

D Y S A U T O N O M I A N E W S

D Y S A U T O N O M I A I N F O R M A T I O N N E T W O R K

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Dysautonomia News was created to inform and educate. The content should not be used as a substitute for professional medical advice, diagnosis or treatment. Readers are encouraged to confirm all information with other sources and a physician. Please keep in mind that research is continually evolving, and future discoveries may change or disprove some currently held beliefs.

Mitochondrial Disease and Dysautonomia: Exploring the Literature

As we have come to discover, dysautonomia is a complex syndrome that effects and is affected by so many variables. This month's issue will explore, in depth, the complicated area of Mitochondrial Disease.

The term Mitochondrial Cytopathies refers to human illness resulting from primary and secondary mitochondrial dysfunction¹.

Mitochondria are specialized components present in almost every cell in the body². They are responsible for energy production, as well as other functions tied to the specialized duties of the different cells in which they reside³. Mitochondria are the only cellular organelles known to have their own DNA (mtDNA) distinct from nuclear DNA.

Human illness resulting from mitochondrial cytopathy sometimes presents with symptoms of **dysautonomia**. The following article provides

general information on mitochondrial cytopathies and also explores several areas where mitochondrial disease presents with symptoms associated with **autonomic** dysfunction.

CATEGORIES

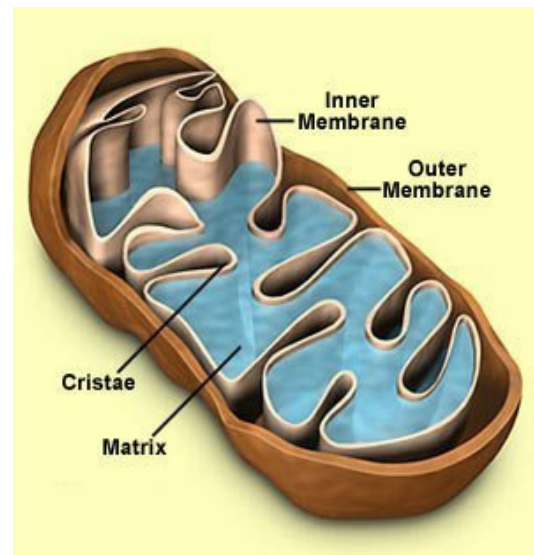
There are three general categories of impaired mitochondrial function:

1. nutritional or disease related
2. chemical induced
3. genetic⁴.

The genetic aspects are particularly important. We inherit our mitochondria from our mothers; therefore genetic mitochondrial mutations are passed from mother to child. Family members with the same mitochondrial DNA mutation could be affected in very different ways. This is true not only in terms of disease severity, but also regarding symptoms, organ systems involved and the age of onset⁵.

SYMPTOMS

Like dysautonomia, mitochondrial disorders can present at any age and affect organs throughout the body producing a wide array of symptoms.



Mitochondrion

A 2001 Cleveland Clinic Journal of Medicine publication describes the autonomic as well as other clinical features that may present with mitochondrial cytopathies as follows⁶:

- Muscle weakness and/or cramping (may cause drooping of the upper eyelids and can affect eye movement)
- Mildly elevated levels of the **creatine kinase MM fraction**
- Poor motility of the esophagus, stomach and intestines
- Failure to gain weight, short stature
- Developmental delays, mental retardation, autism and/or neuropsychiatric disturbances
- Migraine, dementia, seizures and stroke-like episodes

- Cardiac conduction defects and **cardiomyopathy**
- Failure of normal glucose homeostasis by the liver
- **Retinitis pigmentosa**⁷ and **optic atrophy**
- Hearing loss
- Loss of amino acids and **electrolytes** in urine
- **Renal tubular acidosis** and **Fanconi syndrome** (usually in children)
- Diabetes, hypoglycemia
- **Air hunger**, respiratory problems
- Chronic fatigue syndrome
- **Neuropathy**, which can cause distal weakness, loss of deep tendon reflexes, pain, or autonomic features such as temperature instability, inappropriate or lack of sweating, orthostatic **hypotension** and bladder dysfunction. Autonomic neuropathy can also contribute to gastrointestinal dysmotility.

