Casual Friday Series

Functional Approaches in Neuropathy

A Biogenetix Clinical Presentation

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- *The information provided in this presentation is for your consideration only as a practicing health care provider. Ultimately you are responsible for exercising professional judgment in the care of your own patients.*

Lifestyle + Genetics = Chronic Health IMPROVEMENT

Neuropathy Associated with Dysglycemia

- **Peripheral symmetric neuropathy:** This affects the feet and hands. It is the most common form of diabetic neuropathy.
- **Autonomic neuropathy:** This occurs in the nerves that control involuntary functions of the body, such as digestion, urination, or heart rate.
- **Thoracic and lumbar root, or proximal, neuropathy**: This damages nerves along a specific distribution in the body, such as the chest wall or legs.
- **Mononeuropathies**: These can affect any individual nerve.

https://www.medicalnewstoday.com/articles/245310#symptoms

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Insulin resistance in the nervous system

Bhumsoo Kim and Eva L. Feldman

Although neurons are not insulin-dependent, they are insulin-responsive [18]. The InsR and downstream signaling molecules including IRS are expressed throughout the peripheral and central nervous systems (PNS and CNS) (Figure 2). Both InsR mRNA and protein are detected in peripheral sensory neurons of dorsal root ganglion (DRG) neurons [19]. InsR expression is especially high in small-diameter sensory DRG neurons and lateral laminae V and X of the spinal cord, suggesting the involvement of insulin signaling in nociceptive pathways. Immunohistochemistry demonstrates preferential expression of InsRs at the perikarya of DRG neurons [20]. Intrathecal injection of insulin rescues and regenerates sural nerves after crush injury, demonstrating a direct neurotrophic effect of insulin in peripheral neurons [20]. Systemic insulin injection also accelerates reinnervation of motor axons after sciatic nerve transection [21]. With direct injury to the PNS, neuronal regeneration or reinnervation is associated with increased InsR expression.

Neuropathies Associated with:

- Hypothyroidism
- Toxicity
- Nutrient Deficiency
- Injury
- Infection
- Etc…

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Peripheral and Central Nervous System Involvement in Recently Diagnosed Cases of Hypothyroidism: An Electrophysiological Study

N Gupta, M Arora,[1] R Sharma, and KS Arora[2]

In many studies conducted in the past, polyneuropathy was observed to be associated with hypothyroidism. The peripheral polyneuropathy may be due to the defect in nerve cell body, axons or myelin sheath and it results in decreased nerve conduction velocities and amplitudes in peripheral nerves. The most commonly involved nerves are the sural and median nerves, as the distal and sensory nerves are affected earlier. Carpal tunnel syndrome is the main cause of peripheral nerve damage in hypothyroidism due to median nerve entrapment.[4]

Manifestations of cranial nerve involvement in thyroid dysfunction include sensory neural hearing loss and ophthalmopathy. About 37% of the patients of the patients with hypothyroidism were found to be suffering from hearing loss.[5] Brainstem auditory evoked potential (BAEP) is a method used to assess the functional integrity of the thalamocortical projections relaying to the primary auditory cortex and association cortex.[6] Some studies have reported prolongation of both central and peripheral conduction time[3,6,7] even in subclinical hypothyroid conditions.[8]

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Toxic Neuropathies: Mechanistic Insights Based On A Chemical Perspective

Richard M. LoPachin, Ph.D.[1] and Terrence Gavin, Ph.D.[2]

effort was devoted to deciphering the respective mechanisms. Continued research, however, revealed that expression of the presumed hallmark morphological features was dependent upon the daily rate of toxicant exposure. Indeed, many studies reported that the corresponding axonopathic changes were late developing effects that occurred independent of behavioral and/or functional neurotoxicity. This suggested that the toxic axonopathy classification might be based on epiphenomena related to dose-rate. Therefore, the goal of this mini-review is to discuss how quantitative morphometric analyses and the establishment of dose-dependent relationships helped distinguish primary, mechanistically relevant toxicant effects from non-specific consequences. Perhaps more importantly, we will discuss how knowledge of neurotoxicant chemical nature can guide molecular-level research toward a better, more rational understanding of mechanism. Our discussion will focus on HD, the neurotoxic γ-diketone metabolite of the industrial solvents n-hexane and methyl-n-butyl ketone. Early investigations suggested that HD caused giant neurofilamentous axonal swellings and eventual degeneration in CNS and PNS. However, as our review

