



Paradigm Change

M.E. and Retroviruses

In October 2009, a team of researchers from the Whittemore Peterson Institute (WPI) published in the prestigious journal *Science* a paper linking a group of M.E. patients (referred to as having “Chronic Fatigue Syndrome”) with the retrovirus XMRV. The article stated that the blood of 67% of a sample of 101 patients tested positive for the virus, compared to only 3.7% of a control sample.

XMRV, a murine leukemia virus (MLV), was the third retrovirus that had been found to be associated with human disease. The others, HIV and HTLV, were known to cause complex lifelong systemic health disorders. While an association previously had been found between XMRV and prostate cancer, its being linked with a complex neuro-immune disease suggested that it was especially worthy of study.

Thus, the publication generated a great deal of interest amongst virologists and others in the scientific community, as well as substantial media coverage. M.E. patients and others interested in the disease were especially excited, both because of the attention that the finding brought to the disease and because of the hope that it might lead to effective treatment.

The idea that a retrovirus might be at the heart of M.E. is one that had been considered since the mid-1980s, when the illness first emerged in the U.S. As with AIDS, M.E. patients were observed to have immune systems unable to control a wide variety of infections that normal people keep in check. Although one research finding in the early 1990s of a possible retroviral link was eventually dismissed, many people interested in the disease continued to believe that an HIV-like pathogen eventually would be found.

Subsequent to the publication of this paper, millions of dollars were spent following up on its findings. Eventually, the results were determined to have been a laboratory contaminant and the original WPI paper was retracted.

At present, there are no papers linking M.E. or CFS with a retrovirus currently in the medical literature.

-Lisa Petrison, Ph.D.



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M.E. AND RETROVIRUSES

MEDICAL LITERATURE, 2009-2012 (XMRV and MLV's):

Alter HJ, Mikovits JA, Switzer WM, Ruscetti FW, Lo SC, Klimas N, Komaroff AL, Montoya JG, Bateman L, Levine S, Peterson D, Levin B, Hanson MR, Genfi A, Bhat M, Zheng H, Wang R, Li B, Hung GC, Lee LL, Sameroff S, Heneine W, Coffin J, Hornig M, Lipkin WI. A multicenter blinded analysis indicates no association between chronic fatigue syndrome/myalgic encephalomyelitis and either xenotropic murine leukemia virus-related virus or polytropic murine leukemia virus. *MBio*. 2012 Sep 18;3(5). PMID: 22991430

The original investigators who found XMRV and pMLV (polytropic murine leukemia virus) in blood of subjects with CFS report that this association is not confirmed in a blinded analysis of samples from rigorously characterized subjects.

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Alberts B. Retraction. *Science*. 2011 Dec 23;334(6063):1636. PMID: 22194552

Science is fully retracting the report "Detection of an infectious retrovirus, XMRV, in blood cells of patients with chronic fatigue syndrome" (V. C. Lombardi et al., *Science* 326, 585 (2009)).

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Lo SC, Pripuzova N, Li B, Komaroff AL, Hung GC, Wang R, Alter HJ. Retraction for Lo et al., Detection of MLV-related virus gene sequences in blood of patients with chronic fatigue syndrome and healthy blood donors. *Proc Natl Acad Sci U S A*. 2012 Jan 3;109(1):346. PMID: 22203980

A paper showing an association between a retrovirus and CFS is retracted.

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Steffen I, Tyrrell DL, Stein E, Montalvo L, Lee TH, Zhou Y, Lu K, Switzer WM, Tang S, Jia H, Hockman D, Santer DM, Logan M, Landi A, Law J, Houghton M, Simmons G. No Evidence for XMRV Nucleic Acids, Infectious Virus or Anti-XMRV Antibodies in Canadian Patients with Chronic Fatigue Syndrome. *PLoS One*. 2011;6(11):e27870. PMID: 22114717

The authors failed to find XMRV or other MLV's in a group of Canadian patients.



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Cingöz O, Paprotka T, Delviks-Frankenberry KA, Wildt S, Hu WS, Pathak VK, Coffin JM. Characterization, Mapping and Distribution of the Two XMRV Parental Proviruses. J Virol. 2011 Oct 26. PMID: 22031947

This group recently showed that XMRV was created through recombination between two endogenous murine retroviruses, PreXMRV-1 and PreXMRV-2, during the passaging of a prostate tumor xenograft in nude mice. Here, multiple approaches that led to the identification of PreXMRV-2, as well as the distribution of both parental proviruses among different mouse species are described.

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Elfaitouri A, Shao X, Mattsson Ulfstedt J, Muradrasoli S, Bölin Wiener A, Golbob S, Ohrmalm C, Matousek M, Zachrisson O, Gottfries CG, Blomberg J. Murine gammaretrovirus group G3 was not found in Swedish patients with myalgic encephalomyelitis/chronic fatigue syndrome and fibromyalgia. PLoS One. 2011;6(10):e24602. PMID: 22022360

The authors failed to find XMRV or related retroviruses in a population of Swedish CFS patients.

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Hohn O, Bannert N. Origin of XMRV and its demise as a human pathogen associated with chronic fatigue syndrome. Viruses. 2011 Aug;3(8):1312-9. PMID: 21994780

The authors discuss findings related to XMRV and CFS.

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Simmons G, Glynn SA, Komaroff AL, Mikovits JA, Tobler LH, Hackett J Jr, Tang N, Switzer WM, Heneine W, Hewlett IK, Zhao J, Lo SC, Alter HJ, Linnen JM, Gao K, Coffin JM, Kearney MF, Ruscetti FW, Pfof MA, Bethel J, Kleinman S, Holmberg JA, Busch MP; Blood XMRV Scientific Research Working Group (SRWG). Failure to confirm XMRV/MLVs in the blood of patients with chronic fatigue syndrome: a multi-laboratory study. Science. 2011 Nov 11;334(6057):814-7. PMID: 21940862

Coded replicate samples of blood from 15 subjects previously reported to be XMRV/MLV-positive (14 with CFS) and from 15 healthy donors previously determined to be negative



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for the viruses were distributed in a blinded fashion to nine laboratories, which performed assays designed to detect XMRV/MLV nucleic acid, virus replication, and antibody. Only two laboratories reported evidence of XMRV/MLVs; however, replicate sample results showed disagreement, and reactivity was similar among CFS subjects and negative controls. These results indicate that current assays do not reproducibly detect XMRV/MLV in blood samples.

