

Hypoadrenia: a causative factor in MCS and impaired enzymatic detoxification

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The naturopathic philosophy of reducing toxic body burdens of heavy metals and nonmetallic toxins is critically important for the restoration of good health. However, when key detoxification enzymes are dysfunctional, detoxification strategies may promote inflammation and serious damage to the organism. Safe "non-crisis" detoxification via Trans Sulfuration-Sulfate and the sphincter of oddi have been presented. (1-6) When toxins can't be disarmed and excreted safely out of the duodenum, they can sabotage fertility, weaken the immune system, accelerate aging, erode intelligence, trigger carcinogenesis, and activate neurological symptoms and cytokine-driven inflammatory processes that lie at the core of many high-profile diseases. (7-9)

[ILLUSTRATION OMITTED]

One reason that Multiple Chemical Sensitivity (MCS) can be such a stubborn problem is that it involves so many of the body's interlocking systems, and lying at the center of it all is an adrenal deficit in enzymatic detoxification. For this reason, doctors are finding it maddeningly hard to minimize or eliminate the symptoms of MCS, thwart unwanted pain and inflammation, and stop carcinogenesis. Lifestyle changes aren't enough. For the nation's major diseases to be controlled, doctors must learn how to unlock tensed energetic streams that govern healing and repair via adrenal energetics and physiology (the adrenal influence on detoxification enzymes).

Increasing worldwide pollution coupled with overcrowding, contaminated water and food, and indoor air contaminants has between 15 and 37% of the American population complaining of sensitivities or allergies to chemicals, car exhaust, tobacco smoke, air fresheners, and the scents of many common household cleaning agents and body care products. Indoor air contaminants (synthetic cleaning agents, synthetic colognes, perfumes, body care products, and air fresheners) wreck havoc with detoxification functions and the chemistry of the whole body goes awry. These pollutants act as stressors that infiltrate and damage the body and rapidly deplete the nutrient precursors and co-factors required to the body. Moreover, these pollutants throw off the calibration of the body's stress defense mechanisms, propelling the body into a vicious cycle of stress-driven reactions that allow stagnant energy to build up in the upper abdomen.

The best way to understand what MCS is--and what it is not is to observe how it affects the lives of people who have it. MCS has serious implications and social effects that demand more public and professional understanding. MCS sufferers

experience personality changes--becoming angry, depressed, irritated, anxious, fearful, and lethargic--and acute heart symptoms, brain and nervous system reactions, paralysis, an inability to breathe or a feeling of suffocation, intense headaches, dizziness, brain fog, short-term memory losses, muscle and joint pain and convulsions when exposed to certain chemicals.

Most sufferers find it impossible to live a normal life. Shopping and the normal social routines of life become impossible making isolation and withdrawal the only option to avoid a chemical exposure that could trigger a serious or near fatal neurological reaction. When they seek professional help, they are labeled as "psychosomatic" or misdiagnosed with psychiatric disorders, cognitive and neurological impairment, allergies, migraine headaches, sinusitis, or asthma. Sadly, the real cause (enzyme detoxification deficits and the deferral of repair routines due to hypoadrenia) remain obscure and masked by commonly prescribed antihistamines, decongestants, anti-inflammatory drugs, megavitamins (especially B complex and vitamin C), herbs, and cortisone.

Detoxification in Individuals with Impaired Enzymatic Detoxification is Contraindicated and Dangerous

MCS is a disabling, multi-organ syndrome caused by an impaired ability to detoxify chemical toxins. (11,12) According to a recent 2004 International Journal of Epidemiology study, impaired metabolism of toxic chemicals underlies MCS. In this case control study, a gene-gene interaction between enzymes suggested an elevated risk for MCS. (13) These findings parallel other observations of a link between enzyme abnormalities in GulfWar syndrome veterans and in a retrospective case-control analysis reporting cognitive and neurological impairments as symptomatology. (14,15) Clearly, labeling MCS patients as "psychosomatic" is not supported by scientific or clinical evidence. (38)

