogenesis

Keshav K. Singh ✉,* Gyaneshwer Chaubey,* Jake Y. Chen, and Prashanth Suravajhala

20 JUL 2020 // https://doi.org/10.1152/ajpcell.00224.2020

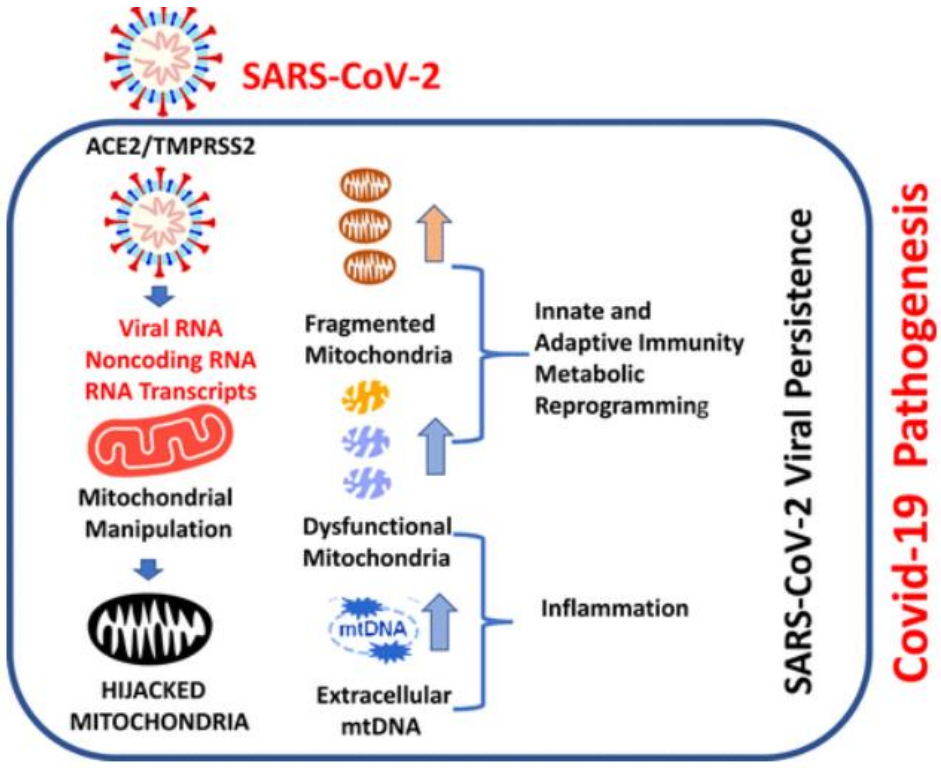


Fig. 9.

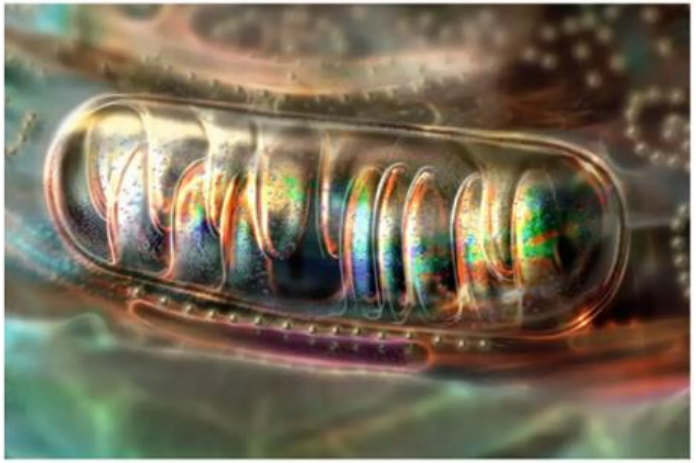
"Based on available data for the SARS-CoV-1 virus**, we suggest how CoV-2 localization of RNA transcripts in mitochondria hijacks the host cell's mitochondrial function to viral advantage.** Besides viral RNA transcripts, RNA also localizes to mitochondria. SARS-CoV-2 may manipulate mitochondrial function indirectly, first by ACE2 regulation of mitochondrial function, and **once it enters the host cell,** open-reading frames (ORFs) such as ORF-9b can **directly manipulate mitochondrial function to evade host cell immunity and facilitate virus replication …**"

