

Casual Friday Series

# Interrupting Neuropathy Pt II

A Biogenetix Clinical Presentation

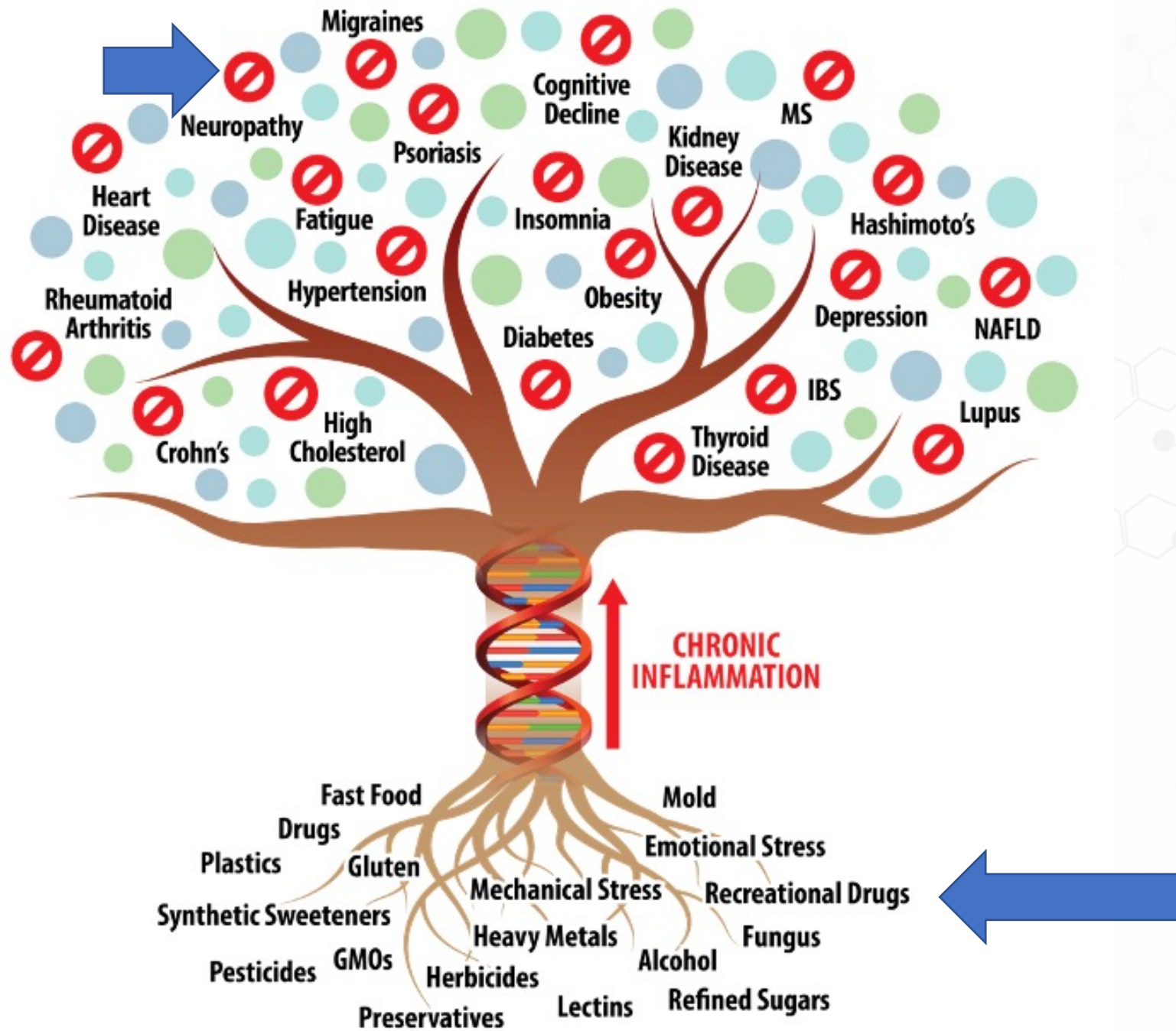
[BIOGENETIX.COM](http://BIOGENETIX.COM)