Effective detoxification protocols for MCS patients must address sulfoxidation deficits, specifically the impairment of the enzyme cysteine dioxygenase (CDO). The fact that CDO is the primary enzyme deficit in MCS patients and that it's not adequately identified by the acetaminophen challenge test, the urinary-sulfate-to-creatinine-ratio and the plasma cysteine-to- sulfate ratio, make it an exceedingly bad idea to employ detoxification strategies that do not conjugate or disarm volatile and inflammation-producing toxins. Indeed, impaired CDO activity has been linked to Rheumatoid arthritis, (41) Lupus, (42) Parkinson's Disease, (43) MCS and neurological diseases. (43-48)

Adrenal Control of Lung-Enzymatic Detoxification of Airborne Toxins

When CDO is not functioning at full strength in the lungs, it fails to act as an enzymatic barrier against the unimpeded transfer of airborne xenobiotics into the lung parenchyma and systemic circulation. Many carcinogens or potential

carcinogens enter the bloodstream without being detoxified. Unfortunately, fasting and common homeopathic and nutritional detoxification strategies may allow these un-detoxified toxins to circulate and do further damage to the organism. Antibodies and oligonucleotide probes raised against CDO in immunohistochemistry and in situ hybridization, respectively, demonstrated that the abnormal expression of CDO breaches the body's primary metabolic barrier against the systemic entry of xenobiotics. (49-52) Since the lungs are the first point of contact for airborne toxins, it makes sense that their entry and access to other tissues before being detoxified by the liver has the potential to cause many of the neurological and organ symptoms of MCS and other diseases. In contrast, orally ingested xenobiotics undergo the hepatic first pass effect. Therefore, it is possible that, without the potential for CDO detoxification within the alveolus, many carcinogens or potential carcinogens would enter into the systemic circulation unimpeded, without detoxification, as strong electrophiles (electron-deficient molecules). Electrophiles react with electron-rich DNA causing mistranslations, mutations, defective DNA repair mechanisms and chronic maldigestion. In these cases, boosting nutrient uptake with new carrier protein-co-transporter technologies may be necessary to nourish these patients and supply the necessary nutritional support to the adrenals and detoxification organs of the body. (1,2,22-24)

Steroid hormone biosynthesis involves enzymes controlled by adrenal physiology. (16-20) Clearly, the repertoire of enzymes expressed in steroidogenesis are also involved in detoxification, specifically with the activity of CDO.

Rather than pursuing aggressive detoxification strategies, practitioners need to make sure that detoxification enzymes are functional and can safely disarm and excrete toxins in a natural fashion and appreciate the fact that innate healing mechanisms repair these damaged enzymes at the acupuncture-energetic juncture.

Hypoadrenia: A Missing Link in MCS, Pain & Inflammation and Degenerative Diseases

The adrenals extend their defensive armor against stressors (including toxic chemicals, microbial or viral threats, and chaotic frequencies) into the energetic system of the body, specifically by controlling Liver, Governing Vessel (GV) and Conception Vessel (CV) meridian energy flow. Hypoadrenia causes chronic and prolonged infection and unwanted inflammation which lies at the root of heart disease and other disorders. A buildup of stagnant energy in the liver and diaphragm, inhibits enzymatic detoxification triggering a wide spectrum of reactive and pro-inflammatory symptoms. Since the liver meridian regulates the free flow of healing energy throughout the body, stagnant Liver Qi agitates emotional states, leading to the following functional deficits:

* Gastro-duodenal disturbances which disrupt Kidney-Adrenal energetics and inhibit Phase III liver detoxification leading to runaway viral infections and extreme reactivity in the pit of the abdomen and diaphragm. (7,8) This diaphragmatic constriction causes immunological unresponsiveness or a dysfunction of the Wei-defensive system. When the adrenals are depleted, the body's defensive armor is energetically and physiologically breached resulting in extreme reactivity to all stressors (chemical toxins, microbial, etc).