Source: https://journals.physiology.org/doi/full/10.1152/ajpcell.00224.2020

Agenda

- Brief recap: What is Kryptopyrroluria?
- Testing
- Therapies
  - Substituting the deficient nutrients
  - Detoxifying the tissues
  - Giving the organism access to bioavailable copper
  - Factoring in mitochondrial support
- **Other resources**

Please do have a look at our most recent webinar for detailed therapy suggestions



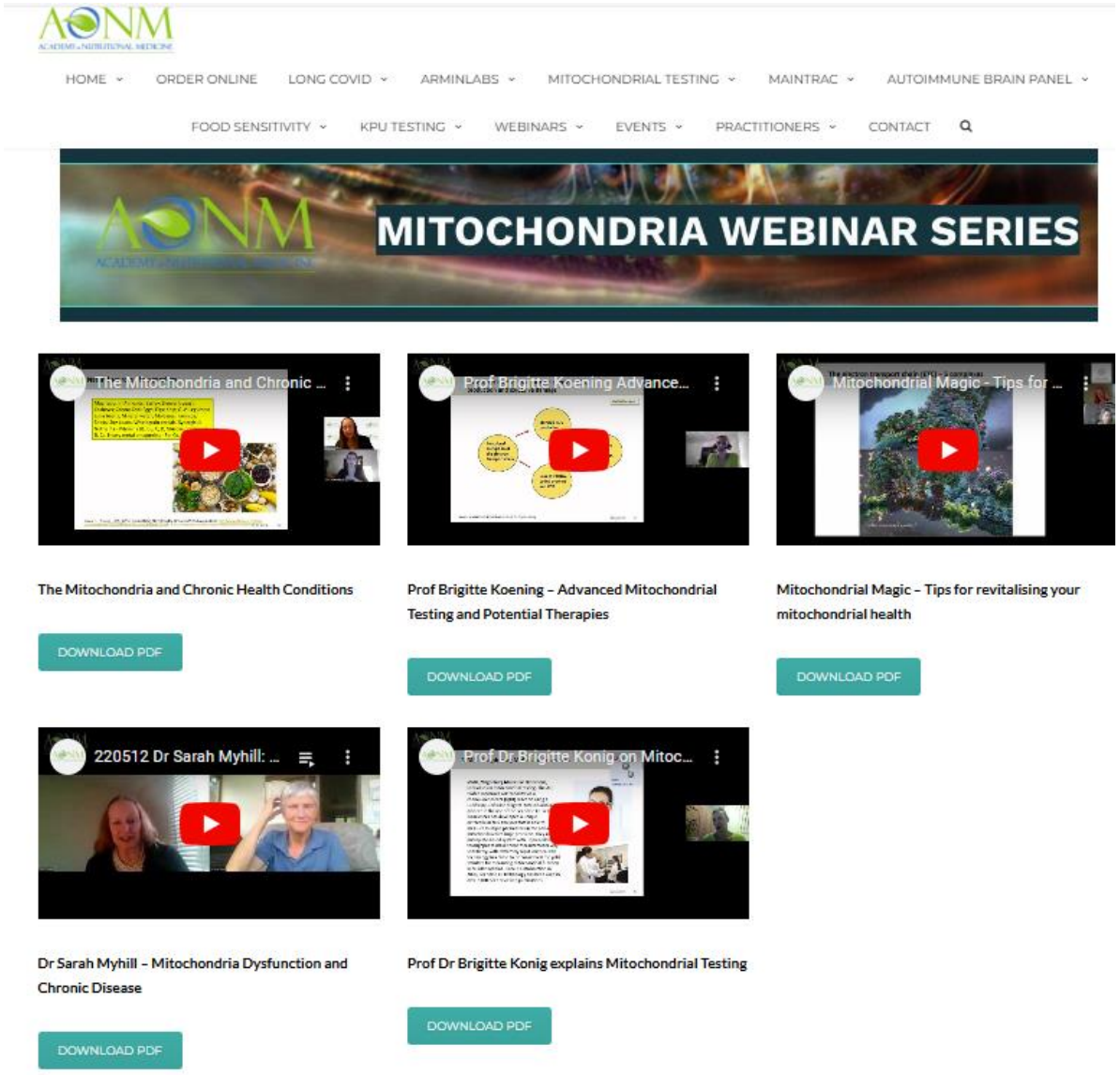
The Mitochondria and Chronic Health Conditions, Part 1