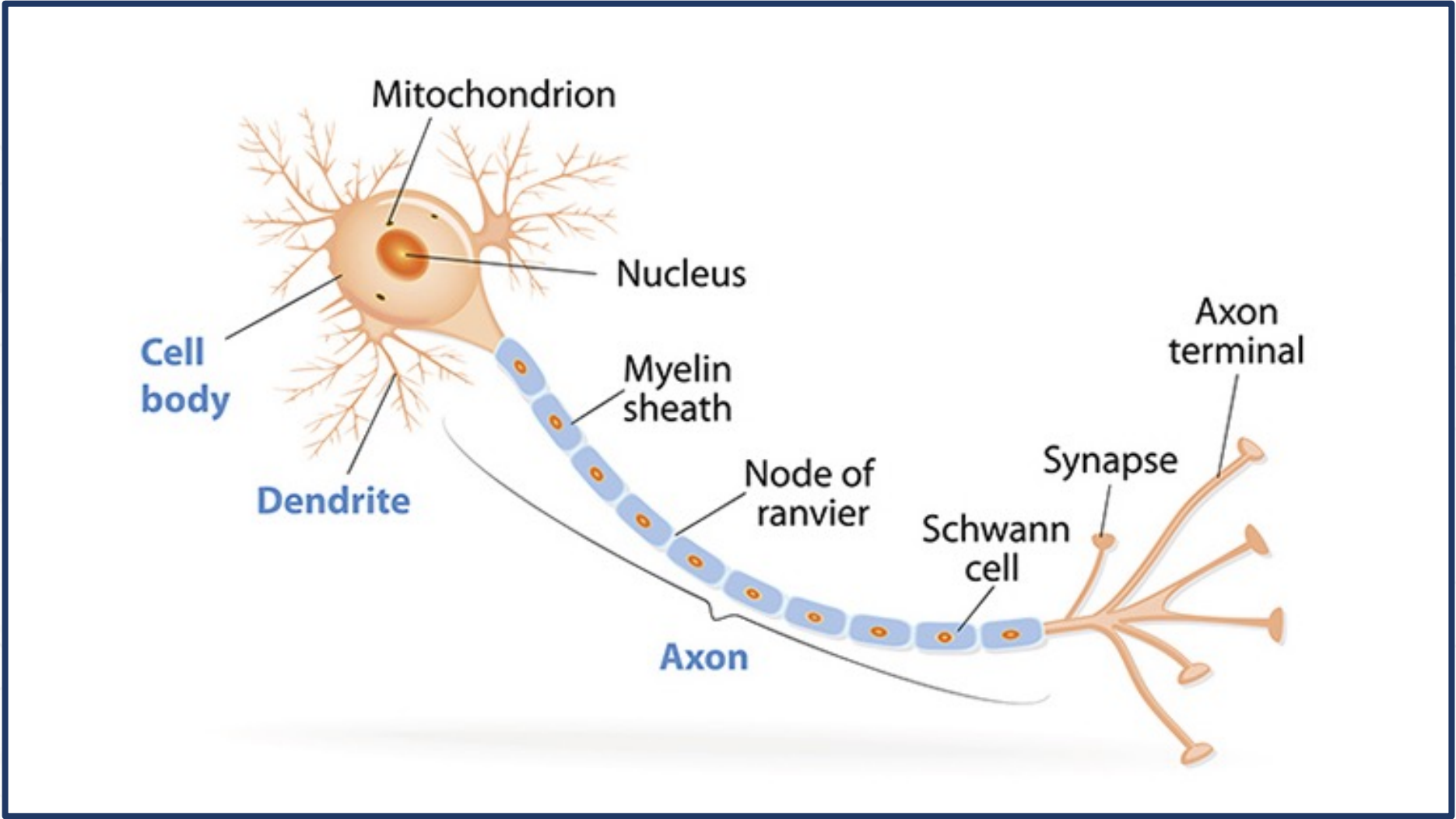


# Disclaimer

- *Information in this presentation is not intended to diagnose, treat, reverse, cure, or prevent any disease. While this presentation is based on medical literature, findings, and text, The following statements have not been evaluated by the FDA.*
- *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.*