Symptoms of autonomic dysfunction have been reported as a feature of mitochondrial disease in a number of other publications as well. A 1999 study of 42 children, 37 of which had confirmed mitochondrial disorders, showed that the autonomic nervous system was involved in 43% of patients⁸. The most frequent autonomic manifestation was

gastrointestinal **dysmotility**, presenting either as difficulty swallowing leading to feeding difficulties and failure to thrive, or chronic diarrhea and constipation. Central **apnea** was common. Intracardiac conduction defects manifesting as **Wolff-Parkinson White syndrome, ventricular tachycardia**, or **supraventricular tachycardia** were present in four children. Alternating unequal pupil size was seen in two of the patients. **Neurogenic bladder** and intestinal **pseudo-obstruction** were present in three siblings, one of whom also had dysregulation of blood pressure and heart rate during stress.

The authors of this study state that neurological presentations are **heterogeneous** in mitochondrial disorders involving the **central, peripheral** and autonomic nervous systems. They conclude that a mitochondrial evaluation is warranted in patients with complex neurologic manifestations or single symptoms plus other system involvement with no other obvious cause⁸.

A 2001 publication also discusses mitochondrial disease presenting with features associated with dysautonomia⁹. This publication outlines the clinical symptoms associated with mitochondrial

encephalomyopathy with lactic acidosis and stroke-like episodes (MELAS), which is the most common maternally inherited mitochondrial disease. Like dysautonomia patients, MELAS patients often present with exercise intolerance and migraine-like headaches. Other clinical features of MELAS include recurrent vomiting, limb weakness, short stature, stroke (usually before age 40) and **encephalopathy** characterized by seizures, dementia or both⁹.

The 1996 publication "Mitochondrial Encephalomyopathies Presenting with Features of Autonomic and Visceral Dysfunction" reviews the cases of three children with mitochondrial encephalomyopathy presenting with autonomic dysfunction. Autonomic dysfunction included gastrointestinal dysmotility, apnea, cardiac arrhythmias, decreased secretion of tears, supersensitivity to the **vasodilator** called metacholine, altered sweating, and postural hypotension¹⁴. The investigators in this study conclude that these patients illustrate that in some mitochondrial encephalomyopathies autonomic features may be prominent and can mimic the clinical features associated with hereditary sensory and autonomic neuropathies.

A 1995 publication reviews a case of mitochondrial encephalomyopathy presenting with features of autonomic dysfunction as well¹⁵. The investigators report on a 28-year-old man with mitochondrial encephalomyopathy with peripheral neuropathy and autonomic symptoms. The physicians hypothesized that autonomic symptoms in this case were due to **axonal** degeneration that included **unmyelinated** fibers.

RELATIONSHIP WITH CHRONIC FATIGUE SYNDROME

Other publications explore the relationship between mitochondrial dysfunction and symptoms associated with dysautonomia as well. The book



titled "Mitochondria in Pathogenesis" contains a chapter entitled "Mitochondrial Dysfunction in Chronic Fatigue Syndrome", authored by Brad Chazotte. Approximately 40% of patients with chronic fatigue syndrome have orthostatic intolerance, a form of dysautonomia¹⁰.

Chazotte presents a study investigating mitochondrial dysfunction in 34 chronic fatigue syndrome (CFS) patients¹¹. The results of this study show impaired mitochondrial ATP-making ability in CFS patients'

cells. Chazotte concludes, *it is no surprise, therefore, that the major CFS complaints in addition to general fatigue are typically muscle fatigability (often perceived as muscle weakness), cognitive dysfunction and sleep abnormalities.*

Of particular interest are reports of the beneficial effects of carnitine, which is involved in mitochondrial B-oxidation of fatty acids—an important source of muscle energy. Ubiquinone (CoQ10), an electron transport chain component in the mitochondrial inner membrane, has also been reported to help CFS patients¹¹.

