

## What is MCS?

Multiple Chemical Sensitivities (MCS) is also known as Environmental Illness (EI), Toxic Injury (TI), and Toxicant Induced Loss of Tolerance (TILT). Originally identified in a 1989 multidisciplinary survey of 89 clinicians and researchers, and modified in 1999, top consensus criteria (Nethercott et al, 1993) for MCS define the condition as:

1. A chronic condition
2. Symptoms recur reproducibly
3. Symptoms recur in response to low levels of chemical exposure.
4. Symptoms occur when exposed to multiple unrelated chemicals
5. Symptoms improve or resolve when trigger chemicals are removed
6. Multiple organ systems are affected.

Products that MCS victims react to include ANY quantity of exposures to pesticides, secondhand smoke, alcohol, fresh paint, scented products and perfumes, candles, fragrances, food preservatives, flavor enhancers, aerosols, tap water, cosmetics, personal care products, new carpets, petroleum products, formaldehyde, outdoor pollutants, newspaper ink, cleaning compounds, printing and office products, and other synthetically derived chemicals. Some also react to natural products that are highly concentrated such as natural orange cleaners due to high pesticide concentration. Symptoms can range from minor annoyances to life-threatening reactions.

Research by Dr. Martin Pall has identified an etiology for MCS in elevated levels of peroxynitrite and nitric oxide in a vicious cycle he refers to as the NO/ONOO cycle of biochemistry.



## References

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# The Cause of MCS



**Nitric Oxide (NO)  
Peroxynitrite (ONOO)  
&**

**The NO/ONOO Cycle**

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## Effects of Peroxynitrite (ONOO)

Peroxynitrite is oxidized from nitric oxide. Excess peroxynitrite depletes energy stores, which is perceived to cause extreme fatigue (Pall, ND). Of more interest to those who suffer from MCS is the fact that peroxynitrite breaks down the blood brain barrier and excess levels allow greater access to the brain (Pall, ND). This greatly increases the effects of chemicals on the brain.

Essentially a non-MCS person has a barrier that protects the brain from damage from low-level chemical exposure, however a person who suffers from MCS has little or no barrier making the brain subject to increased damage and reactivity with minute exposures most people do not react to.

## Effects of Nitric Oxide (NO)

The key effect of nitric oxide is that it inhibits cytochrome P-450 activity and slows degradation of hydrophobic organic chemicals (Pall, ND). This means that excess nitric oxide slows down the body's natural detoxification processes leaving MCS patients subject to the effects of chemical exposure longer than non-sufferers.

Between a reduced blood-brain barrier and increased time to naturally detoxify the body MCS patients are subject to permanent and long-term brain and nervous system damage which includes toxic encephalopathy.

## The NO/ONOO Vicious Cycle

The NO/ONOO cycle is implicated by Dr. Pall in being a plausible etiology for Multiple Chemical Sensitivities (MCS), Fibromyalgia (FM), Chronic Fatigue Syndrome (CFS), Post-Traumatic Stress Disorder (PTSD), and Gulf War Syndrome.

“The only etiologic mechanism proposed for each of these is a vicious cycle mechanism involving elevated levels of nitric oxide and its oxidant product, peroxynitrite. This cycle may be initiated by a variety of diverse short-term stressors, including viral and bacterial infections, physical trauma, severe psychological stress, organic solvent exposure, and exposure to three classes of pesticides, organophosphorus/carbamate pesticides, organochlorine pesticides and pyrethroid pesticides). Each of these short-term stressors are known to be able to trigger responses that lead to increases in nitric oxide levels. Indeed, other initiating short-term stressors, including a protozoan infection, carbon monoxide exposure, thimerosal exposure and ciguatoxin exposure are also known or thought to act to increase nitric oxide levels, as well” (Pall, 2006).

“The vicious cycle initiated by these nitric oxide increases is centered on excessive levels of nitric oxide and its oxidant product peroxynitrite. We are now calling this vicious cycle the NO/ONOO- cycle (30) (pronounced no, oh no!), based on the structures of nitric oxide (NO) and peroxynitrite (ONOO-)” (Pall, 2006).

## Agents to Down-Regulate the NO/ONOO Cycle

The following agents have been predicted to be useful by Dr. Pall and Dr. Ziem (Pall, 2006) in the Pall/Ziem protocol to down-regulate the NO/ONOO cycle biochemistry:

Nebulized Inhaled Reduced Glutathione  
Nebulized Inhaled Hydroxocobalamin

Mixed Natural Tocopherols

Buffered Vitamin C

Magnesium as Malate

Four Different Flavonoid Sources:

Ginkgo Biloba Extract, Cranberry Extract,  
Silymarin, & Bilberry Extract

Selenium as Selenium-Grown Yeast

Coenzyme Q10

Folic Acid

Carotenoids Including Lycopene, Lutein and Alpha-carotene

Alpha-Lipoic acid

Zinc (modest dose)

Manganese (low dose)

Copper (low dose)

Vitamin B<sub>6</sub> in the Form of Pyridoxal Phosphate

Riboflavin 5'-Phosphate (FMN)

Betaine (Trimethylglycine)

Green Tea Extract

Acetyl L-Carnitine.

Unstated is how much is recommended however Dr. Pall will be publishing a book later this year (2006) with more details.

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