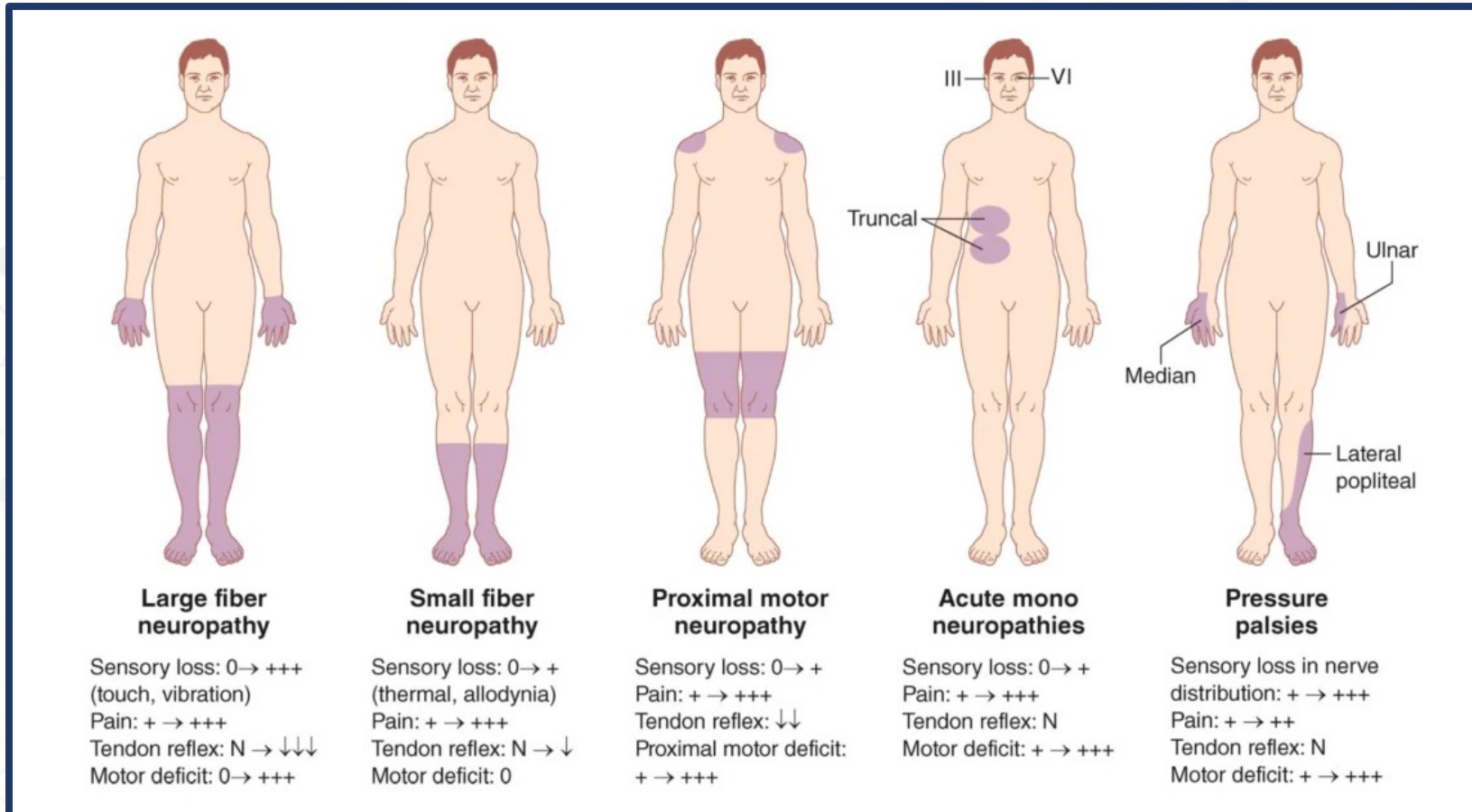








# CLINICAL FEATURES



# Signs

Signs of peripheral neuropathy also include sensory, motor and autonomic components.

