Physiological Basis for Multiple Chemical Sensitivity
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In the introduction it was mentioned that the critics of MCS claim - there is no scientific proof in the medical literature proving the existence of MCS. And therefore MCS is the result of some type of deep underlying emotional problem – psychosomatic – “it’s all in your head”. One can only speculate as to why these statements are made, especially in light of the fact that there are plenty of reports in the medical literature indicating that MCS is a very real physiological disorder. Below is a list of some of those medical studies... this is a short list with plenty more where they come from.

2000 to 2005:

1. Occipital Lobe Meningioma in a Patient with Multiple Chemical Sensitivity
   Moorhead JF, et al
   *American Journal of Industrial Medicine*, 37(4):443-446, April 2000  [Abstract]  [Full Text]

2. Chemical Sensitivity and Fatigue Syndromes from Hypoxia/Hypercapnia
   Ross PM.

3. Deep Subcortical (including limbic) Hypermetabolism in Patients with Chemical Intolerance: Human PET Studies
   Heuser G, et al

   Rea WJ, et al

5. Genetic Susceptibility to Adverse Effects of Drugs and Environmental Toxicants. The Role of the CYP Family of Enzymes
   Ingelman-Sunberg M.
   *Mutation Research*, 482(1-2):11-19, October 2001  [Abstract]  [Full Text]

6. Pupil Light Reaction of Multiple Chemical Sensitivity Patients to Extremely Low Concentrations of Formaldehyde
   Miyata M, et al

7. Mechanisms of Multiple Chemical Sensitivity
   Winder C.
   *Toxicology Letters*, 128 (1-3):85-97, March 10 2002  [Abstract]  [Full Text]
8. Multiple Chemical Sensitivity – An Elevation of Enzyme Induction Thresholds
Mellish CE.
[Abstract] [Full Text]

9. Markers of Genetic Susceptibility in Human Environmental Hygiene and Toxicology: The Role of Selected CYP, NAT and GST genes
Their R, et al
[Abstract] [Full Text]

10. A Metabolic Basis for Fibromyalgia and its Related Disorders: The Possible Role of Resistance to Thyroid Hormone
Garrison RL, et al
[Abstract] [Full Text]

11. Reproducibility of Immunological Test Used to Assess Multiple Chemical Sensitivity Syndrome
Hoover DR, et al
*Clinical and Diagnostic Laboratory Immunology*, 10(6):1029-1036, November 2003  
[Abstract] [Full Text]

12. The Plasma Cysteine/Sulphate Ratio: A Possible Clinical Biomarker
Moss M.
[Full Text]

13. Identification of Responsible Volatile Chemicals that Induce Hypersensitive Reactions to Multiple Chemical Sensitivity Patients
Shinohara N
[Abstract] [Full Text]

14. Effect of Exposure to Volatile Organic Compounds on Plasma Levels of Neuropeptides, Nerve Growth Factor and Histamine in Patients with Self-Reported Multiple Chemical Sensitivity
Kimata H.
*International Journal of Hygiene and Environmental Health*, 207(2):159-163, February 2004  
[Abstract Only]

15. Mycotoxins and Antifungal Drug Interactions: Implications in the Treatment of Illnesses Due to Indoor Chronic Toxigenic Mold Exposures
Anyawu EC
*Scientific World Journal*, 4:167-177, March 12 2004  
[Abstract]

16. Long-Term Exposure to Low Levels of Formaldehyde Increases the Number of Tyrosine Hydroxylase-Immunopositive Periglomerular Cells in Mouse Main Olfactory Bulb
Hayashi H, et al
[Abstract] [Full Text]

17. Effect of Prolonged Exposure to Low Concentrations of Formaldehyde on the Corticotropin Releasing Hormone Neurons in the Hypothalamus and Adrenocorticotropic Hormone Cells in the Pituitary Gland in Female Mice.
Sari DK, et al
[Abstract] [Full Text]
18. Case-Control Study of Genotypes in Multiple Chemical Sensitivity: CYP2D6, NAT1, NAT2, PON1, PON2 and MTHFR
McKeown-Eyssen G, et al

2005 to 2010:

19. The Endoplasmic Reticulum in Xenobiotic Toxicity
Cribb AE, et al
*Drug Metabolism Review*, 37(3):405-442, 2005  [Abstract]

20. Chemical Exposures: Genes and Sensitivity
By Angela Spivey
*Environmental Health Perspective*, 113(3):A157, March 2005  [Full Text]

21. Exposure of Eyes to Perfume: A Double-Blind, Placebo-Controlled Experiment
Elbering J et al
*Indoor Air*, 16(4): 276-281, August 2006  [Abstract]  [Full Text]