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Nutritional Neuropathies

Nancy Hammond, MD, Yunxia Wang, MD, Mazen Dimachkie, MD, and Richard Barohn, MD

Malnutrition can affect all areas of the nervous system. Risk factors for malnutrition include alcohol abuse, eating disorders, older age, pregnancy, homelessness, and lower economic status. Any medical condition that affects the GI tract can also impair absorption of essential vitamins. Nutritional deficiencies have been described in patients with inflammatory bowel disease, fat malabsorption, chronic liver disease, pancreatic disease, gastritis, and small bowel resections. Patients receiving total parental nutrition (TPN) are also at risk for vitamin deficiency and TPN formulations should be carefully formulated to include supplemental vitamins and trace minerals. Neurological complications following gastric bypass surgery are increasingly recognized. Nutritional neuropathies manifest either acutely, subacutely, or chronically. They can be either demyelinating or axonal.

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Peripheral Nerve Trauma: Mechanisms of Injury and Recovery

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Peripheral nerve injuries are common conditions with broad ranging groups of symptoms depending on the severity and nerves involved. Although much knowledge exists on the mechanisms of injury and regeneration, reliable treatments that ensure full functional recovery are scarce. This review aims to summarize various ways these injuries are classified in the light of decades of research on peripheral nerve injury and regeneration.

Review > Curr Opin Neurol. 2013 Oct;26(5):510-5. doi: 10.1097/WCO.0b013e328364c036.

Infectious neuropathies

Christian J M Sindic [1]

Affiliations + expand

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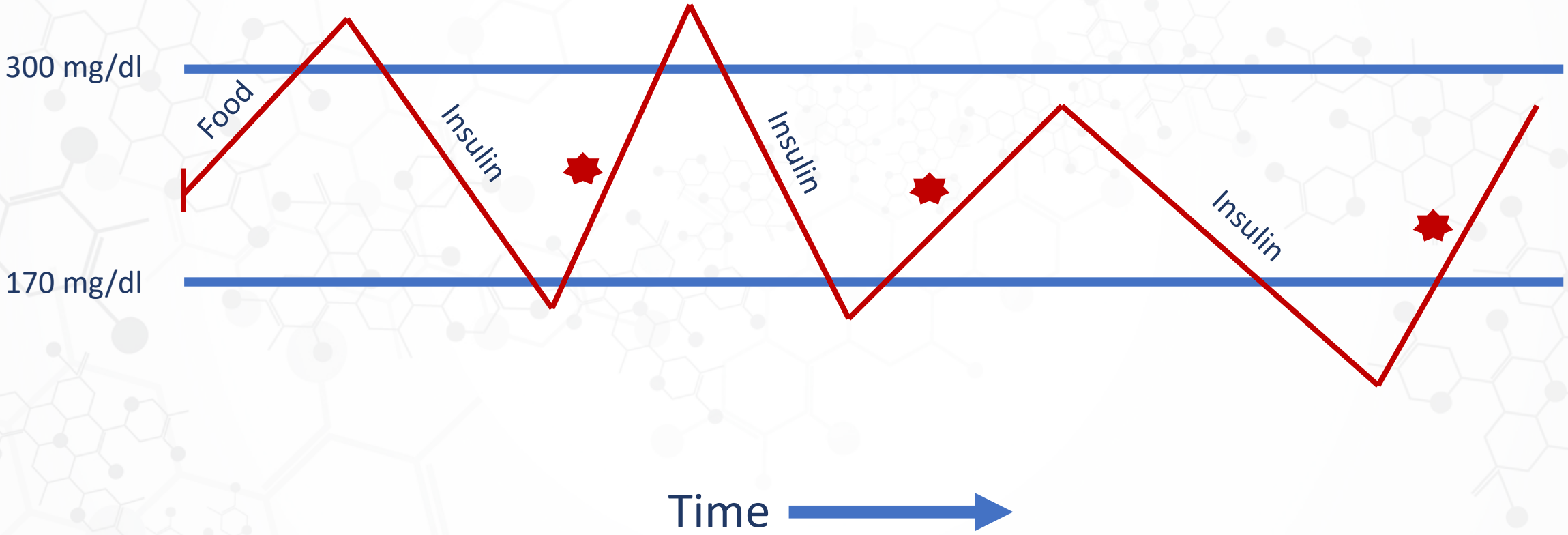
related or not to the presence of cryoglobulins. The absence of vasculitis, the most frequent form is a peripheral sensory neuropathy involving small nerve fibers, and more accurately diagnosed by pain-related evoked potentials. HIV-related neuropathy has become the major neurological complication of HIV infection. Both HIV-induced neuropathy and antiretroviral toxic neuropathy are clinically indistinguishable. The existence of an isolated chronic polyneuropathy due to Borrelia burgdorferi remains highly controversial. Lastly, an active infectious ganglioneuritis caused by varicella zoster virus, producing shingles, is the most frequent infectious neuropathy in the world and may cause various neurological complications. Zoster sine herpete remains frequently undiagnosed.