- The most prominent autonomic sign of neuropathy is orthostatic hypotension



# CLASSIFICATION

There are many ways to classify peripheral neuropathy. One helpful method is to consider four categories, namely **etiology, distribution, pathology and modality.**



The mnemonic ***DANG THERAPIST*** is helpful in recalling the more common causes of peripheral neuropathy:

**D** Diabetes Mellitus

**A** Alcohol

**N** Nutritional (B<sub>12</sub> deficiency)

**G** Guillain-Barre Syndrome

**T** Toxins (Pb, As, Zn, Hg)

**H** Hematologic (cancers, etc.)

**E** Endocrine (hypothyroid)

**R** Rheumatologic (SLE, rheumatoid arthritis, vasculitis)

**A** Amyloid

**P** Porphyria

**I** Infectious (syphilis, HIV)

**S** Sarcoid

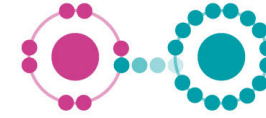
**T** Tumor (paraneoplastic neuropathy)





# NERVE DAMAGE FROM OXIDATIVE STRESS

**OXIDATIVE FREE RADICAL**  
Unstable molecule containing an unpaired electron

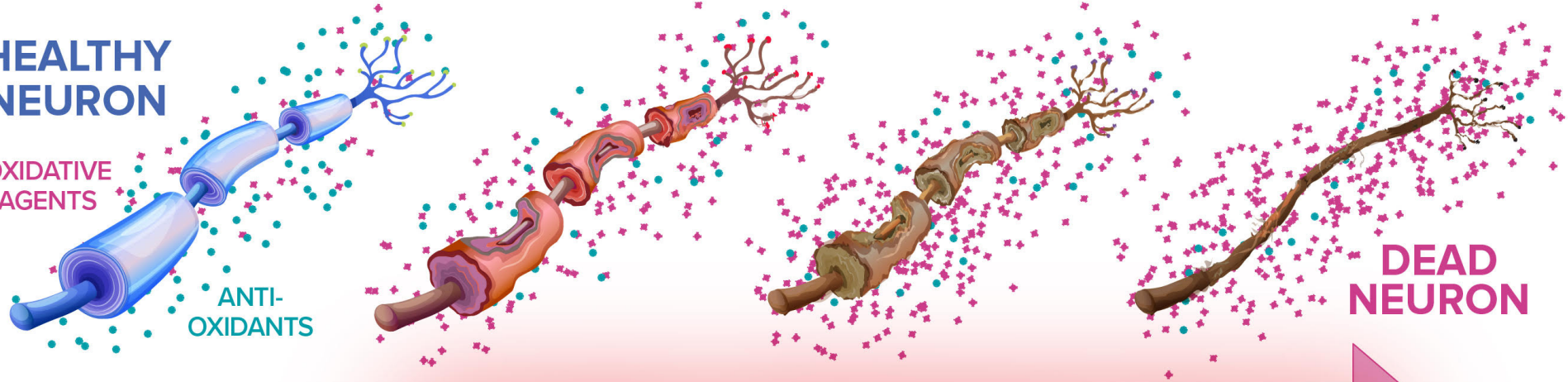


**ANTIOXIDANT MOLECULE**  
Molecule stable enough to donate an electron to a free radical

**HEALTHY NEURON**

**OXIDATIVE AGENTS**

**ANTI-OXIDANTS**



**DEAD NEURON**

**PROLONGED OVERWHELMING IMBALANCE**

**OXIDATIVE AGENTS:** A chemical species that steals electrons from another substance, leading to the oxidation. These are reactive oxygen species (ROS), referring to a group of highly reactive molecules and free radicals containing oxygen.

**ANTIOXIDANTS:** Molecules that help protect the body from the damage caused by ROS and free radicals. Antioxidants neutralize free radicals by donating an electron without becoming destabilized themselves.



# LABORATORY INVESTIGATION

Laboratory studies play an important role in diagnosing and categorizing the peripheral neuropathies. Electrodiagnostic studies are helpful in quantitating the neuropathy, while blood and urine studies are helpful in identifying an etiology.