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Silverman RH, Das Gupta J, Lombardi VC, Ruscetti FW, Pfost MA, Hagen KS, Peterson DL, Ruscetti SK, Bagni RK, Petrow-Sadowski C, Gold B, Dean M, Mikovits JA. Partial Retraction. Science. 2011 Sep 22. PMID: 21940859

In our 23 October 2009 Report, "Detection of an infectious retrovirus, XMRV, in blood cells of patients with chronic fatigue syndrome," two of the coauthors, Silverman and Das Gupta, analyzed DNA samples from chronic fatigue syndrome (CFS) patients and healthy controls. A reexamination by Silverman and Das Gupta of the samples they used shows that some of the CFS peripheral blood mononuclear cell (PBMC) DNA preparations are contaminated with XMRV plasmid DNA.

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Ali MA, Dale JK, Kozak CA, Goldbach-Mansky R, Miller FW, Straus SE, Cohen JL. Xenotropic murine leukemia virus-related virus is not associated with chronic fatigue syndrome in patients from different areas of the us in the 1990s. Virology. 2011 Sep 24;8:450. PMID: 21943244

The authors found no definitive evidence for XMRV DNA sequences or antibody in a cohort of CFS patients, which included patients from diverse regions of the United States. In addition, XMRV was not detected in a cohort of patients with chronic inflammatory disorders.

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Cool M, Bouchard N, Massé G, Laganière B, Dumont A, Hanna Z, Phaneuf D, Morisset R, Jolicoeur P. No detectable XMRV in subjects with chronic fatigue syndrome from Quebec. Virology. 2011 Nov 10;420(1):66-72. PMID: 21925693

The authors failed to find XMRV in a group of CFS patients from Quebec.

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Jerome KR, Diem K, Huang ML, Selke S, Corey L, Buchwald D. Xenotropic murine leukemia virus-related virus in monozygotic twins discordant for chronic fatigue syndrome. *Diagn Microbiol Infect Dis*. 2011 Jul 25. PMID: 21795004

A study looking for XMRV in CFS patients and unaffected identical twins did not find the virus in blood samples from any of the participants.

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Mendoza R, Vaughan AE, Miller AD. The Left Half of the XMRV Retrovirus Is Present in an Endogenous Retrovirus of NIH/3T3 Swiss Mouse Cells. *J Virol*. 2011 Sep;85(17):9247-8. PMID: 21697491

This authors suggested that XMRV has clear ancestors in mice and described a possible source of laboratory contamination for the virus.

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Tuke PW, Tettmar KI, Tamuri A, Stoye JP, Tedder RS. PCR master mixes harbour murine DNA sequences. Caveat emptor! *PLoS One*. 2011;6(5):e19953. PMID: 21647447

The authors looked at primers that might be used to attempt to detect XMRV and suggest that those reagents may be contaminated with the virus.

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Knox K, Carrigan D, Simmons G, Teque F, Zhou Y, Hackett J Jr, Qiu X, Luk KC, Schochetman G, Knox A, Kogelnik AM, Levy JA. No evidence of murine-like gammaretroviruses in CFS patients previously identified as XMRV-infected. *Science*. 2011 Jul 1;333(6038):94-7. PMID: 21628393

The authors failed to find XMRV or other MLVs in blood of a sample of 61 patients with CFS. MLV sequences were detected in commercial laboratory reagents.

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Paprotka T, Delviks-Frankenberry KA, Cingöz O, Martinez A, Kung HJ, Tepper CG, Hu WS, Fivash MJ Jr, Coffin JM, Pathak VK. Recombinant origin of the retrovirus XMRV. *Science*. 2011 Jul 1;333(6038):97-101. PMID: 21628392



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The authors found genetic sequences very similar to those in XMRV in specific mice, and speculate that this was the source of laboratory contamination with the virus.

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Alberts B. Editorial Expression of Concern. *Science*. 2011 Jun 2. PMID: 21628391

The editors of *Science* express their belief that the association between XMRV and CFS “likely reflects contamination of laboratories and research reagents with the virus.”

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Lombardi VC, Hagen KS, Hunter KW, Diamond JW, Smith-Gagen J, Yang W, Mikovits JA. Xenotropic murine leukemia virus-related virus-associated chronic fatigue syndrome reveals a distinct inflammatory signature. *In Vivo*. 2011 May-Jun;25(3):307-14. PMID: 21576403

CFS patients testing positive for XMRV display a specific pattern of cytokines and chemokines.

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Shin CH, Bateman L, Schlaberg R, Bunker AM, Leonard CJ, Hughen RW, Light AR, Light KC, Singh IR. Absence of XMRV retrovirus and other murine leukemia virus-related viruses in patients with chronic fatigue syndrome. *J Virol*. 2011 Jul;85(14):7195-202. PMID: 21543496

The authors failed to find XMRV or related MLVs in the blood of 100 CFS patients and 200 healthy volunteers from the Salt Lake City, Utah, area.

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Makarova N, Zhao C, Zhang Y, Bhosle S, Suppiah S, Rhea JM, Kozyr N, Arnold RS, Ly H, Molinaro RJ, Parslow TG, Hunter E, Liotta D, Petros J, Blackwell JL. Antibody responses against xenotropic murine leukemia virus-related virus envelope in a murine model. *PLoS One*. 2011 Apr 6;6(4):e18272. PMID: 21494670

The authors vaccinated mice with XMRV, observing transiently high levels of antibodies.

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Schutzer SE, Rounds MA, Natelson BH, Ecker DJ, Eshoo MW. Analysis of cerebrospinal fluid from chronic fatigue syndrome patients for multiple human ubiquitous viruses and xenotropic murine leukemia-related virus. *Ann Neurol.* 2011 Apr;69(4):735-8. PMID: 21472770

The authors failed to find XMRV or other common viruses in the cerebrospinal fluid of 43 CFS patients.

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Furuta RA, Miyazawa T, Sugiyama T, Kuratsune H, Ikeda Y, Sato E, Misawa N, Nakatomi Y, Sakuma R, Yasui K, Yamaguti K, Hirayama F. No association of xenotropic murine leukemia virus-related virus with prostate cancer or chronic fatigue syndrome in Japan. *Retrovirology.* 2011 Mar 17;8:20. PMID: 21414229

The authors failed to find “solid evidence” of XMRV sequences or antibodies in any of the blood samples from 500 healthy donors, 67 prostate cancer patients or 100 CFS patients.

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Erlwein O, Robinson MJ, Kaye S, Wills G, Izui S, Wessely S, Weber J, Cleare A, Collier D, McClure MO. Investigation into the presence of and serological response to XMRV in CFS patients. *PLoS One.* 2011 Mar 9;6(3):e17592. PMID: 21408077

The authors failed to find XMRV in a population of CFS patients in the UK, using techniques that they say were similar to those used in the original Science study showing an association.