Post Prandial Instability DM



Glucagon, Epinephrine, Insulin

A tale of 2 cases….

Patient A

Comp. Metabolic Panel (14)

Glucose	**232**	**High**	mg/dL	65-99	01
BUN	12		mg/dL	8-27	01
GlycoMark(R)(1,5 AG)	**<1.0**	**Low**	ug/mL		03

GlycoMark(TM) is intended for use with managing glycemic control in diabetic patients. A low result corresponds to high glucose peaks.
1, 5-AG blood levels can be affected by clinical conditions or medications. Please refer to the directory of services or labcorp website test menu for detailed list of limitations.
Reference Range:
Adults Males: 10.7 - 32.0
Glycemic control goal for diabetic patients: >10

Hemoglobin A1c

Hemoglobin A1c	**13.5**	**High**	%	4.8-5.6	01
Please Note:					01

Prediabetes: 5.7 - 6.4
Diabetes: >6.4
Glycemic control for adults with diabetes: <7.0

TSH	3.770		uIU/mL	0.450-4.500	01
GGT	**131**	**High**	IU/L	0-65	01
Thyroxine (T4)	6.0		ug/dL	4.5-12.0	01
T3 Uptake					
T3 Uptake	25		%	24-39	01
Free Thyroxine Index	1.5			1.2-4.9	
Triiodothyronine (T3)	109		ng/dL	71-180	01
Calcium	8.8		mg/dL	8.6-10.2	01
Protein, Total	**5.9**	**Low**	g/dL	6.0-8.5	01
Albumin	**3.7**	**Low**	g/dL	3.8-4.8	01
Globulin, Total	2.2		g/dL	1.5-4.5	
A/G Ratio	1.7			1.2-2.2	

Patient B

Glucose	75		mg/dL	65-99	01
BUN	24		mg/dL	8-27	01
Creatinine	1.05		mg/dL	0.76-1.27	01
eGFR If NonAfricn Am	70		mL/min/1.73	>59	
GlycoMark(R)(1,5 AG)	20.1		ug/mL		03

GlycoMark(TM) is intended for use with managing glycemic control in diabetic patients. A low result corresponds to high glucose peaks.
1, 5-AG blood levels can be affected by clinical conditions or medications. Please refer to the directory of services or labcorp website test menu for detailed list of limitations.
Reference Range:
Adults Males: 10.7 - 32.0
Glycemic control goal for diabetic patients: >10