* Functional disturbances in the Parasympathetic Nervous Systems (PSNS) or vagus from the common sympathetic nervous system (SNS) response to stress which inhibits lymphatic circulation and drainage, digestion, and liver detoxification even further. In acupuncture-energetic terminology, it is constrained Liver energy with an excess of the Yang root of the kidneys (adrenals) that leads to a PSNS deficiency.

Unfortunately, diet and fasting, glandular nutrition, homeopathy, vitamins, and herbs typically fail to address these functional deficits and make matters worse by repatterning the body farther away from normal physiology into a mode of functioning that requires stimulation. As one would suspect, the stimulatory nature of these therapies weakens the adrenals and disturbs energetic relationships with other meridians, especially the front and back and right and left energetic polarities or the deeper palpable energetic zones that organize the regular meridians. This energetic disruption defers the repair of the body's stress-damaged organs/systems, and unbalances meridian energies.

American or TCM-trained acupuncturists commonly neglect the integrity and balance of the entire human energetic system with primal energy networks (extraordinary meridians) and this is crucial to healing the damage caused by volatile toxins that induce cyclic pro-inflammatory reactions and damage to the organism. Indeed, as Dr. Mark Seem, Director of the Tri-State College of Acupuncture, stated "The two dominant styles of practice in this country--TCM and Five Element acupuncture--both emphasize the ZangFu (called Officials by Five Element practitioners of the Worsley school) and the regular meridians only and ignore the complex surface and primal energetic networks, which, taken as a whole with the regular meridians, constitute human energetics. In this sense, they are disembodied approaches to acupuncture."

After decades of using different clinical approaches, I have concluded that natural therapies should never stimulate the adrenals and never force detoxification unless CDO is functional. While stimulation may result in the disappearance of many symptoms, it will eventually backslide as it goes against innate intelligence and acupuncture-energetic physiology. What types of natural therapies stimulate and evoke stress response? Nutritional approaches that advocate the use of B vitamins, vitamin C, stimulatory herbs, expansive or contractive inorganic minerals, DHEA, pregnenolone, and synthetic vitamins.

Even acupuncture without detoxification may be viewed as a stressor to the body. Dr. Seem states "... in line with modern stress theories, acupuncture serves as a minor stressor to activate the sympathetic nervous system. In doing so it activates the adrenals (the mother of the Liver in acupuncture energetic physiology)..." Since finding clinically effective ways to nourish and fortify the adrenal glands is paramount to activating innate healing, a search was made for an appropriate naturopathic solution. (21)

In addition to powerful connections to the acupuncture meridians, the adrenals connect to SNS nerves at the medulla cells which secrete epinephrine (adrenaline) and norepinephrine (noradrenaline) with SNS stimulation. The SNS, involved in the preparation of the organism for "fight or flight" in emergency situations, inhibits the PSNS and anabolic processes, thereby acting as an inhibitor of gastrointestinal function. The common use of digestive enzymes enforces the SNS-dominant pattern and keeps the adrenals in a perpetual state of stimulation and fails to address core issues underlying maldigestion and malnourishment. Rather than stimulate, our goal is to nourish and strengthen weak physiology in a manner that restores disrupted energetic patterns. (22-24)

The adrenal cortex makes 40 hormones (corticosteroids) formed from cholesterol to help regulate protein and carbohydrate metabolism, metabolism of salt and water, and to provide appropriate stress defense. The glucocorticoids consist mainly of three hormones, cortisone, corticosterone, cortisol and the 17-ketosteroids (sex hormones) such as DHEA. Again, I must re-emphasize that stimulation shifts the body's physiology in the wrong direction. No long-term studies have been done on DHEA or pregnenolone supplementation relative to steroidogenesis and detoxification. One may ask: what effect does taking them have on weak adrenal function, on steroidogenesis and detoxification? Some experts believe that because they bypass the biosynthesis of steroid hormones, they may disturb the normal function of liver detoxification enzymes. After all, it is a physiological fact that the adrenals synthesize steroid hormones via many of the same enzymes used to detoxify the body.