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Garson JA, Kellam P, Towers GJ. Analysis of XMRV integration sites from human prostate cancer tissues suggests PCR contamination rather than genuine human infection. *Retrovirology.* 2011 Feb 25;8:13. PMID: 21352548

The authors report that 2 of 14 patient-derived XMRV integration sites are identical to ones from experimentally infected cells, and they thus conclude that XMRV is a contamination rather than a genuine human pathogen.

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Satterfield BC, Garcia RA, Jia H, Tang S, Zheng H, Switzer WM. Serologic and PCR testing of persons with chronic fatigue syndrome in the United States shows no



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association with xenotropic or polytropic murine leukemia virus-related viruses. *Retrovirology*. 2011 Feb 22;8:12. PMID: 21342521

The authors failed to find XMRV or MuLV in any blood samples of a group of 45 CFS sufferers demonstrating a high degree of disability from across the U.S. and 42 matched controls.

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Onlamoon N, Das Gupta J, Sharma P, Rogers K, Suppiah S, Rhea J, Molinaro RJ, Gaughan C, Dong B, Klein EA, Qiu X, Devare S, Schochetman G, Hackett J Jr, Silverman RH, Villinger F. Infection, viral dissemination, and antibody responses of rhesus macaques exposed to the human gammaretrovirus XMRV. *J Virol*. 2011 May;85(9):4547-57. PMID: 21325416

The authors inoculated five macaque monkeys with XMRV intravenously. The virus established a persistent, chronic disseminated infection, with low transient viremia and provirus in blood lymphocytes during acute infection. Although undetectable in blood after about a month, XMRV viremia was reactivated at 9 months, confirming the chronicity of the infection. Viral sequences were disseminated through the body, infecting CD4 T cells in lymphoid organs including the gastrointestinal lamina propria, alveolar macrophages in lung, and epithelial/interstitial cells in other organs, including the reproductive tract.

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Chaipan C, Dilley KA, Paprotka T, Delviks-Frankenberry KA, Venkatachari NJ, Hu WS, Pathak VK. Severe restriction of xenotropic murine leukemia virus-related virus replication and spread in cultured human peripheral blood mononuclear cells. *J Virol*. 2011 May;85(10):4888-97. PMID: 21325415

The authors studied how XMRV might spread in the body, reporting that human peripheral blood mononuclear cells (PBMCs) can potentially act as a source of infectious XMRV for spread to cells that express low levels of host restriction factors. They state that hypermutation of XMRV in human PBMCs constitutes one of the blocks to replication and spread of XMRV and that hypermutation of XMRV proviruses at GG dinucleotides may be a useful and reliable indicator of human PBMC infection.

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Sakakibara S, Sakakibara K, Tosato G. NF-kappaB activation stimulates transcription and replication of retrovirus XMRV in human B-lineage and prostate carcinoma cells. *J Virol*. 2011 Apr;85(7):3179-86. PMID: 21270144



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The authors report that NF-kB activation can markedly increase XMRV production, and suggest that EBV infection or other sources of inflammation may promote XMRV spread in humans.

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Hohn O, Strohschein K, Brandt AU, Seeher S, Klein S, Kurth R, Paul F, Meisel C, Scheibenbogen C, Bannert N. No evidence for XMRV in German CFS and MS patients with fatigue despite the ability of the virus to infect human blood cells in vitro. PLoS One. 2010 Dec 22;5(12):e15632. PMID: 21203514

The authors failed to find XMRV sequences or XMRV specific antibodies in blood samples of 39 CFS patients, 112 MS patients or 40 healthy donors, all from Germany. The authors were able to experimentally infect samples from healthy donors and CFS patients with XMRV, resulting in the release of low levels of transmittable virus.

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Mikovits JA, Lombardi VC, Pfof MA, Hagen KS, Ruscetti FW. Detection of an infectious retrovirus, XMRV, in blood cells of patients with chronic fatigue syndrome. Virulence. 2010 Sep-Oct;1(5):386-90. PMID: 21178474

The WPI group that initially found XMRV in the blood of CFS patients details the techniques that they used to detect it, suggesting that more than one type of assay be used.

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Smith RA. Contamination of clinical specimens with MLV-encoding nucleic acids: implications for XMRV and other candidate human retroviruses. Retrovirology. 2010 Dec 20;7:112. PMID: 21171980

The authors of Retrovirology counsel the need to take extreme care to make sure that laboratory contamination is not responsible for detection of XMRV in human samples.

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Hué S, Gray ER, Gall A, Katzourakis A, Tan CP, Houldcroft CJ, McLaren S, Pillay D, Futreal A, Garson JA, Pybus OG, Kellam P, Towers GJ. Disease-associated XMRV sequences are consistent with laboratory contamination. Retrovirology. 2010 Dec 20;7(1):111. PMID: 21171979



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The authors demonstrate that primers used as laboratory agents can be contaminated and express concern that patient sequences of XMRV are not more diverse, thus proposing that XMRV might not be a genuine human pathogen.

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Sato E, Furuta RA, Miyazawa T. An endogenous murine leukemia viral genome contaminant in a commercial RT-PCR kit is amplified using standard primers for XMRV. *Retrovirology*. 2010 Dec 20;7:110. PMID: 21171978

The authors found evidence of contamination of endogenous MLV and XMRV genomes in laboratory test kits.

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Oakes B, Tai AK, Cingöz O, Henefield MH, Levine S, Coffin JM, Huber BT. Contamination of human DNA samples with mouse DNA can lead to false detection of XMRV-like sequences. *Retrovirology*. 2010 Dec 20;7:109. PMID: 21171973

The authors tested blood of 112 CFS patients and 36 healthy controls for XMRV, finding it only when other evidence of contamination was present.

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Menéndez-Arias L. Evidence and controversies on the role of XMRV in prostate cancer and chronic fatigue syndrome. *Rev Med Virol*. 2010 Nov 26. PMID: 21113915

The authors summarize what has been learned about XMRV in human illness.

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Henrich TJ, Li JZ, Felsenstein D, Kotton CN, Plenge RM, Pereyra F, Marty FM, Lin NH, Grazioso P, Crochiere DM, Eggers D, Kuritzkes DR, Tsibris AM. Xenotropic murine leukemia virus-related virus prevalence in patients with chronic fatigue syndrome or chronic immunomodulatory conditions. *J Infect Dis*. 2010 Nov 15;202(10):1478-81. PMID: 20936980

The authors failed to find XMRV in blood samples of 32 CFS patients, 43 HIV patients, 97 rheumatoid arthritis patients, 26 hematopoietic stem-cell or solid organ transplant patients, or 96 patients presenting for various types of medical care.



