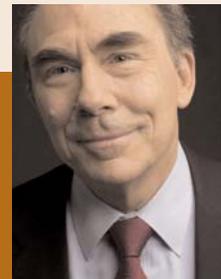




# Ten Discoveries about the Biology of CFS

- 1** Chronic fatigue syndrome is not a form of depression, and many patients with CFS have no diagnosable psychiatric disorder. As with most chronic illnesses, some CFS patients become depressed because of the impact of the illness on their lives, but most studies find that the majority haven't experienced depression before the onset of illness.
- 2** There's a state of chronic, low-grade immune activation in CFS. There is evidence of activated T cells, activation of genes reflecting immune activation and increased levels of immune system chemicals called cytokines.
- 3** There's substantial evidence of poorly functioning natural killer (NK) cells—white blood cells important in fighting viral infections. Studies differ as to whether there may be increased numbers of NK cells in CFS patients.
- 4** Abnormalities in the white matter of the brain have been found in CFS patients using magnetic resonance imaging (MRI) scans. Typically, these are small (fraction of an inch) areas just below the cerebral cortex, the outermost area of the brain hemispheres. Differences in gray matter volume are also being observed.
- 5** Abnormalities in brain metabolism, as indicated by single photon emission computed tomography (SPECT) and positron emission tomography (PET), have been discovered. Other research suggests there's something wrong with energy metabolism and the oxidative electron transport chain in the mitochondria of CFS patients.
- 6** CFS patients experience abnormalities in multiple neuroendocrine systems in the brain, particularly depression of the hypothalamic-pituitary-adrenal (HPA) axis, but also the hypothalamic-prolactin axis and hypothalamic-growth hormone axis.
- 7** Cognitive impairment is common in CFS patients. The most frequently documented abnormalities are difficulty with information processing, memory and/or attention.
- 8** Abnormalities of the autonomic nervous system have been found by numerous independent researchers. These include a failure of the body to maintain blood pressure after a person stands up, abnormal responses of the heart rate to standing and unusual pooling of blood in the veins of the legs. Some studies also find low levels of blood volume.
- 9** CFS patients have disordered expression of genes that are important in energy metabolism. Energy comes from certain natural chemicals that are processed by enzymes inside each cell. These enzymes are controlled by specific genes. Other genomic research is revealing involvement of genes connected to HPA axis activity, the sympathetic nervous system and immune function.
- 10** There's evidence of more frequent latent active infection with various herpesviruses and enteroviruses. The herpesviruses include Epstein Barr, HHV-6 and cytomegalovirus. Other infectious agents, like bacterium that cause Lyme disease, Ross River virus and Q fever, can also trigger CFS.

*The above summary of CFS research findings was provided by Anthony Komaroff, MD, a professor of medicine at Harvard Medical School, senior physician at Brigham and Women's Hospital in Boston and the editor-in chief of Harvard Health Publications. Dr. Komaroff has an ongoing research program on chronic fatigue syndrome and has published over 230 research articles and book chapters.*



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