

## Studies from diverse areas of ME/CFS research – with quotes

### Brain abnormalities

**“Brain-stem hypoperfusion was confirmed in all ME/CFS patients. Patients with ME/CFS have a generalized reduction of brain perfusion, with a particular pattern of hypoperfusion of the brainstem.”**  
Brainstem perfusion is impaired in chronic fatigue syndrome, Costa DC, Tannock C, Brostoff J. QJM. 1995 Nov; 88(11):767-73 <http://www.ncbi.nlm.nih.gov/pubmed/8542261>

**“This study provides evidence that changing motor deficits in CFS have a neurophysiological basis. The slowness of SRTs (Simple Reaction Times) supports the notion of a deficit in motor preparatory areas of the brain.”**  
Deficit in motor performance correlates with changed corticospinal excitability in patients with chronic fatigue syndrome, Davey NJ, Puri BK, Cateley M, Main J, Nowicky AV, Zaman R. Int J Clin Pract. 2003 May; 57(4):262-4 <http://www.ncbi.nlm.nih.gov/pubmed/12800454>

**“We observed significant reductions in global gray matter volume... (which) was linked to the reduction in physical activity, a core aspect of CFS. These findings suggest that the central nervous system plays a key role in the pathophysiology of CFS and point to a new objective and quantitative tool for clinical diagnosis of this disabling disorder.”**  
Gray matter volume reduction in the chronic fatigue syndrome, de Lange, et al. Neuroimage. 2005 Jul 1; 26(3):777-81. <http://www.ncbi.nlm.nih.gov/pubmed/15955487>

### Cardiac and circulatory problems

**“The patients with severe CFS had significantly lower stroke volume and cardiac output than the controls.”**  
Abnormal impedance cardiography predicts symptom severity in chronic fatigue syndrome, Peckerman A et al. Am J of the Med Sciences, 2003; 326(2):55-60 <http://www.ncbi.nlm.nih.gov/pubmed/12920435>

**“A progressive cardiomyopathy caused by incomplete virus multiplication of EBV and/or HCMV in CFS patients is present.”**  
Prevalence of abnormal cardiac wall motion in the cardiomyopathy associated with incomplete multiplication of Epstein-Barr Virus and/or cytomegalovirus in patients with chronic fatigue syndrome, Lerner et al. In Vivo. 2004 Jul–Aug; 18(4):417-24 <http://www.ncbi.nlm.nih.gov/pubmed/15369178>

### Cognitive problems

**“Individuals with CFS appear to have to exert greater effort to process auditory information as effectively as demographically similar healthy adults.”**  
Objective evidence of cognitive complaints in Chronic Fatigue Syndrome: A BOLD fMRI study of verbal working memory, Lange G et al. Neuroimage 2005 June; 26(2):513-24 <http://www.ncbi.nlm.nih.gov/pubmed/15907308>

### Exercise intolerance

**“CFS patients demonstrated significantly lower cardiovascular as well as ventilatory values at peak exercise, compared with the control group.”**  
Physiological responses to incremental exercise in patients with cfs. Inbar O et al. Medicine and Science in Sports and Exercise 2001 Sep; 33(9):1463-70 <http://www.ncbi.nlm.nih.gov/pubmed/11528333>

**"Differences in ion transport and ion channel activity were evident at baseline and were exaggerated after exercise"**  
Exercise responsive genes measured in peripheral blood of women with cfs and matched control subjects, Whistler T, Vernon SD et al. BMC Physiology. 2005 Mar 24;5(1):5  
<http://www.ncbi.nlm.nih.gov/pubmed/15790422>

**"The maximal workload and maximal oxygen uptake attained by the patients with CFS were almost half those achieved by the control subjects. " "When compared with healthy sedentary women, female patients with CFS show a significantly decreased exercise capacity"**  
Exercise capacity in chronic fatigue syndrome, De Becker P, De Meirlier K et al. Archives of Internal Medicine, 2000 Nov 27;160(21):3270-7 <http://www.ncbi.nlm.nih.gov/pubmed/11088089>

**"The response of CFS patients to incremental exercise associates a lengthened and accentuated oxidative stress together with marked alterations of the muscle membrane excitability. These two objective signs of muscle dysfunction are sufficient to explain muscle pain and postexertional malaise."**  
CFS: assessment of increased oxidative stress and altered muscle excitability in response to incremental exercise, Jammes Y et al. Journal of Internal Medicine 2005, Mar; 257(3):299-310  
<http://www.ncbi.nlm.nih.gov/pubmed/15715687>