Professor Brigitte Koenig, Magdeburg Molecular Detections
Gilian Crowther MA (Oxon), Dip NT/ND

www.aonm.org

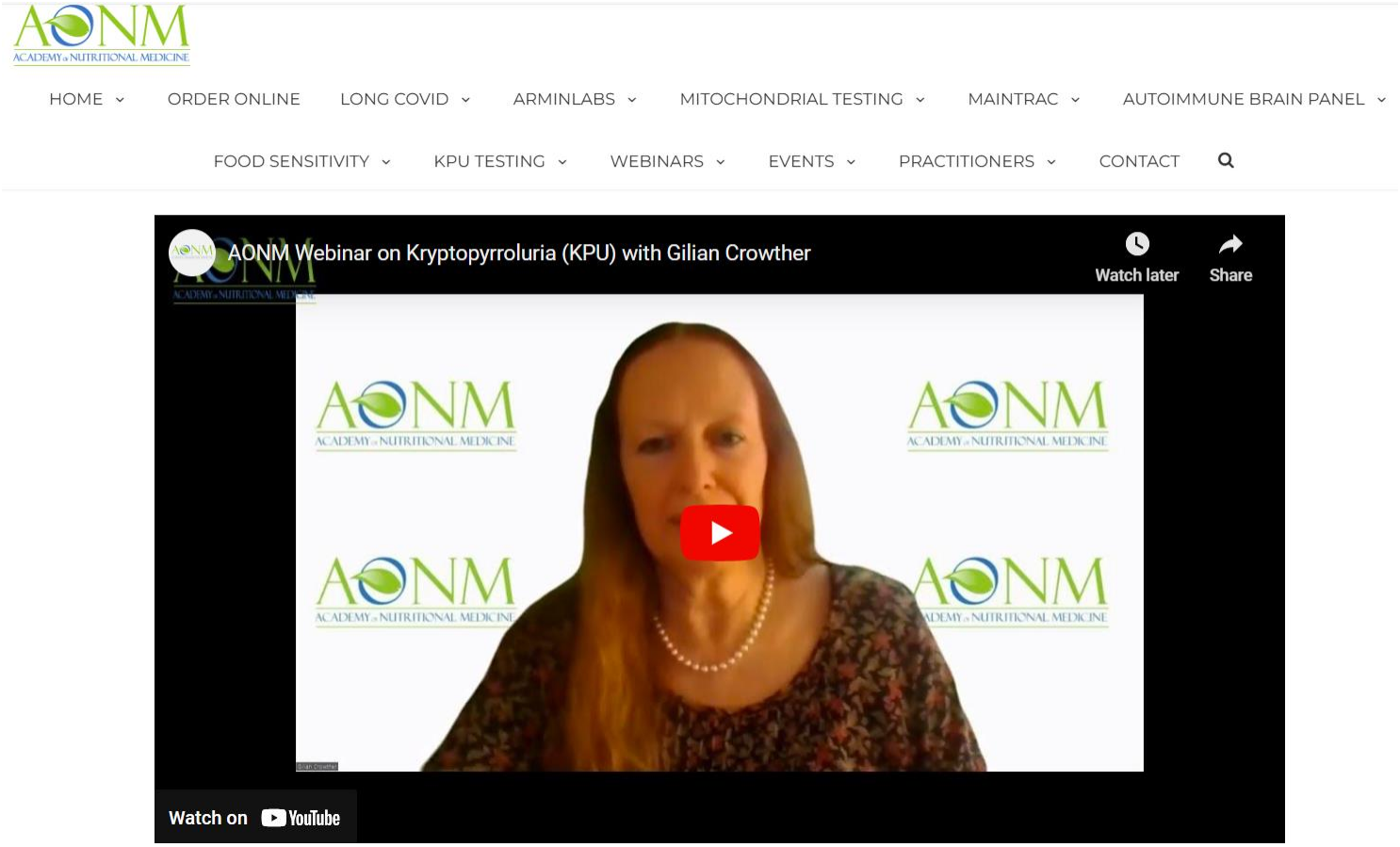
https://aonm.org/mitochondria-webinars/

Further resources in our Mitochondrial Webinar Series



Source: https://aonm.org/mitochondrial-testing/; https://aonm.org/mitochondria-webinars/