Clinically Defining HypoAdrenia and Energetic Deficits

In addition to the simple 5-minute kinesiological assessment (Quantum Repatterning Technique (QRT) Seminars[TM]) (27-28) involving the repatterning of the body against stressors in the physiological-energetic direction of healing, I advocate functional testing (see 1991 Manual of Neurohormonal Regulation (29)) of the adrenals:

* Ragland Test: Take blood pressure after lying on back relaxed for 5 minutes. Leaving the uninflated cuff in place, test again while standing up and immediately take the pressure again (be careful of dizziness). The systolic blood pressure should rise 5-15 (mm of mercury) on standing with healthy adrenals. If the

systolic pressure falls or stays the same, one may suspect hypoadrenia. A drop of 5 points or less corresponds to mild adrenal weakness; a drop in the 5 to 10 point range means substantial hypoadrenia; and more than 10 points suggests the person is bordering on adrenal failure.

* Circulation Test: Have the patient stand and hang their arms at the sides of their body for several minutes. The veins in the backs of the hands should swell with blood and protrude. Now slowly have the patient raise either hand to their heart level for a few minutes. If the protruding veins disappear within 2 to 5 seconds after the hands are elevated to the heart level, one may suspect hypoadrenia (those with strong adrenals can raise their hand over their head and the protruding veins will still not disappear).

* Rogoff Sign Test: Beam a light on the patient's pupil. If the light fails to constrict the pupil and maintain a constant constriction for 38-45 seconds, suspect hypoadrenia. The physiological mechanism behind this abnormal reaction is related to the adrenals' inability to maintain electrolyte balance and secrete adrenalin (which constricts blood vessels).

* Palpation of Energetic Zones: Illness is a pattern of tendino-muscular segmentation with distinct left-right polarity differences in upper and lower zones of the body. Palpating the energetic body to assess the total energetic condition is very different from assessing meridian pulses and energies via select acupoints on the hands and feet. Instead, the focus is on freeing up and tonifying deeper energetic zones and functions via extraordinary meridians such as GV (Du Mo) and CV (Ren Mo), and the Chung Mo which rises upward from Liver and Kidney Yang (adrenals), nourishing all visceral functions. Non-invasive energy techniques are highly successful in balancing yang GV and yin CV polarities and is based on decades of my research and research by leading French acupuncturists. (39,40) My exposure to French acupuncture while practicing with a French-trained medical acupuncturist guided me early in my practice to palpate deeper energetic imbalances in extraordinary deeper meridian zones that correlated exceptionally well with adrenal and PSNS physiology (the GV corresponds to what chiropractors call innate intelligence and represents the spinal cord, cerebrospinal fluid and the peripheral nervous system while the CV meridian corresponds to the brain or brain interferences). (27,28)

Synchronizing Adrenal-Meridian Energetics to Upregulate Detoxification & Augment Innate Healing Mechanisms

Naturopathic medicine describes health as the ability to respond appropriately to a wide range of challenges in a way that maintains equilibrium and integrity. Sickness is the manifestation of an unstable process, a pattern of disharmonic resonances that disrupt the body's delicate and intertwined communication networks. A lack of sunlight, fresh air, clean water, and wholesome raw organic

foods decrease the healthy resonances needed by the adrenals to control the free flow of healing energy. Harmonic resonances restore adrenal function at extraordinary deeper meridian zones that connect to the higher harmonics of the earth's magnetic field. (26) Fifteen years ago, this understanding led to discovering a homeopathic-like process of infusing harmonics into phytomedicines called the Synchrozyme[™] process. This approach helps to maintain the polarities of Yang and Yin, SNS and PSNS (adrenergic and cholinergic) and defines the sum and prerequisite for all healing energy by restoring the body's functional unity. It took three decades of research to conclude that diet and nutrition alone cannot restore adrenal energetics and enzymatic detoxification functions.