### Genetics

**"Clustering of quantitative polymerase chain reaction data from patients with CFS/ME revealed 7 subtypes with distinct differences in Med. Outcomes Survey Short Form-36 scores, clinical phenotypes and severity."**  
Gene expression subtypes in patients with chronic fatigue syndrome/myalgic encephalomyelitis, Kerr et al. J of Infect Diseases 2008 Apr 15;197(8):1171-1184 <http://www.ncbi.nlm.nih.gov/pubmed/18462164>

**"Genomic studies showed that persistent cases express Epstein Barr virus-specific genes and demonstrate abnormalities of mitochondrial function."**  
Chronic Fatigue Syndrome: Inflammation, Immune Function, and Neuroendocrine Interactions, Klimas NG and Koneru AO. Current Rheumatology Reports 2007 Vol. 9 (6)/Dec  
<http://www.springerlink.com/content/1535x16058474m11/>

### Gut dysfunction

**"Patients have a compromised gastrointestinal mucosal integrity which contributes to immune activation and is a major factor in CFS. The cause of intestinal barrier damage is multifactorial and complex. One factor is likely viruses (Epstein-Barr Virus and HHV-6)." "A genetic predisposition to gastrointestinal problems likely exists"**  
ME/CFS & Chronic Infection of the Gut – Notes on Dr. Kenny De Meirlier's Presentation in Perth  
[http://www.prohealth.com/library/showarticle.cfm?id=8489&t=CFIDS\\_FM](http://www.prohealth.com/library/showarticle.cfm?id=8489&t=CFIDS_FM)

**"The results support the view that a weakened tight junction barrier with subsequent gut-derived inflammation is a novel pathway in CFS and that it is a new target for drug development in CFS."**  
Normalization of leaky gut in chronic fatigue syndrome (CFS) is accompanied by a clinical improvement: effects of age, duration of illness and the translocation of LPS from gram-negative bacteria, Maes and Leunis. Neuro Endocrinol. Lett. 29 December 2008,(6): 902–10.  
<http://www.ncbi.nlm.nih.gov/pubmed/19112401>

### Immune dysfunction

**"The presence of a 37 kDa 2-5A binding protein in extracts of peripheral blood mononuclear cells may distinguish patients with chronic fatigue syndrome from healthy subjects and those suffering from other diseases."**

A 37 kDa 2-5A binding protein as a potential biochemical marker for chronic fatigue syndrome, De Meirleir et al. Am J of Medicine 2000 Feb;108(2):99-105. <http://www.ncbi.nlm.nih.gov/pubmed/1126321>

**"These results implicate abnormal immune activity in the pathology of exercise intolerance in CFS and are consistent with a channelopathy involving oxidative stress and nitric oxide-related toxicity."** Snell, et al. In Vivo, 2005 Mar-Apr;19(2):387-90 <http://www.ncbi.nlm.nih.gov/pubmed/15796202>

**"We found that significantly more CFS patients had elevations in either protein levels or number of cells than healthy controls (30 versus 0%), and 13 CFS patients had protein levels and cell numbers that were higher than laboratory norms"** Spinal fluid abnormalities in patients with chronic fatigue syndrome, Natelson BH et al. Clinical and Diagnostic Lab. Immunology, 2005 Jan;12(1):52-5 <http://www.ncbi.nlm.nih.gov/pubmed/15642984>

## Mitochondrial dysfunction

**"...a remarkable correlation is observed between the degree of mitochondrial dysfunction and the severity of illness."**

Chronic Fatigue Syndrome and mitochondrial dysfunction, Myhill, Booth and McLaren. Int J of Clinical and Experimental Med 2(1), 1-16, 2009 <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=2680051>

**"CFS is associated with significantly raised concentrations of ventricular lactate, potentially consistent with recent evidence of decreased cortical blood flow, secondary mitochondrial dysfunction, and/or oxidative stress abnormalities in the disorder"**

Ventricular cerebrospinal fluid lactate is increased in cfs compared with generalized anxiety disorder: an in vivo 3.0 T 1H MRS imaging study, Sanjay J et al. <http://www.cfid-cab.org/cfs-info/Braintscans/mathew.et.al.08.txt>

## Orthostatic intolerance

**"Symptoms of orthostatic intolerance, such as disabling fatigue, dizziness, diminished concentration, tremulousness, and nausea, are often found in patients with CFS."**

The Importance of Orthostatic Intolerance in the Chronic Fatigue Syndrome, Schondorf and Freeman. Am. J of the Medical Sciences 1999 vol. 317(2):117-123 <http://www.ncbi.nlm.nih.gov/sites/entrez>

**"POTS was defined as symptoms of orthostatic intolerance associated with an increase in heart rate from the supine to upright position of >30 beats per minute or to a heart rate of >120 beats per minute on standing."** "POTS is a frequent finding in patients with CFS/ME."