The investigators of the study state “it should be clear that our data do not prove that mitochondrial dysfunction causes CFS. Rather, we show that mitochondrial dysfunction is *involved* in CFS”. Whether the cause of this dysfunction is some immune- or cell-signaling anomaly, perhaps due to a genetic predisposition triggered by a viral or bacterial infection, remains to be seen¹¹.

The degree to which this information may have impact is not yet clear. Dr. Bruce Cohen, a lead investigator in mitochondrial disease, believes evaluating every person who has chronic fatigue syndrome for mitochondrial cytopathy

would not be practical. He believes it probably should be reserved for patients who have had an exhaustive but uninformative investigation of their illness⁶.

RELATIONSHIP TO CYCLIC VOMITING SYNDROME

Dr. Richard Boles, a metabolic geneticist at Childrens Hospital, Los Angeles is also interested in the association between mitochondrial disease and symptoms of dysautonomia.

His 2001 publication “Cyclic Vomiting in Mitochondrial Disease” engages the relationship of cyclic vomiting, mitochondrial disease and dysautonomia¹². Boles discusses the cases of 15 children with known mitochondrial disease and 50 children with cyclic vomiting and additional neuromuscular problems (a group at risk for possible mitochondrial disease). Boles reports “many of these children have a specific pattern of additional clinical and laboratory findings including GI dysmotility (reflux, delayed gastric emptying, constipation), dysautonomia (unexplained fevers, high heart rate, etc.), muscle weakness, chronic fatigue, seizures and pain (head, abdomen and/or extremities). The latter, referred to as “muscle cramps”, is occasionally associated with

swelling and skin discoloration in a manner suggestive of **neuro-vascular dystrophy**". The children's symptoms tended to be episodic and variable, and no single child suffered from all of the reported problems.

In most (but not all) cases, siblings, the mother and occasionally other maternal relatives had a history of intermittent and usually mild disease manifestations, which included varying symptoms such as migraine, seizures, dysautonomia, depression, hypothyroidism, "hypoglycemia", gut dysmotility (reflux disease, severe constipation, etc.) exercise intolerance, muscle pain and **peripheral neuropathy**⁵. A few of the children's families had a history of **Sudden Infant Death Syndrome (SIDS)**. Research has shown that SIDS may be related to autonomic dysfunction¹³.

The United Mitochondrial Disease Foundation's "Ask the Mito Doc" web page (www.umdf.org) sheds further light on the occurrence of dysautonomia with mitochondrial disease. Statements made by physicians on the UMDF's web page include the following:

- In my personal experience, dysautonomia is not rare

in children and adults with probable mitochondria-related disease, especially those with maternal inheritance⁵. –Richard Boles, MD

- Although no scientific study has been published on the matter of temperature intolerance in people with mitochondrial cytopathies, it is a common feature of many affected adults and children¹⁶. –Bruce H. Cohen, MD
- In my personal experience, localized swelling and/or pain are common in children with mitochondrial disease. Changes in color and/or temperature of the skin can also occur. Usually the arms and/or legs are involved, but the face and/or torso (including the chest) can also be affected. Like other "mito symptoms", the problem usually comes and goes, often triggered by stress (fasting, fever, illness, exercise, sunburn, etc.). I believe these changes are manifestations of dysautonomia, as they usually occur in individuals with at least one other sign of dysautonomia⁵. –Richard Boles, MD

MAKING THE DIAGNOSIS

Diagnosis of mitochondrial disease may include several tests. The two major biochemical features in most mitochondrial diseases are **lactic acidosis** and **respiratory chain** deficiency⁹. However, one study showed that serum lactic acid levels were normal in a number of children with both mitochondrial disease and dysautonomia⁸.