22. Drug Intolerance in Patients with Idiopathic Environmental Intolerance Syndrome
Niedoszytko M, et al
*The International Journal of Clinical Practice*, 60(10):1327-1329, October 2006  [Abstract]  [Full Text]

23. The Role of the Brain and Mast Cells in MCS
Heuser G.
Townsend Letter, October 2006  [Full Text]

24. Relevance of the Deletion Polymorphisms of the Glutathione S-transferases GSTT1 and GSTM1 in Pharmacology and Toxicology.
Bolt HM,
*Current Drug Metabolism*, 7(6):613-628, Aug 2006  [Abstract Only]

25. Increased Release of Histamine in Patients with Respiratory Symptoms Related to Perfume.
Elbering J, et al
*Experimental Allergy*, 37(11):1676-1680, 2007  [Abstract]  [Full Text]

26. Immune Effects of Respiratory Exposure to Fragrance Chemicals
Ezendam J et al
*RIVM Reports*, 2007  [Abstract]  [Full Text]

27. A Cross-Sectional Study of Self-Reported Chemical-Related Sensitivity is Associated with Gene Variants of Drug-Metabolizing Enzymes
Schnakenberg E, et al.
*Environmental Health*, 6:6, 2007  [Full Text]
28. Effect of Long-Term Exposure to Low-Level Toluene on Airway Inflammatory Response in Mice
   Fujimaki H, et al

29. The Effects of Evaporating Essential Oils on Indoor Air Quality
   Su HJ, et al

30. Volatile Organic Compounds Contribute to Airway Hyperresponsiveness
    Jang AS, et al
    The Korean Journal of Internal Medicine, 22(1):8-12, March 2007  Abstract  Full Text

31. Odor Processing in Multiple Chemical Sensitivity
    Hilbert L, et al

32. Quality of Life and Capsaicin Sensitivity in Patients with Airway Symptoms Induced by Chemicals and Scents: A Longitudinal Study
    Ternesten-Hasseus E, et al

33. Gene-Environment Interactions in Environmental Lung Diseases
    Kleeberger SR, et al
    Novartis Foundation Symposium, 293:168-178, 2008  Abstract Only

34. Coagulation Cascade and Fibrinolysis in Patients with Multiple-Drug Allergy Syndrome
    Asero R, et al
    Annals of Allergy, Asthma & Immunology, 100(1):44-48, January 2008  Abstract  Full Text

35. Sequence Variations in Subjects with Self-Reported Multiple Chemical Sensitivity (sMCS): A Case-Control Study
    Wiesmuller GA, et al.
    Journal of Toxicology and Environmental Health, 71(11-12):786-794, January 2008  Abstract  Full Text

36. The Health Effects of Nonindustrial Indoor Air Pollution
    Bernstein J, et al
    The Journal of Allergy and Clinical Immunology, 121(3):585-591, March 2008  Abstract  Full Text

37. Mechanisms of Increased Airway Sensitivity to Occupational Chemicals and Odors
    Millqvist E.
    Current Opinion in Allergy and Clinical Immunology, 8(2):135-139, April 2008  Abstract Only

38. Detection of Low-Level Environmental Chemical Allergy by a Long-Term Sensitization Method
    Fukuyama T, et al
    Toxicology Letters, 180(1):1-8, July 30 2008  Abstract  Full Text
39. Aquesthesia for Patients with Idiopathic Environmental Intolerance and Chronic Fatigue Syndrome
Fisher MM, et al
*British Journal of Anaesthesia*, 101(4):486-491, October 2008  [Abstract]  [Full Text]

40. Breathtaking TRP Channels: TRPA1 and TRPV1 in Airway Chemosensation and Reflex Contro
Bessac BF, et al
*Physiology*, 23(6):360-370, December 2008  [Abstract]  [Full Text]

41. Cerebral Imaging and Olfactory Disorders: A Review
Plallly J, et al

42. Phenotypes of Individuals Affected by Airborne Chemicals in the General Population
Berg ND, et al
*International Archives of Occupational and Environmental Health*, 82(4):509-517, March 2009  [Abstract]  [Full Text]

43. Relation of PON1 and CYP1A1 Genetic Polymorphisms to Clinical Findings in a Cross-Sectional Study of a Greek Rural Population Professionally Exposed to Pesticides
Tsatsakis AM, et al
*Toxicology Letters*, 186(1):66-72, April 10 2009,  [Abstract]  [Full Text]

44. Neuroregulation of Human Nasal Mucosa
Baraniuk JN, et al

45. Glyphosate-Based Herbicides are Toxic and Endocrine Disrupters in Human Cell Lines
Gasnier C, et al
*Toxicology*, 262(3):184-191, August 21 2009  [Abstract]  [Full Text]