Hemoglobin A1c					
Hemoglobin A1c	5.3		%	4.8-5.6	01
Please Note:					01

Prediabetes: 5.7 - 6.4
Diabetes: >6.4
Glycemic control for adults with diabetes: <7.0

TSH	1.380		uIU/mL	0.450-4.500	01
Homocyst(e)ine	**25.9**	**High**	umol/L	0.0-19.2	01
Uric Acid	7.8		mg/dL	3.8-8.4	01

Therapeutic target for gout patients: <6.0

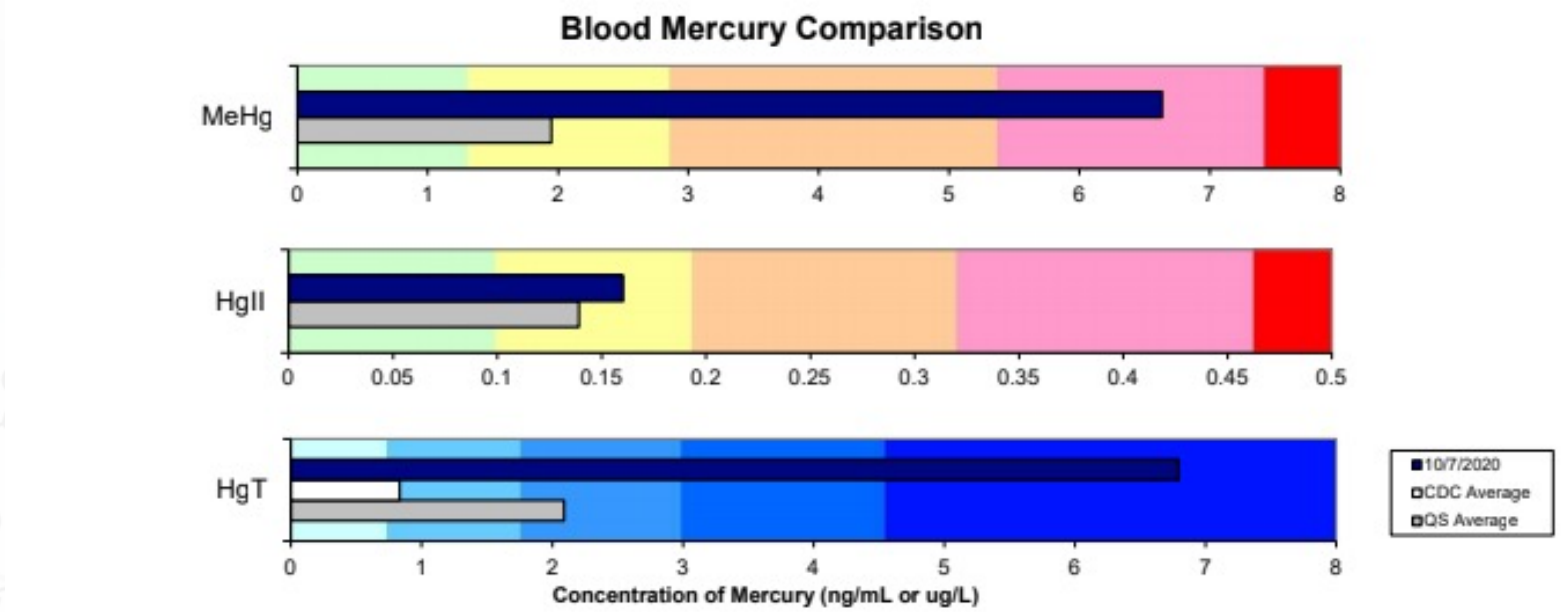
Phosphorus	3.7		mg/dL	2.8-4.1	01
LDH	**241**	**High**	IU/L	121-224	01
GGT	26		IU/L	0-65	01
Thyroxine (T4)	7.5		ug/dL	4.5-12.0	01
T3 Uptake					
T3 Uptake	29		%	24-39	01
Free Thyroxine Index	2.2			1.2-4.9	
Triiodothyronine (T3)	**58**	**Low**	ng/dL	71-180	01

Patient A: 65-year-old male, atenolol, metformin, insulin, statin, hctz.