## **Electrodiagnostic Studies:**

- **Nerve Conduction Study**
- **Electromyography (EMG)**



## **Nerve Conduction Study:**

The recording and measurement of the compound nerve and muscle action potential elicited in response to a single supramaximal electrical stimulus, to measure the terminal latency, amplitude and duration of the evoked potential, as well as the conduction velocity.

Nerve conduction studies are helpful in documenting that a neuropathy exists, quantitating the severity, and noting the distribution of the neuropathy, i.e. whether it is distal, proximal or diffuse. In addition, nerve conduction studies can provide information on the modality involved, i.e. motor versus sensory, and can also give clues as to the underlying pathology, whether axonal or demyelinating.





**Demyelinating neuropathies** (neuropathies due to loss or destruction of myelin) result in slowed conduction velocities and prolonged distal latencies, because conduction velocity is proportional to the velocity of the largest-diameter myelinated fibers. Dispersion of evoked compound action potentials (CAP) can also be seen in demyelinating neuropathies, because all of the action potentials elicited in response to a single electrical stimulus will not reach the recording potential at the same time. Severe demyelinating neuropathies can also produce conduction block, which is a major decrease in amplitude of the muscle CAP upon proximal stimulation of its nerve as compared to distal stimulation.

**Axonal neuropathies** (neuropathies due to loss of axons or their cell bodies) generally result in a reduced amplitude of the compound motor or sensory nerve action potentials.





## **Electromyography (EMG):**

The recording and study of insertional, spontaneous, and voluntary electrical activity of muscle.

This test allows one to physiologically evaluate the motor unit, including the anterior horn cell, peripheral nerve, and muscle. EMG is helpful when evaluating patients with weakness, in that it can help one determine whether weakness is due to anterior horn cell disease, nerve root compression, peripheral neuropathy, or an intrinsic disease of muscle itself (myopathy).

EMG can differentiate acute denervation from chronic denervation, and may thus give an indication as to the time course of the lesion causing the neuropathy.



•**Acute Denervation:** Fibrillations and positive waves are present indicating spontaneous discharge of individual muscle fibers.

•**Chronic Denervation:** Voluntary motor unit potentials are of large amplitude and long duration, and are frequently polyphasic, because the motor units are enlarged as a result of re-innervation of adjacent previously denervated muscle fibers. Recruitment of additional motor units in response to increasing the force of muscular contraction is reduced for the same reason.

•**Demyelinating Neuropathy:** A decreased recruitment pattern is seen, since demyelination interferes with conduction of individual action potentials along the course of a peripheral nerve. Because denervation and reinnervation of muscle fibers are not features of demyelinating neuropathies, the configuration of the voluntary motor unit potentials is usually normal, and fibrillation potentials are not seen.



# Blood Studies

Routine blood studies should be obtained in all patients with peripheral neuropathy in order to screen for reversible causes. The following blood tests are recommended:

- Complete blood count
- Chemistry profile
- Sedimentation rate
- Thyroid studies
- Vitamin B<sub>12</sub> level
- ANA, rheumatoid factor
- Serum protein electrophoresis, serum immunoelectrophoresis
- RPR and HIV (if the clinical situation warrants)



## CBC With Differential/Platelet

Test	Current Result and Flag	Previous Result and Date	Units	Reference Interval
WBC <sup>01</sup>	8.1		x10E3/uL	3.4-10.8
RBC <sup>01</sup>	4.62		x10E6/uL	3.77-5.28
Hemoglobin <sup>01</sup>	13.6		g/dL	11.1-15.9
Hematocrit <sup>01</sup>	41.8		%	34.0-46.6
MCV <sup>01</sup>	91		fL	79-97
MCH <sup>01</sup>	29.4		pg	26.6-33.0
MCHC <sup>01</sup>	32.5		g/dL	31.5-35.7
RDW <sup>01</sup>	12.8		%	11.7-15.4
Platelets <sup>01</sup>	360		x10E3/uL	150-450
Neutrophils <sup>01</sup>	49		%	Not Estab.
Lymphs <sup>01</sup>	38		%	Not Estab.
Monocytes <sup>01</sup>	8		%	Not Estab.
Eos <sup>01</sup>	3		%	Not Estab.
Basos <sup>01</sup>	1		%	Not Estab.
Neutrophils (Absolute) <sup>01</sup>	4.1		x10E3/uL	1.4-7.0
Lymphs (Absolute) <sup>01</sup>	3.1		x10E3/uL	0.7-3.1
Monocytes(Absolute) <sup>01</sup>	0.6		x10E3/uL	0.1-0.9
Eos (Absolute) <sup>01</sup>	0.2		x10E3/uL	0.0-0.4
Baso (Absolute) <sup>01</sup>	0.0		x10E3/uL	0.0-0.2
Immature Granulocytes <sup>01</sup>	1		%	Not Estab.
Immature Grans (Abs) <sup>01</sup>	0.1		x10E3/uL	0.0-0.1