The gold standard for diagnosis of mitochondrial disease is a pathologic point mutation that can be identified in white blood cells⁶. However, a mutation cannot be found in many patients, and therefore diagnosis may require visual and biochemical examination of muscle tissue. From the **morphological** standpoint, patients with mitochondrial diseases often have **ragged-red fibers** in the muscle biopsy¹⁷.

Clearly, literature shows that some patients presenting with symptoms of dysautonomia may have mitochondrial disease. Dysautonomia patients who suspect they have mitochondrial disease should seek out a physician who specializes in these disorders. The United Mitochondrial Disease Foundation (www.umdf.org) has information on physicians that

specialize in identifying mitochondrial cytopathy.

There is currently no cure for mitochondrial disease. However, the benefits of a proper diagnosis cannot be understated. They include genetic counseling and a variety of treatments, some of which may be as simple as vitamins and cofactors.

Great strides are being made in the understanding of mitochondrial disease. The following are a few resources available to those who want to learn more about mitochondrial cytopathies:

- The United Mitochondrial Disease Foundation promotes research for cures and treatments of mitochondrial disorders and provides support to affected individuals and families. Visit their web site at: www.umdf.org
- The publication "Mitochondrial Cytopathy in Adults: What we Know so Far" is available online at: <http://www.ccjm.org/pdf/files/COHEN701.PDF>
- NINDS Mitochondrial Myopathies Information Page: http://www.ninds.nih.gov/health_and_medical/disorders/mitochon_doc.htm

- Mitochondrial Substructure:
http://cellbio.utmb.edu/cellbio/mitochondria_1.htm
Substructure
- The Mitochondrial Life cycle: How do mitochondria replicate??
<http://cellbio.utmb.edu/cellbio/mitoch2.htm>
- Mitochondrial Disorders:
<http://www.neuro.wustl.edu/neuromuscular/mitosyn.html>
- Cyclic Vomiting Syndrome Association:
<http://www.cvsaonline.org>
- The book "Mitochondrial Disorders in Neurology 2" by Anthony H. V. Schapira and S. DiMauro is geared toward medical professionals. Have your medical dictionary ready for this one... It is a 2002 revised edition published by Boston: Butterworth-Heinemann, ISBN: 0750672889
- The book "Mitochondria in Pathogenesis" edited by John J. Lemasters and Anna-Liisa Nieminen is written for the medical professional. It was published in 2001 by Kluwer Academic/Plenum Publishers, New York, ISBN 0306464330

References - see page 16

Research in Review

The Dysautonomia Information Network's Research in Review column presents research abstracts from MEDLINE followed by a review of the study in laymen's terms. Opinions expressed in research reviews are those of each individual author and are not necessarily those of all affiliates of the Dysautonomia Information Network. Patients are encouraged to read each publication and make their own interpretation.

Full text articles can be purchased at Loansome Doc Ordering System:
http://www.nlm.nih.gov/loansomedoc/loansome_home.html

Isometric Arm Counter-Pressure Maneuvers to Abort Impending Vasovagal Syncope.

Brignole M, Croci F, Menozzi C, Solano A, Donateo P, Oddone D, Puggioni E, Lolli G.
Journal of the American College of Cardiology. 2002 Dec 4;40(11):2053-9.
PMID: 12475469

OBJECTIVES: We hypothesized that isometric arm exercises were able to increase blood pressure (BP) during the phase

of impending **vasovagal syncope** and allow the patient to avoid losing consciousness. **BACKGROUND:** Hypotension is always present during the prodromal phase of vasovagal syncope. **METHODS:** We evaluated the effect of handgrip (HG) and arm-tensing in 19 patients affected by tilt-induced vasovagal syncope. The study consisted of an acute single-blind, placebo-controlled, randomized, cross-over tilt-table efficacy study and a clinical follow-up feasibility study. **RESULTS:** In the acute tilt study, HG was administered for 2 min, starting at the time of onset of symptoms of impending syncope. In the active arm, HG caused an increase in systolic blood pressure (SBP) from 92 +/- 10 mm Hg to 105 +/- 38 mm Hg, whereas in the placebo arm SBP decreased from 91 +/- 11 mm Hg to 73 +/- 21 mm Hg ($p = 0.008$). Heart rate behavior was similar in the two arms. In the active arm, 63% of patients became asymptomatic, versus 11% in the control arm ($p = 0.02$); conversely, only 5% of patients developed syncope, versus 47% in the control arm ($p = 0.01$). The patients were trained to self-administer arm-tensing treatment as soon as symptoms of impending syncope occurred. During 9 +/- 3 months of follow-up, the treatment was actually performed in 95/97 episodes of