1. DM2 dx 7 years
2. Progressive distal to proximal
3. Sequencing Pattern present
4. PAD – 40-year smoker

Patient B: middle aged female, levothyroxine, statin.

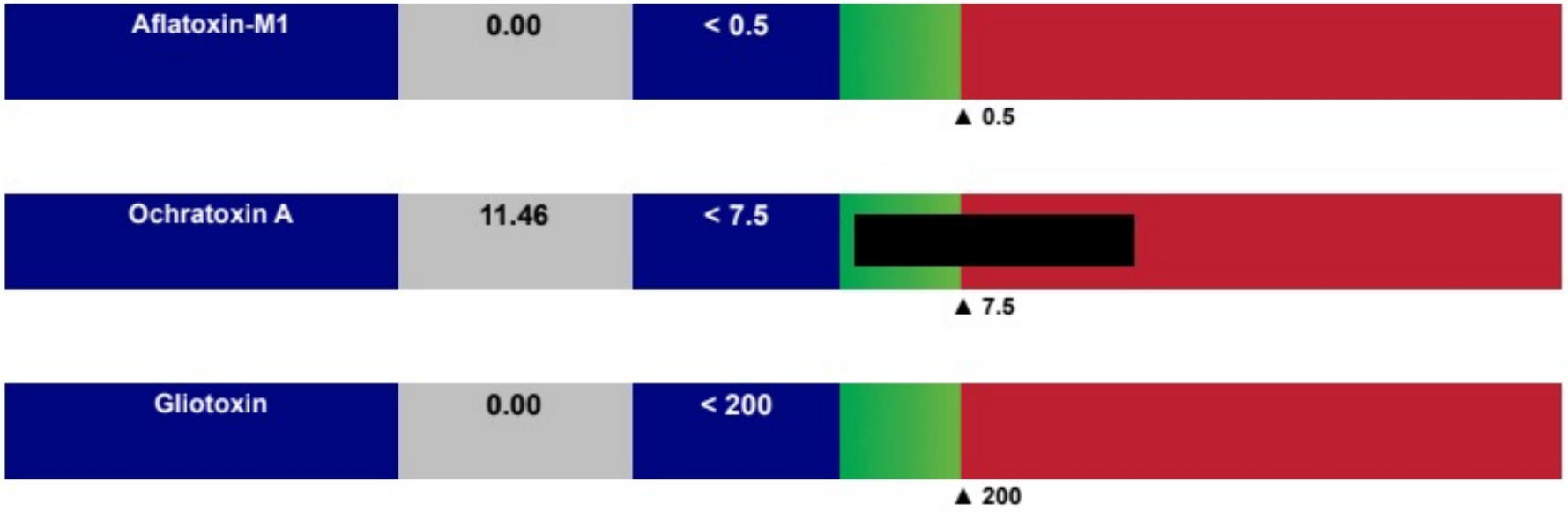
1. NutrEval WNL
2. No known chemical exposures – office job.
3. Failed VCS test
4. Amalgams Present



Potentially Toxic Elements

Element	10/7/2020	NA	Range	Units	Percentile Rank by Quintile 20	40	60	80	100	Percentile
Antimony	8.6	NA	<7.5	µg/L						99%
Arsenic	3.4	NA	<5.0	µg/L						64%
Cadmium	0.4 B	NA	<0.84	µg/L						60%
Cobalt	0.2 B	NA	<5.0	µg/L						41%
Lead	1.17	NA	<2.6	µg/dL						48%
Mercury	6.5	NA	<6.0	µg/L						83%
Silver	< 0.1	NA	<2.6	µg/L						NA
Strontium	21	NA	<50	µg/L						47%