### Comp. Metabolic Panel (14)

Test	Current Result and Flag	Previous Result and Date	Units	Reference Interval
▲ <b>Glucose</b> <sup>01</sup>	<b>201</b> <b>High</b>		mg/dL	70-99
BUN <sup>01</sup>	17		mg/dL	6-24
Creatinine <sup>01</sup>	0.97		mg/dL	0.57-1.00
eGFR	69		mL/min/1.73	>59
BUN/Creatinine Ratio	18			9-23
Sodium <sup>01</sup>	137		mmol/L	134-144
Potassium <sup>01</sup>	4.1		mmol/L	3.5-5.2
Chloride <sup>01</sup>	100		mmol/L	96-106
▼ <b>Carbon Dioxide, Total</b> <sup>01</sup>	<b>19</b> <b>Low</b>		mmol/L	20-29
Calcium <sup>01</sup>	9.9		mg/dL	8.7-10.2
Protein, Total <sup>01</sup>	7.3		g/dL	6.0-8.5
Albumin <sup>01</sup>	4.8		g/dL	3.8-4.9

### Comp. Metabolic Panel (14) (Cont.)

Globulin, Total	2.5		g/dL	1.5-4.5
A/G Ratio	1.9			1.2-2.2
Bilirubin, Total <sup>01</sup>	<0.2		mg/dL	0.0-1.2
Alkaline Phosphatase <sup>01</sup>	110		IU/L	44-121
AST (SGOT) <sup>01</sup>	34		IU/L	0-40
▲ <b>ALT (SGPT)</b> <sup>01</sup>	<b>46</b> <b>High</b>		IU/L	0-32



## Hgb A1c with eAG Estimation

Test	Current Result and Flag	Previous Result and Date	Units	Reference Interval
▲ <b>Hemoglobin A1c</b> <sup>01</sup>	<b>10.6 High</b>		%	4.8-5.6
Please Note: <sup>01</sup>				
	Prediabetes: 5.7 - 6.4			
	Diabetes: >6.4			
	Glycemic control for adults with diabetes: <7.0			
Estim. Avg Glu (eAG)	258		mg/dL	

## Thyroxine (T4) Free, Direct

Test	Current Result and Flag	Previous Result and Date	Units	Reference Interval
T4,Free(Direct) <sup>01</sup>	1.42		ng/dL	0.82-1.77

## C-Peptide, Serum

Test	Current Result and Flag	Previous Result and Date	Units	Reference Interval
▲ <b>C-Peptide, Serum</b> <sup>01</sup>	<b>8.5 High</b>		ng/mL	1.1-4.4
C-Peptide reference interval is for fasting patients.				

## Vitamin D, 25-Hydroxy

Test	Current Result and Flag	Previous Result and Date	Units	Reference Interval
▼ <b>Vitamin D, 25-Hydroxy</b> <sup>01</sup>	<b>28.5 Low</b>		ng/mL	30.0-100.0

## C-Reactive Protein, Cardiac

Test	Current Result and Flag	Previous Result and Date	Units	Reference Interval
▲ <b>C-Reactive Protein, Cardiac</b> <sup>01</sup>	<b>8.69 High</b>		mg/L	0.00-3.00
Relative Risk for Future Cardiovascular Event				
	Low	<1.00		
	Average	1.00 - 3.00		
	High	>3.00		

## Homocyst(e)ine

Test	Current Result and Flag	Previous Result and Date	Units	Reference Interval
▲ <b>Homocyst(e)ine</b> <sup>01</sup>	<b>14.9 High</b>		umol/L	0.0-14.5



# Urine Studies

1. The following studies are recommended to screen for reversible causes of neuropathy:

- Heavy metal screen (Hg, Pb, Zn, As)
- Urine protein electrophoresis, urine immunoelectrophoresis

\***Chest x-ray**, helpful to screen for asymptomatic lung cancer that can sometimes cause a purely sensory neuropathy.