impending syncope (98%) and was successful in 94/95 (99%). No patients suffered injury or other adverse morbidity related to the relapses. **CONCLUSIONS:** Isometric arm contraction is able to abort impending vasovagal syncope by increasing systemic BP. Arm counter-pressure maneuvers can be proposed as a new, feasible, safe, and well accepted first-line treatment for vasovagal syncope.

* * *

Review

by Michelle Sawicki

This study presents a promising new counter-maneuver that may abate impending syncope. Patients were trained to tense their arms to the maximum tolerated isometric contraction by gripping one hand with the other and pushing away the two arms. This arm-tensing maneuver has been shown to increase systolic blood pressure.

Patients were discharged with the recommendation to self-administer the arm-tensing maneuver as soon as they felt like they were going to faint. Follow-up with patients showed that they were able to perform the arm-tensing maneuver in 98% of cases and to relieve symptoms in 99% of these cases. The authors do admit that most of the patients'

episodes of impending syncope would have resolved spontaneously without leading to fainting, even in the absence of arm-tensing treatment.

The authors conclude that arm-tensing will definitely abort the vasovagal reaction in some cases, while in others it will give the patient enough time to initiate other maneuvers to prevent fainting, such as lying down. It is important to note that arm-tensing is not a “cure” for vasovagal syncope. Patients will still suffer symptoms associated with this disorder, and it isn’t until symptoms of impending syncope that self-administered arm-tensing exercises may ward off a faint.

It is also important to note that this study included patients with a history of one or more fainting episodes *with* prodromal symptoms. Research has reported that approximately one third of patients do not experience symptoms suggestive of impending syncope¹.

Patients should not try any new treatments without first obtaining a physician’s approval.

Reference

1. Alboni, P., Brignole, M., Menozzi, C., Raviele, A., Del Rosso, A., Dinelli, M., Solano, A., Bottoni, N. (2001). Diagnostic value of history in patients with syncope with or without heart disease. *Journal of the American College of Cardiology*, 37(7), 1921-1928.

We Need Your help!

You can contribute to the Dysautonomia Information Network (DINET) in the following ways:

Share your experiences in The Patient’s Voice!

The Patient’s Voice is a newsletter column where patients can express themselves and write about experiences relating to dysautonomia - both positive and negative. It is a place to share medical experiences, suggestions, short stories and poetry, etc. Send contributions to:

DINET.org@comcast.net

We look forward to hearing from you!

Help Build Our Worldwide Physician Finder!

If you know of physicians that have a special interest in any type of dysautonomia, please submit their contact information to us at:

http://www.potsplace.com/physician_finder.htm

Or write to:

Dysautonomia Information
Network
P.O. Box 55
Brooklyn, MI 49230
United States

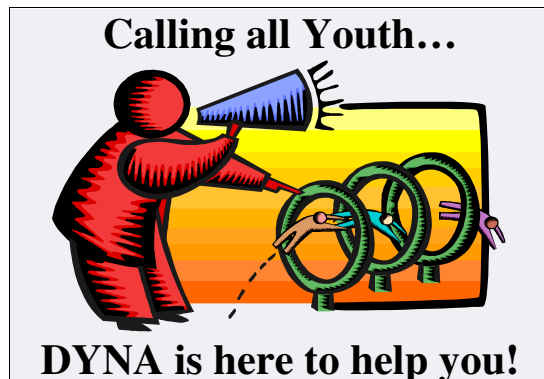
Research

Do you like to research and know how to use PubMed? If the answer is yes, DINET could use your help! Please email DINET.org@comcast.net for more information.