Postural orthostatic tachycardia syndrome is an under-recognized condition in chronic fatigue syndrome, Hoad A, Newton. J et al. 2008 QJM 101(12):961-965 <http://qjmed.oxfordjournals.org/cgi/content/abstract/101/12/961>

## Prognoses

**"After 9 years QOL [quality of life] was the same as at diagnosis, only mental health had improved."** Nine-Year Follow-Up of Danish Chronic Fatigue Syndrome: Impact on Health, Social, Vocational, and Personal Lives, Andersen, Permin and Albrecht. J of Chronic Fatigue Syndrome, 2008, vol. 14 (2):7-23 <http://listserv.nodak.edu/cgi-bin/wa.exe?A2=ind0802b&L=co-cure&T=0&P=1694>

## Sleep abnormalities

**"Higher levels of deep sleep and/or lower levels of light sleep have been reported in several all-night polysomnography studies in CFS patients."**

Paradoxical Nrems Distribution in "Pure" Chronic Fatigue Patients. A Comparison With Sleep Apnea-Hypopnea Patients and Healthy Control Subjects, *Le Bon O et al.* Journal of Chronic Fatigue Syndrome, vol.14,(2) Jan. 2008, pp.45-59  
<http://www.informaworld.com/smp/content~content=a902823230~db=all~jumpype=rss>

**"CFS patients had significant differences in polysomnographic findings from healthy controls and felt sleeper and more fatigued than controls after a night's sleep."**  
Sleep structure and sleepiness in chronic fatigue syndrome with or without co-existing fibromyalgia, *Togo F et al.* Arthritis Research & Therapy 2008;10(3):F56.<http://www.ncbi.nlm.nih.gov/pubmed/18474105>

## Viruses

**"Enterovirus VP1, RNA and non-cytopathic viruses were detected in the stomach biopsy specimens of CFS patients with chronic abdominal complaints."**

Chronic fatigue syndrome is associated with chronic enterovirus infection of the stomach, *Chia and Chia.* Journal of Clinical Pathology, 2008; 61:43-48.<http://jcp.bmj.com/cgi/content/abstract/61/1/43>

**"Parvovirus B19 may be involved in the pathogenesis of CFS. The gastro-intestinal tract appears as an important reservoir of infection for several potentially pathogenic viruses."**  
Detection of herpesviruses and parvovirus B19 in gastric and intestinal mucosa of chronic fatigue syndrome patients, *Frémont, Metzger, Rady, Hulstaer, De Meirier.* In Vivo. 2009 Mar-Apr;23(2):209-13  
<http://www.ncbi.nlm.nih.gov/pubmed/19414405>

**"In both MS and CFS patients, we found increased levels of HHV-6 antibody and HHV-6 DNA. A decrease in cellular immune responses was also detected in CFS patients. These data suggest that HHV-6 reactivation plays a role in the pathogenesis of these disorders."**  
Frequent HHV-6 reactivation in multiple sclerosis (MS) and chronic fatigue syndrome (CFS) patients, *Ablassi, et al.* J Clin Virol. 2000 May;16(3):179-91  
<http://www.ncbi.nlm.nih.gov/pubmed/10738137>

**"...it is plausible that active infection with HHV-6 may trigger and perpetuate CFS in a subset of patients."** Is human herpesvirus-6 a trigger for chronic fatigue syndrome? *Komaroff AL.* J Clin Virol. 2006 Dec;37 Suppl 1:S39-46. Review.  
[http://www.hhv-6foundation.org/hv6cts\\_komaroff.html](http://www.hhv-6foundation.org/hv6cts_komaroff.html)

**"The changes of immunological parameters in CFS patients with active dual infection were characterized by significant decrease of CD3+ and CD4+ T cells, significant increase of CD95+ cells and decrease of CD4+/CD8+ ratio."**  
Activation of human herpesviruses 6 and 7 in patients with chronic fatigue syndrome, *Chapenko et al.* J Clin Virol. 2006 Dec;37 Suppl 1:S47-51  
<http://www.ncbi.nlm.nih.gov/pubmed/17276369>

## Websites with ME/CFS research

The National CFIDS Foundation [www.nct-net.org](http://www.nct-net.org) Invest in ME <http://www.investinme.org/index.html>

HHV-6-Foundation: <http://www.hhv-6foundation.org> Name Us <http://www.name-us.org/index.html>

Whittemore Peterson Institute <http://www.wpiinstitute.org/> CFS Research Foundation <http://www.cfsrf.com/>