… and please do watch KPU Part 1 if you haven't already



https://aonm.org/kpu-webinar/

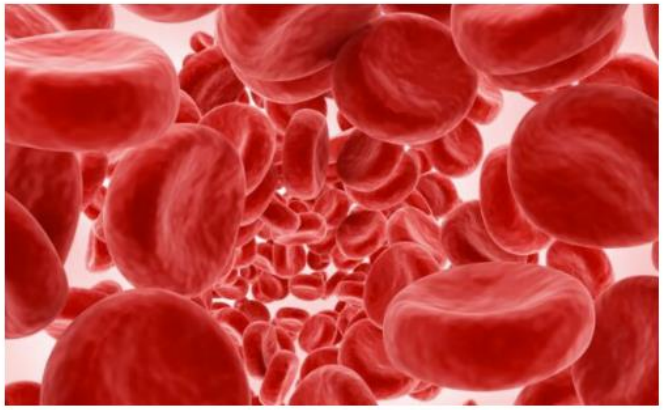
Article on AONM's "Health Hub" about the hidden link between KPU and mitochondrial disorders

AONM Health Hub

LYME DISEASE TESTING | CANCER MONITORING | MITOCHONDRIAL TESTING | WEBINARS | PANS/PANDAS TESTING | COVID-19

WORLD ENCEPHALITIS DAY 2023 | ONLINE SHOP | CONTACT US

Home » The Hidden Link Between Kryptopyrroluria (KPU) and Mitochondrial Disorders



ACADEMY OF NUTRITIONAL MEDICINE

The Hidden Link Between Kryptopyrroluria (KPU) and Mitochondrial Disorders

- BY AONM HEALTH HUB

Published on 28 May, 2024

Visit our Main AONM Website

Maintrac®: A New Paradigm in Personalised Cancer Support

The Hidden Link Between Kryptopyrroluria (KPU) and Mitochondrial Disorders

Unveiling the Mysteries of Post-COVID Fatigue: A Paradigm Shift in Long COVID Understanding

Indulge in Wellness: Exploring the Formula Food Complex – Chocolate and Vanilla

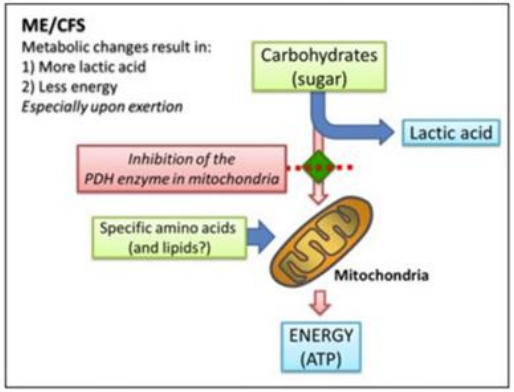
Understanding the Escalation of Neuroinflammation Post-COVID: A Growing Concern

https://aonmhealthhub.org/the-hidden-link-between-kryptopyrroluria-kpu-and-mitochondrial-disorders/academy-of-nutritional-medicine/;
https://aonm.org/kryptopyrroluria-the-elephant-in-the-room/

AONM newsletters with many articles about the mitochondria: archive goes back to 2014

ME updates: Could pyruvate be the clue?

Robert Naviaux of UCSD and Ron Davis of the Open Medicine Foundation have already found strong metabolic data substantiating that ME could be caused by energy production issues. The latest metabolomics study suggests that the breakdown does not occur in the aerobic production pathway so much as just before that. Fluge and Mella et al. in Norway have shown that ME is associated with defective oxidative metabolism – and that this most likely involves impaired pyruvate dehydrogenase (PDH) function. The PDH enzyme is a key component in one of the most important pathways for conversion of carbohydrates to energy – a process that takes place in the mitochondria. If the PDH enzyme is impaired, cells are likely to increase the utilisation of alternative fuels, which may explain the changes in the amino acid profile found in ME patients.