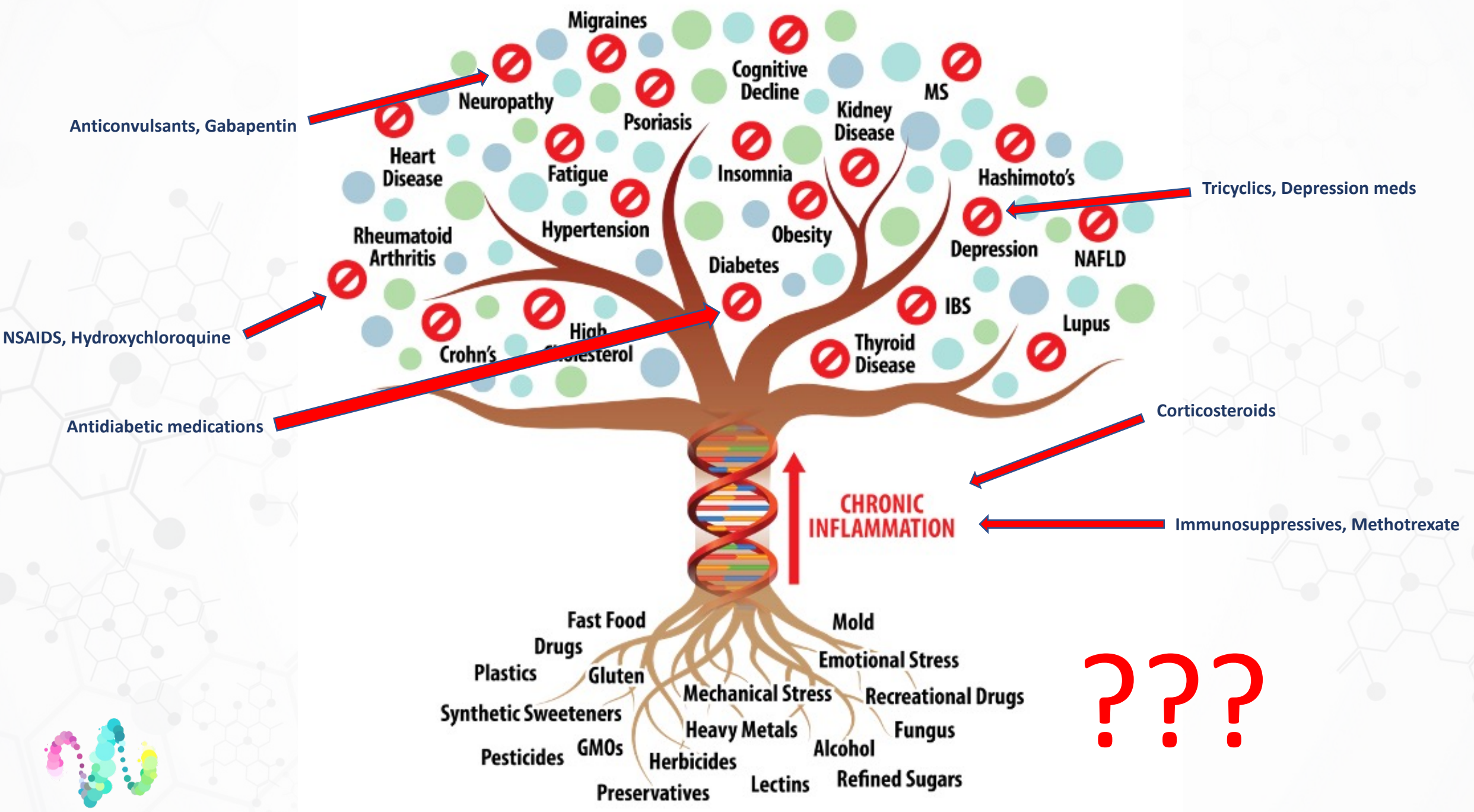


Moderate (75th-95th percentile)					
<span style="float: right;">  Heavy Metals            Environmental Toxins         </span>					
TEST NAME	CURRENT RESULT	PREVIOUS RESULT	CURRENT RESULT	PREVIOUS RESULT	REFERENCE
Arsenic*	40.39				≤52 ug/g
Lead*	0.64				≤1.16 ug/g
Mercury*	0.73				≤1.61 ug/g
Nickel	6.83				≤12.13 ug/g
Thallium*	0.29				≤0.43 ug/g
Tin*	1.06				≤3.72 ug/g
Atrazine mercapturate*	0.05				≤0.05 ug/g
Glyphosate	7.19				≤7.6 ug/g
Mono-(2-ethyl-5-oxohexyl) phthalate (MEOHP)*	12.24				≤23.4 ug/g

59-year-old, female, dx c/ diabetes







???

# Rescue Stage



21-Day Metabolic Clearing Program

# Repair Stage



Neuropathy Support Kit or Regen Support Bundle

# Recovery Stage



Monthly Wellness Bundle + Nexugen