Aspergillus



Environmental Relative Moldiness Index (ERMI)	39.1

Interpretation	Q4

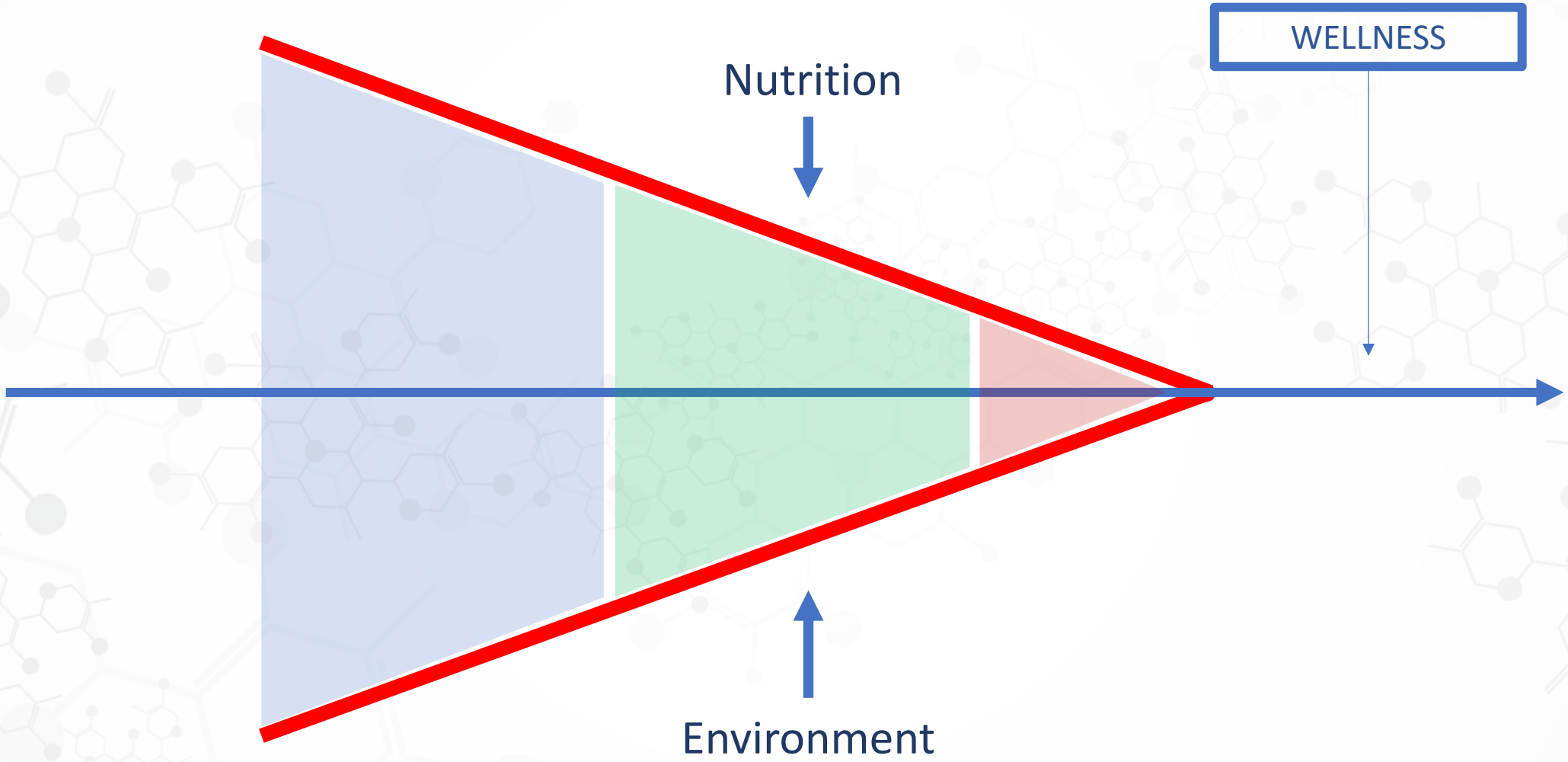
ERMI score was developed by the US government for environmental mold safety (mold related asthma) and the score table is a general recommendation.