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Yan Y, Liu Q, Wollenberg K, Martin C, Buckler-White A, Kozak CA. Evolution of functional and sequence variants of the mammalian XPR1 receptor for mouse xenotropic gammaretroviruses and the human-derived retrovirus XMRV. *J Virol.* 2010 Nov;84(22):11970-80. PMID: 20844050

The authors screened rodents and other mammals for sequence variation in the Xpr1 receptor for the mouse xenotropic or polytropic mouse leukemia viruses (X-MLVs or P-MLVs, respectively) of the gammaretrovirus family and for susceptibility to mouse-derived X/P-MLVs and to XMRV, identifying multiple distinct susceptibility of phenotypes.

*

Mikovits JA, Huang Y, Pfost MA, Lombardi VC, Bertolette DC, Hagen KS, Ruscetti FW. Distribution of xenotropic murine leukemia virus-related virus (XMRV) infection in chronic fatigue syndrome and prostate cancer. *AIDS Rev.* 2010 Jul-Sep;12(3):149-52. PMID: 20842203

The authors of the original paper Science finding an association between XMRV and CFS discuss issues in laboratory techniques used to attempt to find the virus.

*

Mikovits JA, Lombardi VA, Ruscetti FW. Xenotropic Murine Leukemia Virus-Related Virus: Current Research, Disease Associations, Therapeutic Opportunities. *Future Medicine Therapy.* 2010 7(4), 377-384.

Information and hypotheses about XMRV and its possible role in CFS are summarized.

*

Hong P, Li J, Li Y. Failure to detect Xenotropic murine leukaemia virus-related virus in Chinese patients with chronic fatigue syndrome. *Virol J.* 2010 Sep 13;7:224.

The authors failed to find XMRV in peripheral blood mononuclear cells (PBMCs) and plasma of Chinese patients with CFS.

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Singh IR. Detecting retroviral sequences in chronic fatigue syndrome. *Viruses.* 2010 Nov;2(11):2404-8. PMID: 21994623



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The findings of sequences related to XMRV in CFS patients and reported in the Lo et al 2010 paper are discussed.

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Courgnaud V, Battini JL, Sitbon M, Mason AL. Mouse retroviruses and chronic fatigue syndrome: Does X (or P) mark the spot? *Proc Natl Acad Sci U S A.* 2010 Sep 7;107(36):15666-7. PMID: 20798036

Commentary on Lo et al 2010, from the same publication issue.

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Lo SC, Pripuzova N, Li B, Komaroff AL, Hung GC, Wang R, Alter HJ. Detection of MLV-related virus gene sequences in blood of patients with chronic fatigue syndrome and healthy blood donors. *Proc Natl Acad Sci U S A.* 2010 Sep 7;107(36):15874-9. PMID: 20798047

The authors found murine leukemia virus (MLV) like virus sequences in 32 of 37 (86.5%) CFS patient samples compared with only 3 of 44 (6.8%) of samples from healthy volunteer blood donors. No evidence of mouse DNA contamination was detected in the PCR assay system or the clinical samples. Seven of 8 gag-positive patients tested again positive in a sample obtained nearly 15 y later. A genetically diverse group of MLV-related viruses were found, with sequences from CFS patients more closely related to those of polytropic mouse endogenous retroviruses than to those of XMRVs.

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Rusmevichientong A, Chow SA. Biology and pathophysiology of the new human retrovirus XMRV and its association with human disease. *Immunol Res.* 2010 Dec;48(1-3):27-39. PMID: 20717743

The authors summarize what is known about XMRV thus far.

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Qiu X, Swanson P, Luk KC, Tu B, Villinger F, Das Gupta J, Silverman RH, Klein EA, Devare S, Schochetman G, Hackett J Jr. Characterization of antibodies elicited by XMRV infection and development of immunoassays useful for epidemiologic studies. *Retrovirology.* 2010 Aug 17;7:68. PMID: 20716359



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The authors infect three rhesus macaque monkeys with XMRV to determine dynamics of the antibody responses.

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Stieler K, Fischer N. Apobec 3G efficiently reduces infectivity of the human exogenous gammaretrovirus XMRV. PLoS One. 2010 Jul 23;5(7):e11738. PMID: 20668529

The authors study the Apobec3 (A3) proteins, a family of cytidine deaminases that serve as one important group of host proteins to control primary infection and efficient viral spread of XMRV.

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Crowhurst G. XMRV: does this virus hold the key to myalgic encephalomyelitis/CFS? Br J Nurs. 2010 Jul 22-Aug 11;19(14):919-22. PMID: 20647985

The authors discuss the importance of finding XMRV in CFS patients.

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McClure M, Kaye S. Can detection of xenotropic murine leukemia virus-related virus be linked to chronic fatigue syndrome? Expert Rev Mol Diagn. 2010 Jul;10(5):537-9. PMID: 20629499

Current knowledge about the role of XMRV in CFS is discussed.

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Switzer WM, Jia H, Hohn O, Zheng H, Tang S, Shankar A, Bannert N, Simmons G, Hendry RM, Falkenberg VR, Reeves WC, Heneine W. Absence of evidence of xenotropic murine leukemia virus-related virus infection in persons with chronic fatigue syndrome and healthy controls in the United States. Retrovirology. 2010 Jul 1;7:57. PMID: 20594299

The authors failed to find XMRV using multiple molecular or serologic assays in archived blood samples of 51 people with CFS and 56 healthy people from populations in Kansas and Georgia.

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Silverman RH, Nguyen C, Weight CJ, Klein EA. The human retrovirus XMRV in prostate cancer and chronic fatigue syndrome. *Nat Rev Urol*. 2010 Jul;7(7):392-402. PMID: 20517289

The authors discuss what is known about XMRV in CFS and prostate cancer.

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Fischer N, Schulz C, Stieler K, Hohn O, Lange C, Drosten C, Aepfelbacher M. Xenotropic murine leukemia virus-related gammaretrovirus in respiratory tract. *Emerg Infect Dis*. 2010 Jun;16(6):1000-2. PMID: 20507757

The authors detected XMRV-specific sequences in 2%-3% of samples from 168 immunocompetent carriers and approximately 10% of samples from 161 immunocompromised patients.

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Baraniuk JN. Xenotropic murine leukemia virus-related virus in chronic fatigue syndrome and prostate cancer. *Curr Allergy Asthma Rep*. 2010 May;10(3):210-4. PMID: 20425007

The authors discuss what is known about the role of XMRV in prostate cancer and CFS.