# NERVE DAMAGE FROM OXIDATIVE STRESS

**OXIDATIVE FREE RADICAL**  
Unstable molecule containing an unpaired electron

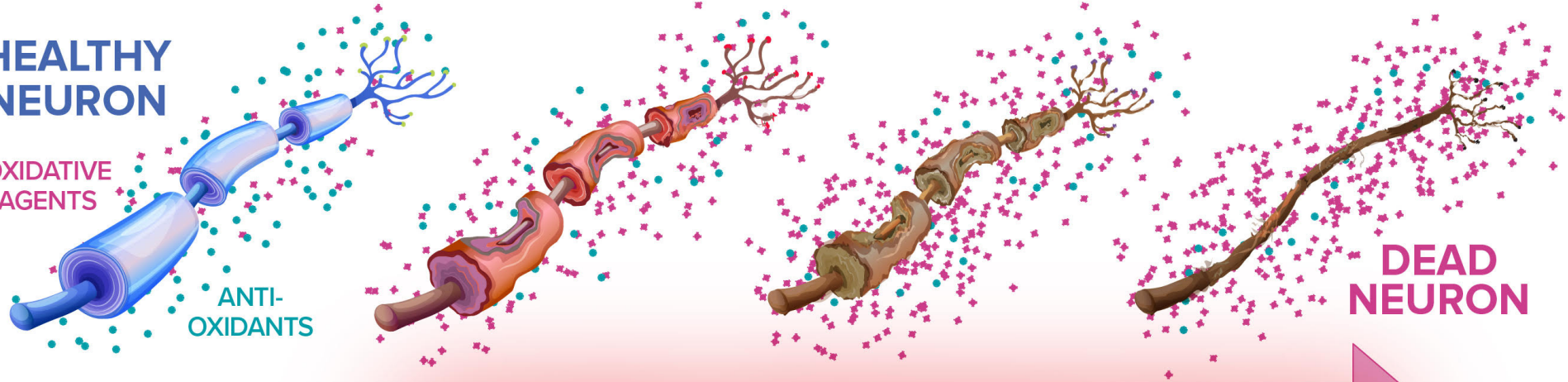


**ANTIOXIDANT MOLECULE**  
Molecule stable enough to donate an electron to a free radical

**HEALTHY NEURON**

**OXIDATIVE AGENTS**

**ANTI-OXIDANTS**



**DEAD NEURON**

**PROLONGED OVERWHELMING IMBALANCE**

**OXIDATIVE AGENTS:** A chemical species that steals electrons from another substance, leading to the oxidation. These are reactive oxygen species (ROS), referring to a group of highly reactive molecules and free radicals containing oxygen.

**ANTIOXIDANTS:** Molecules that help protect the body from the damage caused by ROS and free radicals. Antioxidants neutralize free radicals by donating an electron without becoming destabilized themselves.