For patients with CIRS condition, in general, an ERMI score of 2 or less is considered safe. For more information please consult with your doctor for the best advice on how to interpret the results.

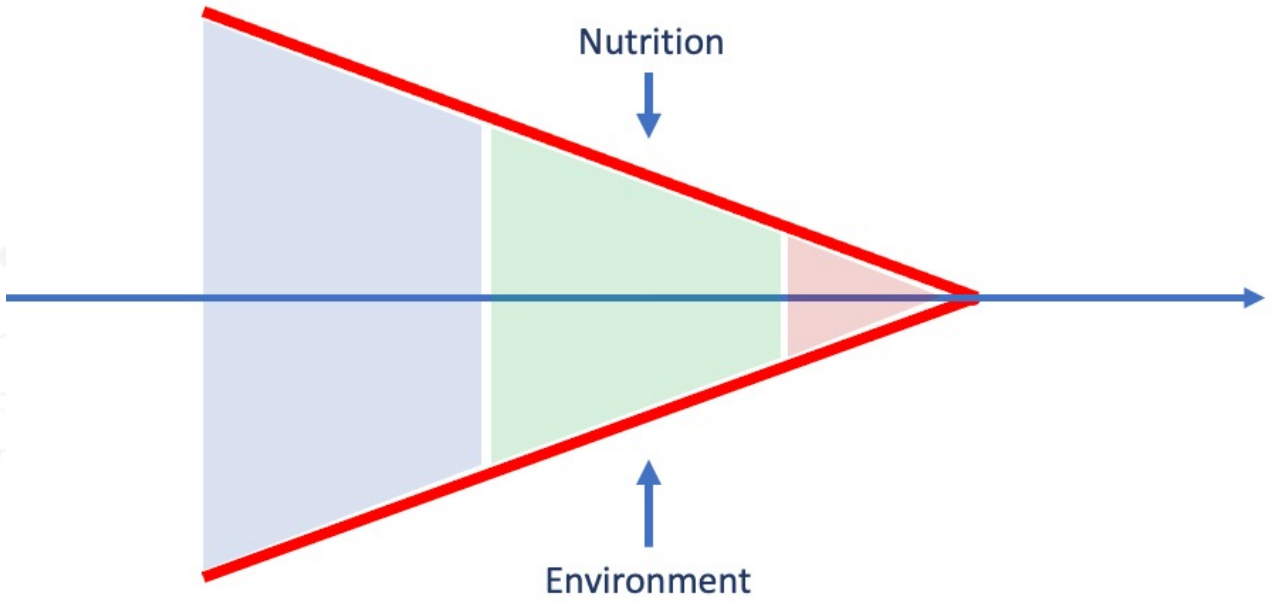
4.2 The interpretation was made with reference to the following table:

Level	ERMI Values	Interpretation	Comment
Q 1	Less than - 4	Low Relative Moldiness Index	Further investigation is not needed to determine the sources of the mold.
Q 2	-4 to < 0	Low - Medium Relative	Further investigation may be needed to determine the sources of the mold if occupants have been reactive, sensitized, genetically predisposed or otherwise immuno-compromised.
Q 3	0 to < 5	Medium- High Relative	
Q 4	5 to < 20	High Relative Moldiness Index	Source and cause of mold should be determined and remediation is undertaken, reducing the ERMI to levels below Q2.
	> 20	Very High Relative	

Protocols



NeuronaStem



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