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Kim S, Rusmevichientong A, Dong B, Remenyi R, Silverman RH, Chow SA. Fidelity of target site duplication and sequence preference during integration of xenotropic murine leukemia virus-related virus. *PLoS One*. 2010 Apr 20;5(4):e10255. PMID: 20421928

The authors studied the fidelity of XMRV integration DNA into cells, concluding that it involves a coordinating joining of two viral DNA ends space 4 bp apart on the target DNA and that it proceeds with high fidelity.

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Miyazawa T. Endogenous retroviruses as potential hazards for vaccines. *Biologicals*. 2010 May;38(3):371-6. PMID: 20378372

The article discusses the risk that vaccines may be contaminated with retroviruses such as XMRV.



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Singh IR, Gorzynski JE, Drobysheva D, Bassit L, Schinazi RF. Raltegravir is a potent inhibitor of XMRV, a virus implicated in prostate cancer and chronic fatigue syndrome. PLoS One. 2010 Apr 1;5(4):e9948. PMID: 20376347

The authors evaluated 45 different drugs to see if any were capable of inhibiting XMRV replication. Those that were effective included the retroviral integrase inhibitor raltegravir; an integrase inhibitor, L-000870812; and two nucleoside reverse transcriptase inhibitors, zidovudine (ZDV) and tenofovir disoproxil fumarate (TDF). Combinations of the substances displayed particular effectiveness.

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Paprotka T, Venkatachari NJ, Chaipan C, Burdick R, Delviks-Frankenberry KA, Hu WS, Pathak VK. Inhibition of xenotropic murine leukemia virus-related virus by APOBEC3 proteins and antiviral drugs. J Virol. 2010 Jun;84(11):5719-29. PMID: 20335265

The establishment of XMRV infection in patients may be dependent on infection of A3G/A3F-deficient cells, and cells expressing low levels of A3G/A3F, such as prostate cancer cells, may be ideal producers of infectious XMRV. Furthermore, the anti-HIV-1 drugs AZT, tenofovir, and raltegravir may be useful for treatment of XMRV infection.

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Groom HC, Yap MW, Galão RP, Neil SJ, Bishop KN. Susceptibility of xenotropic murine leukemia virus-related virus (XMRV) to retroviral restriction factors. Proc Natl Acad Sci U S A. 2010 Mar 16;107(11):5166-71. PMID: 20194752

The authors look at blood cell restriction factors that might have the capability of preventing replication of XMRV. They found that human APOBEC3 and tetherin proteins are able to block XMRV replication. Expression of human TRIM5alpha had no effect on viral infectivity. The virus was inhibited by factors from nonhuman species, including mouse Apobec3, tetherin, and Fv1 proteins.

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van Kuppeveld FJ, de Jong AS, Lanke KH, Verhaegh GW, Melchers WJ, Swanink CM, Bleijenberg G, Netea MG, Galama JM, van der Meer JW. Prevalence of xenotropic murine leukaemia virus-related virus in patients with chronic fatigue syndrome in the Netherlands: retrospective analysis of samples from an established cohort. BMJ. 2010 Feb 25;340:c1018. PMID: 20185493



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The authors failed to find XMRV in the blood of 76 CFS patients or 69 matched controls from the Netherlands.

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Groom HC, Boucherit VC, Makinson K, Randal E, Baptista S, Hagan S, Gow JW, Mattes FM, Breuer J, Kerr JR, Stoye JP, Bishop KN. Absence of xenotropic murine leukaemia virus-related virus in UK patients with chronic fatigue syndrome. *Retrovirology*. 2010 Feb 15;7:10. PMID: 20156349

The authors failed to find XMRV DNA in a sample of 170 CFS patients and 295 controls from the UK.

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Erlwein O, Kaye S, McClure MO, Weber J, Wills G, Collier D, Wessely S, Cleare A. Failure to detect the novel retrovirus XMRV in chronic fatigue syndrome. *PLoS One*. 2010 Jan 6;5(1):e8519. PMID: 20066031

The authors failed to find XMRV or MLV sequences in the blood of a group of 186 CFS patients in the UK.

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Stieler K, Schulz C, Lavanya M, Aepfelbacher M, Stocking C, Fischer N. Host range and cellular tropism of the human exogenous gammaretrovirus XMRV. *Virology*. 2010 Mar 30;399(1):23-30. PMID: 20110097

The authors look at how XMRV might spread, showing that it can infect various human cell types.

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Lombardi VC, Ruscetti FW, Das Gupta J, Pfof MA, Hagen KS, Peterson DL, Ruscetti SK, Bagni RK, Petrow-Sadowski C, Gold B, Dean M, Silverman RH, Mikovits JA. Detection of an infectious retrovirus, XMRV, in blood cells of patients with chronic fatigue syndrome. *Science*. 2009 Oct 23;326(5952):585-9. PMID: 19815723

The authors found DNA from XMRV in the blood of 67% of a sample of 101 CFS patients vs. 3.7% of healthy controls. Cell culture experiments suggested that the virus is infectious.



Paradigm Change

MEDICAL LITERATURE, 1991-2000

Gelman IH, Unger ER, Mawle AC, Nisenbaum R, Reeves WC. Chronic fatigue syndrome is not associated with expression of endogenous retroviral p15E. Mol Diagn. 2000 Jun;5(2):155-6. PMID: 11066017

The endogenous retrovirus p15E does not seem to be associated with CFS.

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Heneine W, Woods TC, Sinha SD, Khan AS, Chapman LE, Schonberger LB, Folks TM. Lack of evidence for infection with known human and animal retroviruses in patients with chronic fatigue syndrome. *Clin Infect Dis.* 1994 Jan;18 Suppl 1:S121-5. PMID: 8148438

Authors tested human T-lymphotropic viruses types I and II; human spuma retrovirus; simian T-lymphotropic virus type I; simian retroviruses types 1, 2, and 3; bovine leukemia virus; feline leukemia virus; and gibbon ape leukemia virus on CFS patients' blood and concluded that none of them was playing a role in the disease.

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Khan AS, Heneine WM, Chapman LE, Gary HE Jr, Woods TC, Folks TM, Schonberger LB. Assessment of a retrovirus sequence and other possible risk factors for the chronic fatigue syndrome in adults. *Ann Intern Med.* 1993 Feb 15;118(4):241-5. PMID: 8420441

The HTLV-II gag gene sequence was not a marker for CFS in a study of well-defined patients.

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Folks TM, Heneine W, Khan A, Woods T, Chapman L, Schonberger L. Investigation of retroviral involvement in chronic fatigue syndrome. *Ciba Found Symp.* 1993;173:160-6; discussion 166-75. PMID: 8387909

The authors did not find a variety of retroviruses (HTLV-II, simian T cell leukaemia virus, human spumavirus, bovine leukaemia virus and simian retrovirus) to be associated with CFS.