Thank you!

Did You Know...

- Many public libraries have interloan programs that can borrow books for you from other libraries...



What is DYNA?

[Dysautonomia Youth Network of America, Inc.](http://www.dynakids.org)

Young people with the various dysautonomia conditions may experience sudden isolation from their peers due to the impact of their symptoms. They often must make sudden life style changes in the prime of their adolescence. The

Dysautonomia Youth Network of America (DYNA) is a 501 (c) (3) non-profit organization dedicated to serving these individuals.

DYNA provides members with a positive support network and strives to heighten awareness of dysautonomia conditions within the pediatric and adolescent medical community. DYNA publishes a heart-warming and informative newsletter that is mailed to many physicians, hospitals, and private individuals across the nation.

One of the favorite support programs for DYNA youth members is the Computer Connections Club. This club puts youth members in touch with each other over the Internet in a secure and private manner.

DYNA believes in empowering youth members and encourages them to become involved in their own cause. DYNA does not charge membership fees.

" A Ray of Hope"

[For more information visit our website at: www.dynakids.org](http://www.dynakids.org)

[Dysautonomia Youth Network of America, Inc.](http://www.dynakids.org)
[1301 Greengate Court](http://www.dynakids.org)
[Waldorf, MD 20601](http://www.dynakids.org)
[301-705-6995](http://www.dynakids.org)

Glossary

Air Hunger: a pattern of deep and rapid respiration, seen particularly in metabolic acidosis. Also called Kussmaul's respiration and Kussmaul-Kien respiration. Definition from: <http://www.mercksource.com> Powered by Dorland's Illustrated Medical Dictionary

Apnea: Temporary absence or cessation of breathing. Definition from: <http://www.bartleby.com> The American Heritage® Dictionary of the English Language: Fourth Edition. 2000.

Autonomic: The part of the vertebrate nervous system that regulates involuntary action, as of the intestines, heart, and glands, and that is divided into the sympathetic nervous system and the parasympathetic nervous system. <http://www.bartleby.com> The American Heritage® Dictionary of the English Language: Fourth Edition. 2000.

Axon: A long fiber of a nerve cell (a neuron) that acts somewhat like a fiber-optic cable carrying outgoing (efferent) messages. Definition from: www.medterms.com MedicineNet, Inc.

Central Nervous System: the portion of the vertebrate nervous system consisting of the brain and spinal cord. Definition from: <http://www.bartleby.com> The American Heritage® Dictionary of the English Language: Fourth Edition. 2000.

Creatine Kinase: an enzyme (a type of protein) found in

muscle and brain. Normally, very little CK is found circulating in the blood. Elevated levels indicate damage to either muscle or brain; possibly from a myocardial infarction (heart attack), muscle disease, or stroke. Definition from: http://www.healthatoz.com/healthatoz/Atoz/ency/creatin_kinase_test.html

Cardiomyopathy: a general diagnostic term designating primary noninflammatory disease of the heart muscle, often of obscure or unknown etiology and not the result of ischemic, hypertensive, congenital, valvular, or pericardial disease. It is usually subdivided into *dilated*, *hypertrophic*, and *restrictive c*. Definition from: <http://www.mercksource.com> Powered by Dorland's Illustrated Medical Dictionary

Dysautonomia: malfunction of the autonomic nervous system. Definition from: <http://www.mercksource.com> Powered by Dorland's Illustrated Medical Dictionary

Dysmotility (syndrome): A vague, descriptive term used to describe diseases of the muscles of the gastrointestinal tract (esophagus, stomach, small and large intestines) in which the muscles do not work normally (hence the term dysmotility). Other terms that are sometimes used for dysmotility problems are gastroparesis when the stomach is involved, and chronic intestinal pseudo-obstruction when the intestines and stomach are involved. Definition

from:

<http://www.med.miami.edu/patients/glossary/art.asp?articlekey=1898>

Electrolytes: *Physiology* Any of various ions, such as sodium, potassium, or chloride, required by cells to regulate the electric charge and flow of water molecules across the cell

membrane. Definition from:

<http://www.bartleby.com> The American Heritage® Dictionary of the English Language: Fourth Edition. 2000.