46. The Chemical Defensive System in the Pathobiology of Idiopathic Environment- Associated Diseases
Korkina L, et al
*Current Drug Metabolism*, 10(8): 914-931, October 2009  [Abstract]  [Full Text]

47. Brain Dysfunction in Multiple Chemical Sensitivity
Orriols R, et al
*Journal of Neurological Science*, 287(1-2):72-8, December 15 2009  [Abstract]  [Full Text]

2010 to 2014:

48. How Can We Cure NO/ONOO - Cycle Diseases?
Pall ML
*Townsend Letter For Doctors and Patients*, 319-320:75-86, 2010  [Full Text]

49. Functional Impairment in Chronic Fatigue Syndrome, Fibromyalgia, and Multiple Chemical Sensitivity
Lavergne RM, et al
*Canadian Family Physician*, 52(2):e57-e65, February 2010  [Abstract]  [Full Text]
50. Xenobiotic, Bile Acid and Cholesterol Transporters: Function and Regulation  
Klaassen CD, et al.  
[Abstract][Full Text]

51. Genetic Susceptibility Factors for Multiple Chemical Sensitivity Revisited  
Berg ND, et al.  
*International Journal of Hygiene and Environmental Health*, 213(2): 131-139, March 2010  
[Abstract][Full Text]

52. Factors Associated with Prospective Development of Environmental Annoyance  
Eek F, et al.  
[Abstract][Full Text]

53. Idiopathic Environmental Intolerance (IEI): From Molecular Epidemiology to Molecular Medicine  
De Luca C, et al.  
*Indian Journal of Experimental Biology*, 48(7):625-635, July 2010  
[Abstract Only]

54. Multiple Chemical Sensitivity is a Response to Chemicals Acting as Toxicants via Excessive NMDA Activity  
Pall ML  
*Journal of Psychosomatic Research*, 69(3): 327-328, September 2010  
[Full Text]

55. Electroconvulsive Therapy Substantially Reduces Symptom Severity and Social Disability Associated with Multiple Chemical Sensitivity: A Case Report.  
Elberling J, et al.  
*The Journal of Electroconvulsive Therapy (ECT)*, 26(3):231-233, September 2010  
[Abstract Only]

56. Human PON1, a Biomarker of Risk of Disease and Exposure  
Furlong CE, et al.  
*Chemico-Biological Interactions*, 187(1-3):355-361, September 6 2010  
[Abstract][Full Text]

57. Biological Definition of Multiple Chemical Sensitivity from Redox State and Cytokine Profiling and not from Polymorphisms of Xenobiotic-Metabolizing Enzymes  
De Luca C, et al.  
[Abstract][Full Text]

58. Debating the Legitimacy of a Contested Environmental Illness: A Case Study of Multiple Chemical Sensitivities (MCS)  
Phillips T.  
*Sociology of Health & Illness*, 32(7):1026-1040, November 2010  
[Abstract][Full Text]

59. A Novel Methodology to Evaluate Health Impacts Caused by VOC Exposures Using Real-Time VOC and Holter Monitors  
Mizukoshi A, et al.  
[Abstract][Full Text]

60. Increased Capsaicin-Induced Secondary Hyperalgesia in Patients with Multiple Chemical Sensitivity.  
Holst H, et al.  
[Abstract Only]
61. Non-Allergic Cutaneous Reactions in Airborne Chemical Sensitivity – A Population Based Study  
Berg ND, et al  
*International Journal of Hygiene and Environmental Health*, February 14 2011 (Epub ahead of print)  
[Abstract](#)  [Full Text](#)

62. Isolation and lack of Access in Multiple Chemical Sensitivity: A Qualitative Study  
Gibson PR, et al  
*Nursing and Health Sciences*, 13(3): 232-237, 2011  
[Abstract](#)  [Full Text](#)

63. Effect of Exposure to Volatile Organic Compounds (VOCs) on Airway Inflammatory Response in Mice  
Wang F, et al  
[Abstract](#)  [Full Text](#)

64. Women with Multiple Chemical Sensitivity Have Increased Harm Avoidance and Reduced 5-HT1A Receptor Binding Potential in the Anterior Cingulate and Amygdala  
Hillert L, et al  
[Abstract](#)  [Full Text](#)

65. Evaluation of Genetic Polymorphism in Patients with Multiple Chemical Sensitivity  
Cui X, et al  
*Plos One*, 8(8): e73708, 2013  
[Abstract](#)  [Full Text](#)

Caccamo D, et al  
*Oxidative Medicine and Cellular Longevity*, Epub July 7 2013  
[Abstract](#)  [Full Text](#)

67. Multiple Chemical Sensitivity: On the Scent of Central Sensitization  
Tran M.T., et al  
[Abstract](#)  [Full Text](#)