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Paradigm Change

Honda M, Kitamura K, Nakasone T, Fukushima Y, Matsuda S, Nishioka K, Matsuda J, Hashimoto N, Yamazaki S. Japanese patients with chronic fatigue syndrome are negative for known retrovirus infections. *Microbiol Immunol.* 1993;37(10):779-84. PMID: 7507200

HTLV-II was not found in a group of CFS patients in Japan.

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Centers for Disease Control and Prevention (CDC). Inability of retroviral tests to identify persons with chronic fatigue syndrome, 1992. *MMWR Morb Mortal Wkly Rep.* 1993 Mar 19;42(10):183, 189-90. PMID: 8446093

Researchers were not able to distinguish CFS from healthy controls with three retroviral tests.

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Gow JW, Simpson K, Schliephake A, Behan WM, Morrison LJ, Cavanagh H, Rethwilm A, Behan PO. Search for retrovirus in the chronic fatigue syndrome. *J Clin Pathol.* 1992 Dec;45(12):1058-61. PMID: 1479030

Researchers did not find evidence of HTLV-II in a group of CFS patients.

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DeFreitas E, Hilliard B, Cheney PR, Bell DS, Kiggundu E, Sankey D, Wroblewska Z, Palladino M, Woodward JP, Koprowski H. Retroviral sequences related to human T-lymphotropic virus type II in patients with chronic fatigue immune dysfunction syndrome. *Proc Natl Acad Sci U S A.* 1991 Apr 1;88(7):2922-6. PMID: 1672770

The authors found an association between an HTLV-II like virus and CFS.



Paradigm Change

M.E. AND RETROVIRUSES

MEDIA COVERAGE

Lombardi 2009 (XMRV) Study:

October 15, 2009

The New York Times

Consults: Experts on the Front Lines of Medicine

Readers Ask: A Virus Linked to Chronic Fatigue Syndrome

<http://consults.blogs.nytimes.com/2009/10/15/readers-ask-a-virus-linked-to-chronic-fatigue-syndrome/?scp=1&sq=Klimas&st=cse>

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October 12, 2009

The Wall Street Journal

Cancer-Causing Virus Linked to Chronic Fatigue

By Amy Dockser Marcus

<http://online.wsj.com/article/SB125501227713473525.html>

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October 9, 2009

Los Angeles Times

Virus Discovery Called Breakthrough in Fight Against Chronic Fatigue Syndrome

By Thomas H. Maugh II

<http://www.latimes.com/news/nationworld/nation/la-sci-fatigue9-2009oct09,0,3368993.story>

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October 8, 2009

The New York Times

Virus is Found in Many with Chronic Fatigue Syndrome

By Denise Grady



Paradigm Change

<http://www.nytimes.com/2009/10/09/health/research/09virus.html>

Subsequent XMRV and MLV Study Results:

February 6, 2012
The New York Times
Fallout From Fatigue Syndrome Retraction Is Wide
By David Tuller

http://www.nytimes.com/2012/02/07/health/fallout-from-fatigue-syndrome-retraction-is-far-and-wide.html?_r=2&pagewanted=all

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December 26, 2011
The New York Times
Scholars Retract Another Study Linking Virus To Fatigue Syndrome
By David Tuller

<http://www.nytimes.com/2011/12/27/health/research/scholars-retract-another-study-linking-xmr-v-to-chronic-fatigue-syndrome.html>

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December 22, 2011
The New York Times
Fatigue Syndrome Study Is Retracted By Journal
By David Tuller

<http://www.nytimes.com/2011/12/23/health/research/science-journal-retracts-chronic-fatigue-syndrome-paper.html>

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December 22, 2011
Nature News Blog
XMRV Paper Withdrawn
By Daniel Cressey

<http://blogs.nature.com/news/2011/12/xmr-v-paper-withdrawn.html>



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December 22, 2011

Science Insider

In A Rare Move, Science Without Authors' Consent Retracts Paper That Tied Mouse Virus To Chronic Fatigue Syndrome

By Jon Cohen

<http://news.sciencemag.org/scienceinsider/2011/12/in-a-rare-move-science-without-a.html?ref=hp>

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October 9, 2011

The National

Recent, Newmaking Scientific Research Has Been Debunked

By Robert Matthews

<http://www.thenational.ae/news/uae-news/technology/recent-newsmaking-scientific-research-has-been-debunked>

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October 8, 2011

The Australian

Fatigue Syndrome Takes Its Toll in the U.S.

By Leigh Dayton

<http://www.theaustralian.com.au/news/health-science/fatigue-syndrome-takes-its-toll-in-us/story-e6frg8y6-1226161062564>

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September 30, 2011

Science

The Waning Conflict Over XMRV and Chronic Fatigue Syndrome

By Jon Cohen

<http://www.sciencemag.org/content/333/6051/1810.summary?sid=55a04988-8df0-479d-8081-f5a363f4bd3e>



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September 27, 2011
Good Morning America
Chronic Fatigue Syndrome: Study Casts Doubt on Mouse-Virus Link
By Katie Moisse

<http://abcnews.go.com/Health/Wellness/chronic-fatigue-syndrome-study-casts-doubt-mouse-virus/story?id=14611118>

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September 23, 2011
Time
Scientists Back Down From Viral Cause of Chronic Fatigue Syndrome
By Meredith Melnick

<http://healthland.time.com/2011/09/23/scientists-back-down-from-viral-cause-of-chronic-fatigue-syndrome/>

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September 23, 2011
Science
False Positive
By Jon Cohen and Martin Enserink

<http://www.sciencemag.org/content/333/6050/1694.full>

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September 22, 2011
The New York Times
Viral Theory Is Set Back in Chronic Fatigue Syndrome Study
By David Tuller

http://www.nytimes.com/2011/09/23/health/research/23fatigue.html?_r=1

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September 22, 2011
The Scientist



Paradigm Change

Again: No XMRV-Chronic Fatigue Link

By Tia Ghose

<http://the-scientist.com/2011/09/22/again-no-xmrv-chronic-fatigue-link/>

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June 2, 2011

Minneapolis Post

Study That Linked Retrovirus With Chronic Fatigue Syndrome Was Seriously Flawed,
Research Suggests

By Susan Perry

[http://www.minnpost.com/healthblog/2011/06/02/28801/study_that_linked_retrovirus_wit
h_chronic_fatigue_syndrome_was_seriously_flawed_research_suggests](http://www.minnpost.com/healthblog/2011/06/02/28801/study_that_linked_retrovirus_with_chronic_fatigue_syndrome_was_seriously_flawed_research_suggests)