Encephalopathy: A general term describing brain dysfunction. Examples include encephalitis, meningitis, seizures and head trauma.

Definition from:

<http://geoparent.com/dictionary/Detailed/103.htm>

Fanconi's Syndrome: a set of kidney malfunctions brought about by a variety of seemingly unrelated disorders. Kidney malfunction leads to excessive urine production and excessive thirst, resulting in deficits of water, calcium, potassium, magnesium, and other substances in the body. It often leads to bone disease and stunted growth. Definition from:

http://www.healthatoz.com/healthatoz/Atoz/ency/fanconis_syndrome.html

Heterogeneous: consisting of or composed of dissimilar elements or ingredients; not having a uniform quality throughout. 2. in genetics, the term denotes a trait that can be produced by different genes or combinations of genes. Definition

from: www.mercksource.com Powered by Dorland's Illustrated Medical Dictionary

Hypotension: abnormally low blood pressure; seen in shock but not necessarily indicative of

it. Definition from: www.mercksource.com

Powered by Dorland's Illustrated Medical Dictionary

Lactic Acidosis: a condition characterized by the accumulation of lactic acid in bodily tissues. Definition from:

http://www.fasthealth.com/dictionary//lactic_acidosis.php Published under license with Merriam-Webster, Incorporated. © 1997-2000.

Morphological (morphology):

1 a. The branch of biology that deals with the form and structure of organisms without consideration of function. **b.** The form and structure of an organism or one of its parts: *the morphology of a cell; the morphology of vertebrates.* **2.** *Linguistics* The study of the structure and form of words in language or a language, including inflection, derivation, and the formation of

compounds. Definition from:

<http://www.bartleby.com> The American Heritage® Dictionary of the English Language: Fourth Edition. 2000.

Neuropathy: A disease or abnormality of the nervous system. Definition from:

<http://www.bartleby.com> The American Heritage® Dictionary of the English Language: Fourth Edition. 2000.

Neurogenic Bladder: a urinary problem in which there is abnormal emptying of the bladder with subsequent

retention or incontinence of urine. Depending on the type of nervous damage, the bladder may empty spontaneously (incontinence) or may not empty at all (retention with overflow leakage). Definition from: MEDLINEplus, <http://www.nlm.nih.gov/medlineplus/ency/article/000754.htm>

Neurovascular Dystrophy:

Also known as reflex sympathetic dystrophy (RSD), it is a clinical syndrome of variable course and unknown cause characterized by pain, swelling, and vasomotor dysfunction of an extremity. Definition from: <http://www.emedicine.com/med/byname/reflex-sympathetic-dystrophy.htm>

Optic Atrophy: damage to the optic nerve resulting in a degeneration or destruction of the optic nerve. Definition from: AdvanceRX.com, Building Better Health <http://www.buildingbetterhealth.com/topic/topic100587231>

Peripheral Nervous System: The part of the vertebrate nervous system constituting the nerves outside the central nervous system and including the cranial nerves, spinal nerves, and sympathetic and parasympathetic nervous systems. Definition from: <http://www.bartleby.com> The American Heritage® Dictionary of the English Language: Fourth Edition. 2000.

Peripheral Neuropathy: A condition caused by damage to the nerves in the peripheral nervous system. Symptoms can be described as burning,

shooting pain, throbbing, aching, and "feels like frostbite" or "walking on a bed of coals."