The duality of nourishment, physically and energetically, allows the body to keep itself in equilibrium and to balance itself when that equilibrium is disrupted. The body's restorative secrets are intrinsically linked to its ability to expand and exploit its myriad resources at these frequencies. (25) Enhancing quantum coherence synchronizes adrenal-energetic functions, making one highly resilient to stress. In nutritional applications, this coherent, amplified crystalline resonant field propels nutrients deep into cells, (22-24,26) providing a plausible scientific theory on how to regulate the entire organism while shielding it from EMF-microwave stressors that weaken the hypothalamic-pituitary-adrenal axis. The body needs nourishment from healthy resonances that are woefully missing in today's polluted environment. Plus, the naturopathic goals of enhancing electron transfer functions and stabilizing molecular defenses to reduce oxidative stress are supported in the sub-molecular realm where homeopathy has already shown us powerful methodologies to control and regulate biochemical reactions.

Once the adrenals are functioning optimally, both physically and energetically, the body can adapt to the stresses and strains of everyday living without distress. Detoxification is without effort and without harm to the body. Healing energies are not hindered by stress overload (daily doses of unwanted toxins or interferences from electromagnetic pollution) because they operate coherently and with functional unity.

Clinically, I use a wide array of botanicals to strengthen adrenal function which, in turn, boosts detoxification enzymes and facilitates the destruction of reactive electrophiles and oxidants into innocuous, excretable metabolites. (29-36) However, a strong word of caution: a high percentage of supplements we tested were toxic and presented a serious challenge to MCS sufferers. A high percentage of natural supplements are irradiated or contain toxic ingredients that trigger MCS reactions. These toxic ingredients silently suppress immunity, weaken and stress the adrenals and make MCS patients more toxic. Our research on the toxicity of supplements is confirmed by in vitro screening studies at the University of California of 196 natural products where Dr. Daryl See

reported that 191 were toxic or ineffective (as antioxidants or immunomodulators) with only 5 products or 2.5% reported as being non-toxic. (37)

In summary, the suffering of MCS patients is real and related to impairments in liver detoxification that are induced by stressors and hypoadrenia. Once the metabolic barrier to toxins has been breached, carcinogens or potential carcinogens enter systemic circulation unimpeded, without detoxification, amplifying the inflammatory cascade and causing dysregulation of neurological and vascular system functioning. This impaired detoxification ability manifests itself in acupuncture-energetic physiology as a deferral or a disruption in the free-flow of meridian energies found in palpable energetic zones that must be freed up, strengthened and balanced with other zones for optimal adrenal function.

New systems of rapid assessment can quickly pinpoint energetic zones of dysfunctional physiology and repattern the body's neuromuscular status. (27,28) Such a tool quickly unveils the core issues in innate, immunological and hormonal unresponsiveness providing unparalleled insight into the quantum domain of life where complex, interwoven, energy fields govern our existence and determine how fast we will heal or recover from an illness, trauma, or an infection. Rather than rely on treatments that are often off-target and embarrassingly simplistic, practitioners need to depart from fragmented, analytical thinking, and listen to body language. Body language--the interpretation of hypertonic and hypotonic muscles relative to deep energetic zones--communicates the body's problematic condition with incredible accuracy. By eliminating interferences and stressors, the body's innate healing energies can direct powerful and efficient repair strategies.

Clinical methods need to be adapted to address the widespread increase in environmental, food and supplemental toxicity. Ideally, supplementation should be chemically and energetically free of toxic substances and resonances. Nutra-botanicals matched to the three extraordinary meridians (Ren Mo, Du Mo, and Chung Mo) may be helpful in eliminating body stressors, realigning body energies, and nourishing stress-damaged organs and glands. Then, the flow of energetic streams can assist the body in discharging toxins, eliminating opportunistic infections, and correcting nutritional deficiency states in the shortest time possible.