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June 1, 2011

Scientific American

Retrovirus No Longer Thought to Be Cause of Chronic Fatigue Syndrome

By Erica Westly

[http://www.scientificamerican.com/article.cfm?id=virus-no-longer-thought-cause-
chronic-fatigue-syndrome&WT.mc_id=SA_sharetool](http://www.scientificamerican.com/article.cfm?id=virus-no-longer-thought-cause-chronic-fatigue-syndrome&WT.mc_id=SA_sharetool) Facebook

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June 1, 2011

The Wall Street Journal

More Doubt Cast on Study of Chronic Fatigue

By Amy Dockser Marcus

<http://online.wsj.com/article/SB10001424052702304563104576357850809296970.html>

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June 1, 2011

The New York Times

Two Studies Examine Syndrome of Fatigue

By David Tuller



Paradigm Change

http://www.nytimes.com/2011/06/01/health/research/01fatigue.html?_r=2

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May 31, 2011
The Washington Post
Reports: Mouse Virus Doesn't Cause Chronic Fatigue Syndrome
By Brian Vastag

http://www.washingtonpost.com/national/reports-virus-linked-to-chronic-fatigue-syndrome-a-lab-contaminant/2011/05/31/AG7O4dFH_story.html

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May 31, 2011
US News and World Report
Studies Refute Virus' Link to Chronic Fatigue Syndrome
By Amanda Gardner

http://www.usnews.com/mobile/articles_mobile/studies-refute-virus-link-to-chronic-fatigue-syndrome

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May 31, 2011
The Wall Street Journal
Chronic-Fatigue Paper Called Into Question
By Amy Dockser Marcus

http://online.wsj.com/article/SB10001424052702303745304576355852212887170.html?mod=googlenews_wsj

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May 6, 2011
Science Insider
More Bad News for Chronic Fatigue Syndrome and the Mouse Virus Thesis
By Jon Cohen

<http://news.sciencemag.org/scienceinsider/2011/05/more-bad-news-for-chronic-fatigue.html?ref=hp>



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January 3, 2011
The New York Times
Exhausted by Illness, and Doubts
By David Tuller

<http://www.nytimes.com/2011/01/04/health/04fatigue.html>

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August 24, 2010
The Wall Street Journal
New Hope in Fatigue Fight
By Amy Dockser Marcus

http://online.wsj.com/article_email/SB1000142405274870384660457544774407696832_2-IMyQjAxMTAwMDIwMzEyNDMyWj.html

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August 23, 2010
USA Today
Virus Link to Chronic Fatigue Studied

http://www.usatoday.com/news/health/2010-08-23-chronic-fatigue-virus_N.htm

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August 23, 2010
The New York Times
Study Links Chronic Fatigue Syndrome to Virus
By David Tuller

<http://www.nytimes.com/2010/08/24/health/research/24fatigue.html?%2334;chronic%20fatigue%20syndrome=&r=2&sq=&st=cse&%2334;=&scp=3&pagewanted=print>

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July 14, 2010
The New York Times
Delay in Release of Study on Chronic Fatigue Syndrome Prompts an Outcry



Paradigm Change

By David Tuller

<http://www.nytimes.com/2010/07/14/health/14fatigue.html?%2334;chronic%20fatigue%20syndrome=&sq=&st=cse&%2334;=&scp=8&pagewanted=print>

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July 2, 2010
Scientific American
Chronic Fatigue Findings Were Held Back
By Heidi Ledford

<http://www.scientificamerican.com/article.cfm?id=chronic-fatigue-findings>

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June 30, 2010
The Wall Street Journal
Chronic-Fatigue Link to Virus Disputed
By Amy Dockser Marcus

<http://online.wsj.com/article/SB10001424052748703374104575337160225739290.html>

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The Wall Street Journal
XMRV Timeline

http://si.wsj.net/public/resources/images/P1-AZ799_CLASH_G_20110311181505.jpg

Social Issues:

October 22, 2011
Bloomberg
Controversial New Virus Tied to Fatigue Not Transmitted by Blood
By Michelle Fay Cortez

<http://www.bloomberg.com/news/2011-10-23/controversial-new-virus-tied-to-fatigue-not-transmitted-by-blood.html>



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September 23, 2011
The New York Times
Off-Label Use of H.I.V. Medications Is Catalyst for More Controversy
By Scott James

http://www.nytimes.com/2011/09/23/us/off-label-use-of-hiv-medications-is-catalyst-for-more-controversy.html?_r=1

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August 2011
FDA
Investigating Viruses in Cells Used to Make Vaccines
Evaluating the Potential Threat Posed by Transmission of Viruses to Humans

<http://www.fda.gov/biologicsbloodvaccines/scienceresearch/biologicsresearchareas/ucm127327.htm>

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July 4, 2011
Scientific American
Donor Fatigue: Should Blood Banks Reject Chronic Fatigue Sufferers?
By Nina Bai

<http://www.scientificamerican.com/article.cfm?id=donor-fatigue>

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April 4, 2010
The Wall Street Journal
Potential Risk to Blood Supply Probed
By Amy Dockser Marcus

<http://online.wsj.com/article/SB10001424052702303450704575160081295988608.html>

Whittemore Peterson Institute & Judy Mikovits:

December 5, 2011



Paradigm Change

Science
Science Insider
Criminal Attorney Speaks for Controversial CFS Researcher
By Jon Cohen

<http://news.sciencemag.org/scienceinsider/2011/12/criminal-attorney-speaks-for-con.html?ref=ra>

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December 3, 2011
ABC News
Chronic Fatigue Researcher Jailed Following Controversy
By John Gever

<http://abcnews.go.com/Health/Wellness/chronic-fatigue-researcher-jailed-controversy/story?id=15076224#.TtsRv81DFD8>

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December 2, 2011
Slate
Stolen Notebooks and a Biochemist in Chains
By Julie Rehmeyer

http://www.slate.com/articles/health_and_science/medical_examiner/2011/12/judy_miko_vits_in_prison_what_does_it_mean_for_research_on_chronic_fatigue_syndrome_.html

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December 2, 2011
Science
Dispute Over Lab Notebooks Lands Researcher in Jail
By Jon Cohen

<http://www.sciencemag.org/content/334/6060/1189.summary>

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November 29, 2011
Science
Science Insider



Paradigm Change

CFS Researcher Reportedly Surrenders to Nevada Police

By Jon Cohen

<http://news.sciencemag.org/scienceinsider/2011/11/cfs-researcher-reportedly-surren.html>

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November 29, 2011

The Sacramento Bee

Scientist Surrenders in Reno Research Theft Case

By Scott Sonner

<http://www.sacbee.com/2011/11/29/4087793/scientist-surrender-in-reno-in.html#ixzz1f8VZHS8T>

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November 29, 2011

Nature

Embattled Scientist in Theft Probe

By Ewen Callaway

<http://www.nature.com/news/embattled-scientist-in-theft-probe-1.9505>

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November 28, 2011

Reno Gazette Journal

Missing Notebooks Returned to Reno Chronic Disease Lab

By Frank X. Mullen Jr.