Definition from: <http://www.aegis.com/factshts/network/simple/neurop.html>

Pseudo-obstruction: Intestinal pseudo-obstruction (false blockage) is a condition that causes symptoms like those of a bowel obstruction (blockage). But when the intestines are examined, no obstruction is found. The symptoms of intestinal pseudo-obstruction are caused by a problem in how the muscles and nerves in the intestines work. Definition from Healthlink Medical college of Wisconsin <http://healthlink.mcw.edu/article/930605705.html>

Ragged-red Fibers: A pathological finding in which muscle fibers appear grossly ragged. The periphery of the fibers stain red histochemically because there are too many mitochondria, some with abnormal structure, clustered around their edges. Naviaux, R. K. (1997). Overview: The spectrum of mitochondrial disease. In K. Weber (Ed.), *Mitochondrial and Metabolic Disorders* (p. 20). Oradell, NJ: PSY-ED Corporation.

Renal Tubular Acidosis (RTA): a disease that occurs when the kidneys fail to excrete acids into the urine, which causes a person's blood to remain too acidic. Definition from: National Kidney and Urologic Diseases Information Clearinghouse <http://www.niddk.nih.gov/health/kidney/pubs/rtar/rtah.htm>

Respiratory Chain: the metabolic pathway along which electron transport occurs in cellular respiration: *also:* the series of respiratory enzymes involved in this pathway. Definition from: www.fasthealth.com Published under license with Merriam-Webster, Incorporated. © 1997-2000.

Retinitis Pigmentosa: any of several hereditary progressive degenerative diseases of the eye marked by night blindness in the early stages, atrophy and pigment changes in the retina, constriction of the visual field, and eventual blindness - called also *pigmentary retinopathy*. Definition from: www.fasthealth.com Published under license with Merriam-Webster, Incorporated. © 1997-2000.

Supraventricular Tachycardia (SVT): a rhythm disturbance of your heart. You experience rapid heart rate caused by an electrical impulse starting in the upper chambers of your heart. Definition from: eMedicine <http://www.emedicine.com/aaem/topic431.htm>

Sudden Infant Death Syndrome (SIDS): A fatal syndrome that affects sleeping infants under a year old, characterized by a sudden cessation of breathing and thought to be caused by a defect in the central nervous system. Also called crib death. Definition from: <http://www.bartleby.com> The American Heritage® Dictionary of the English Language: Fourth Edition. 2000.

Unmyelinated: Lacking a myelin sheath (The insulating

envelope of myelin that surrounds the core of a nerve fiber or axon and facilitates the transmission of nerve impulses). Definition from: <http://www.bartleby.com> The American Heritage® Dictionary of the English Language: Fourth Edition. 2000.

Wolff-Parkinson White Syndrome: In those who suffer from Wolff-Parkinson-White Syndrome, there is an additional or accessory conducting pathway, which leads from the atria to the ventricles of the heart. This can cause a disorderly action of the heart, with attacks of rapid heart beating which give rise to palpitation. Definition from: British Health Foundation <http://www.bhf.org.uk/questions/index.asp?secondlevel=370&thirdlevel=514>

Vasodilator: a drug that causes dilation of blood vessels. Definition from: <http://define.ansme.com/words/v/vasodilator.html> WordNet © 1.7, © 2001 Princeton University

Ventricular Tachycardia: a rapid heartbeat initiated within the ventricles, characterized by 3 or more consecutive premature ventricular beats. Definition from: MEDLINEplus <http://www.nlm.nih.gov/medlineplus/ency/article/000187.htm>

Vasovagal syncope: the most common cause of fainting, occurs in otherwise healthy people. It can affect people of all ages, but is particularly common in young women. It is also known as Neurocardiogenic Syncope or Vasodepressor Syncope. As these terms

suggest, the cause is low heart rate or blood pressure, leading to inadequate circulation to the brain. This results in fainting, or loss of consciousness (i.e., syncope). Definition from eCure Me http://www.ecureme.com/emyhealth/data/Neurocardiogenic_Syncope.asp

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