References

1. Yanick P MCS: Understanding Causative Factors. Townsend Letter for Doctors. 2001 (Jan) 55-59.
2. Yanick P New Perspectives on Allergies and Seasonal Disorders. May 2001, Townsend Letter for Doctors and Patients, 45-8.

3. Yanick P. Lymphatic Therapy for Chronic Immune & Metabolic Disorders, Detoxification. Townsend Letter for Doctors, January 1995, 34-40.
4. Yanick P. New Insights into Brain Fog, Memory & Learning Disorders, Insomnia, Anxiety, Depression and Immune Disorders. Townsend Letter for Doctors & Patients, June, 2000, 154-56.
5. Yanick P. Hormone Resistance and the Ground Regulation System. Townsend Letter for Doctors & Patients, January 1999, 88-90.
6. Yanick P Detoxification Breakthroughs for Addictions and Chronic Toxicity. Townsend Letter for Doctors and Patients. 2001 (July) 93-95.
7. Yanick P Oral Chelation of Biliary Tract and Circulatory System. Townsend Letter for Doctors and Patients. 2002 (Nov) 52-55.
8. Yanick P Disorders of the gall bladder-duodenum in overweight patients. June 1994. Townsend Letter for Doctors and Patients. 568-70.
9. Yanick P Mycotoxicosis: A new emerging cofactor in Alzheimer's, Environmental Illness. July 2002. Townsend Letter for Doctors and Patients 154-8.
10. Yanick P Histadine-GLA-Zinc Complex to Block Unwanted Pain & Inflammation. Townsend Letter for Doctors and Patients. 2004 (Feb-March) 164-167.
11. Ashford NA, Miller CS. Chemical Exposures: Low Levels and High Stakes. 2nd Ed, New York, NY; Van Nostrand Reinhold, 1998.
12. Cullen M. The Worker with MCS: an overview. In Cullen M (ed.) Occupational Medicine: State of the Art Review. Ohil Handley and Belfusi 1987;2; 655-63.
13. Gail McKeown-Eyssen et al: Case-control study of genotypes in multiple chemical sensitivity: International Journal of Epidemiology, 2004;33:1-8.
14. Haley RW et al: Association of low PQNI aleresterase activity with neurological symptoms in Gulf War veterans. Toxicol Appl Pharmacol 1299; 157:227-33.
15. Binkley K et al: Idiopathic Environmental Intolerance. J Allergy Clin Immunol 2001;107: 887-90.
16. Orth DN, et al: The adrenal cortex. In: Wilson JD, Foster DW (eds) 1992 William's Textbook of Endocrinology. Saunders, Philadelphia, pp 489-619.

17. Miller WL 1988 Molecular biology of steroid hormone synthesis. *Endocr Rev* 9:295-318.
18. Engeland WC, et al: Expression of cytochrome P450 aldosterone synthase, 11 flhydroxylase mRNA during adrenal regeneration. 1995 *Endocr Res* 21:449-454.
19. Lehoux J-G, Mason JI, Ducharme L 1992 In vivo effects of ACTH on hamster steroidogenic enzymes. *Endocrinology* 131:1874-1882.
20. Hanukoglu I. Steroidogenic enzymes: structure, function: Role in regulation of steroid hormone biosynthesis. *J. Steroid Biochem. Mol. Biol.* 43:779-804, 1992.
21. Seem M: *Acupuncture Imaging*. Healing Arts Press, 1990, Vermont.
22. Yanick, P *Quantum Medicine*, Writer Service Publications, Portland, Oregon, 2000.
23. Yanick, P. Boosting Nutrient Uptake in Chronic Illness, *Townsend Letter for Doctors & Patients*, December 2000.
24. Yanick P. Meridian/Organ Nutraceutical Resonant Complexes. *Townsend Letter for Doctors & Patients*, May, 2000, 136-39.
25. McTaggart L: *The Field*. Harper Collins, 2001, Hammersmoth, London.
26. Yanick P *The Quantum Naturopath: Activating Quantum Healing with New Flexoelectric Technology*. Feb/March 2003. *Townsend Letter for Doctors and Patients*. 154-56.
27. Yanick P *Quantum Repatterning Technique Amer Chiropractic* 2003; 50.
28. Yanick P. *The Quantum Repatterning Technique: Assessing Immunological Unresponsiveness in Prolonged Viral Illness*. *Townsend Letter for Doctors and Patients*. 2003 (Jan) 128-130.
29. Asano, K. et al. Effect of *Eleutherococcus senticosus* extract on human physical working capacity. 1986, *Planta Med* 3:175-177.
30. Bohr, B. et al: Flow-cytometric studies with *E. senticosus* extract as an immunomodulatory agent. 1987, *Arzneimforsch* 37(10):1193-1196.
31. Bradley, P.R. (ed.), *British Herbal Compendium*, 1992. 1. Bournemouth: British Herbal Medicine Association.