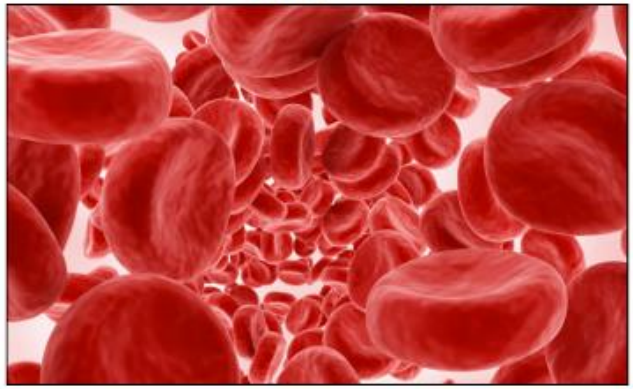
From "New study on pathological mechanisms in ME from Bergen research group" by Øystein Fluge, Karl Johan Tronstad and Olav Mella in Kavli Fondet

Naviaux believes the mitochondria are the first organelles to detect danger or toxicity, and downregulate as a protective mechanism. The burning question is whether/why our

2

* NEW AONM TEST: KPU *

The Hidden Connection between Kryptopyrroluria and Mitochondrial Disorders



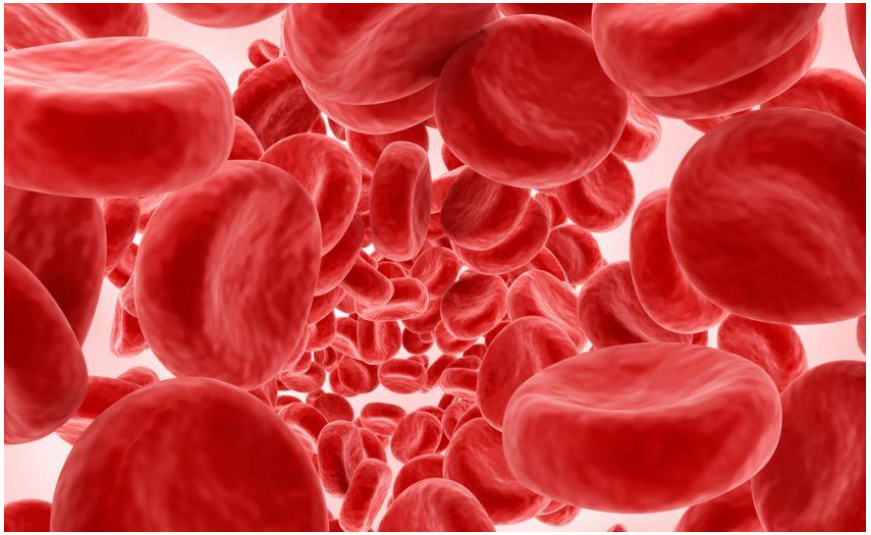
KPU is a metabolic disorder related to an abnormality in the production and breakdown of haem. This abnormality means free pyrroles are eliminated undetected via the urine. Pyrroles are building blocks of the haem group – a component of e.g. haemoglobin – and can act like a chelation agent, attaching to specific nutrients like zinc, pyridoxal-5-phosphate (the active form of B6) and manganese. These get washed out in the urine instead of being properly metabolised and utilised.

The disorder can be inherited or acquired. The production of haem has eight steps, four of which take place in the mitochondria. It therefore makes sense that KPU can occur as a result of mitochondrial dysfunction, when the mitochondrial steps are disabled, such as aminolevulinic acid synthase (ALAS), the first step in haem production. Many of the correlates that have been noted could be linked to impaired mitochondrial function. Dr. Klinghardt has for example found that it often correlates with Lyme Disease, in around 80% of patients that he sees, as well as in patients with heavy metal toxicity, and in children with autism.

It is clear that if there is a disruption to haem this will disorder the oxygen transport system, since haem is a ring-shaped molecular component of haemoglobin necessary to bind oxygen for delivery via the blood to the tissues. Disturbed oxygen transport will cause fatigue, and potentially muscular pain (due to the resulting build-up of lactic acid from the alternative energy delivery system that upregulates: glycolysis). But haem is needed in so many other physiological processes too, such as the cytochrome P450 enzymes so essential for detoxification. Myoglobin requires haem too, the oxygen-binding protein located primarily in muscles; exacerbation of the hypermobility form of Ehlers-Danlos Syndrome (hEDS) has been linked to this disorder as a result.

3

Newsletters: https://aonm.org/newsletters/; 2. https://aonm.org/wp-content/uploads/2017/03/March-2017-newsletter.pdf;
3. https://aonm.org/wp-content/uploads/2024/04/AONM-Newsletter-April-2024.pdf



Thanks very much for your attention!

info@aonm.org
0333 121 0305

gilian@aonm.org/0786 772 6387