32. Bruneton, J. Pharmacognosy, Phytochemistry, Medicinal Plants. 1995, Paris: Lavoisier Publishing.
33. Dowling EA et al. Effect of Eleutherococcus senticosus 1996. Med Sci Sports Exerc 28(4):482-499.
34. Fang J et al. Immunologically active polysaccharides of E. senticosus. 1985 Phytochem 24:2619-2622.
35. Tang, W. and G. Eisenbrand. Chinese Drugs of Plant Origin: Chemistry, Pharmacology, and Use in Traditional & Modern Medicine. 1992. NY: Springer Verlag.
36. Wagner H H et al: Economic and Medicinal Plant Research. 1985, London; Orlando, FL: Academic Press, 155-215.
37. See, D. Journal of the American Nutraceutical Association, 1996, Vol 2:1, 25-41.
38. Rea, WJ Chemical Sensitivity 1992 Lewis Publishers, Florida.
39. Low R Secondary Vessels of Acupuncture 1985. London, UK: Thorson's Publishers.
40. Van Nghi N & Chamfrault, A L'Energetique Humaine 1969 Angouleme, France Charente Printers.
41. Emery, p et al Ann Rheum Dis, 1992 51:3, 318-20.
42. Gordon C et al Lancet, 1992, 339:8784, 25-6.
43. Tanner CM Neurology, 1991, 41:5 Suppl 2, 89-91.
44. Steventon G et al. Xenobiotic metabolism in motor neuron disease. Lancet 1988;2(8612):644-7.
45. McFadden SA. Phenotypic variation in xenobiotic metabolism and adverse environmental response: focus on sulfur-dependent detoxification pathways. Toxicology 1996;111(1-3):43-65.
46. Tanner CM. Liver enzyme abnormalities in Parkinson's disease. Geriatrics 1991;46(Suppl 1):60-63.
47. Steventon GB et al. Xenobiotic Metabolism in Alzheimer's Disease, Neurology, 1989;40:1095-98.

48. Steventon GB et al. A review of xenobiotic metabolising enzymes in Parkinson's disease and motor neuron disease, *Drug Metabolism and Drug Interactions*, 2001 18, 79-98.

49. Millard J et al Expression of CDO and sulfite oxidase in the human lung: a potential role for sulfate in the protection from airborne xenobiotica. *Molecular Pathology* 2003; 56:270-74.

50. Stanley LA et al. Cytochrome P-450 induction in human lung tumor-derived cell lines. Characterization and effects of inflammatory mediators. *Eur J Biochem* 1992;208: 521-9.

51. Hume R et al. Differential expression and immunohistochemical localization of the phenol and hydroxysteroid sulphotransferase enzyme families in the developing lung. *Histochem Cell Biol* 1996;105:147-52.

52. Florin T et al. Metabolism of dietary sulphate: absorption and excretion in humans. *Gut* 1991;32:766-73.

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