<http://www.rgj.com/article/20111128/NEWS/111280325/Missing-notebooks-returned-Reno-chronic-disease-lab?odyssey=mod%7Cnewswell%7Ctext%7CLocal+News%7Cs>

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November 22, 2011

Science Insider

Inmate Mikovits Meets Judge

By Jon Cohen



Paradigm Change

<http://news.sciencemag.org/scienceinsider/2011/11/inmate-mikovits-meets-judge.html?ref=ra>

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November 22, 2011

Science

Science Insider

Details Emerge of the Criminal Charges Against Embattled CFS Researcher

By Jon Cohen

<http://news.sciencemag.org/scienceinsider/2011/11/details-emerge-of-the-criminal.html>

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November 22, 2011

Chicago Tribune

Discredited Chronic Fatigue Researcher in California Jail

By Trine Tsouderos

<http://www.chicagotribune.com/health/ct-nw-chronic-fatigue-scientist-arrest-20111122,0,5455739.story>

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November 22, 2011

The Independent (UK)

“Fugitive” ME Scientist Arrested

By Steve Connor

<http://www.independent.co.uk/news/science/fugitive-me-scientist-arrested-6265843.html>

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November 21, 2011

The Scientist

Chronic Fatigue Researcher Arrested

By Jef Akst

<http://the-scientist.com/2011/11/21/chronic-fatigue-researcher-arrested/>

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Paradigm Change

November 19, 2011

Retraction Watch

Chronic Fatigue Syndrome Researcher Judy Mikovits Arrested

<http://retractionwatch.wordpress.com/2011/11/19/chronic-fatigue-syndrome-researcher-judy-mikovits-arrested/#more-5249>

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November 14, 2011

Science

Science Insider

Lawsuit Filed Against Chronic Fatigue Syndrome Researcher by Former Employer

By Jon Cohen

<http://news.sciencemag.org/scienceinsider/2011/11/lawsuit-filed-against-chronic-fatigue.html>

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October 5, 2011

NatureNews

Integrity Issue Follows Fired Researcher

By Heidi Ledford

<http://www.nature.com/news/2011/111005/full/news.2011.574.html>

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October 4, 2011

ScienceInsider

Chronic Fatigue Syndrome Researcher Fired Amidst New Controversy

By Jon Cohen

http://news.sciencemag.org/scienceinsider/2011/10/xmrv-researcher-fired.html?rss=1&utm_source=dlvr.it&utm_medium=twitter

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October 4, 2011

The Scientist



Paradigm Change

Chronic Fatigue Researcher Fired

By Edyta Zielinska

<http://www.the-scientist.com/2011/10/04/chronic-fatigue-researcher-fired/>

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October 3, 2011

Chicago Tribune

Manipulation Alleged in Paper Linking Virus, Chronic Fatigue Syndrome

By Trine Tsouderos

<http://www.chicagotribune.com/health/chi-chronic-fatigue-syndrome-paper-10032011,0,6792877.story>

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November 12, 2009

The New York Times

A Big Splash from an Upstart Medical Center

By Denise Grady

<http://query.nytimes.com/gst/fullpage.html?res=9E0CE0D6153AF931A25752C1A96F9C8B63>

XMRV Search Process:

March 2013

Discover Magazine

Chasing the Shadow Virus: Chronic Fatigue Syndrome and XMRV

By Hillary Johnson

<http://discovermagazine.com/2013/march/17-shadow-virus#.UTPWFM0gQue>

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November 4, 2011

Cure Talk

Dr. Ian Lipkin and Dr. Mady Hornig Use Deep Sequencing and Proteomics To Hunt CFS Viruses



Paradigm Change

By Kate Benson

<http://trialx.com/curetalk/2011/11/dr-ian-lipkin-and-dr-mady-hornig-use-deep-sequencing-and-proteomics-to-hunt-cfs-viruses/>

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September 27, 2011

ScienceInsider

Insider Looking Out: How People with Chronic Fatigue Syndrome View the Death of XMRV

By Jon Cohen

<http://news.sciencemag.org/scienceinsider/2011/09/insider-looking-out-how-people.html?ref=hp>

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March 17, 2011

Nature

Cause for Concern

Editorial

<http://www.nature.com/nature/journal/v471/n7338/full/471266a.html>

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March 14, 2011

Nature

Virology: Fighting for a Cause

By Ewen Callaway

<http://www.nature.com/news/2011/110314/full/471282a.html>

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March 12, 2011

The Wall Street Journal

Amid War on a Mystery Disease, Patients Clash with Scientists

By Amy Dockser Marcus

<http://online.wsj.com/article/SB10001424052748704008704575639193973468402.html>



Paradigm Change

The Wall Street Journal Health Blog:

December 27, 2011
The Wall Street Journal
Health Blog
Second High-Profile XMRV-Related Paper Retracted
By Amy Dockser Marcus

<http://blogs.wsj.com/health/2011/12/27/second-high-profile-xmrv-related-paper-retracted/>

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December 22, 2011
The Wall Street Journal
Health Blog
Science Retracts Paper on XMRV-Chronic Fatigue Syndrome Link
By Katherine Hobson

<http://blogs.wsj.com/health/2011/12/22/science-retracts-paper-on-xmrv-chronic-fatigue-syndrome-link/>

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October 24, 2011
The Wall Street Journal
Health Blog
Scientists Say XMRV Poses No Risk to Blood Supply
By Amy Dockser Marcus

http://blogs.wsj.com/health/2011/10/24/scientists-say-xmrv-poses-no-risk-to-blood-supply/?mod=google_news_blog

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October 3, 2011
The Wall Street Journal
Health Blog
Scientist Who Led XMRV Research Team Let Go



Paradigm Change

By Amy Dockser Marcus

<http://blogs.wsj.com/health/2011/10/03/scientist-who-led-xmr-v-research-team-let-go/?KEYWORDS=XMRV>

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September 23, 2011

The Wall Street Journal

Health Blog

A.M. Vitals: XMRV Link to Chronic Fatigue Theory Faces More Doubt

By Katherine Hobson

<http://blogs.wsj.com/health/2011/09/23/a-m-vitals-xmr-v-link-to-chronic-fatigue-theory-faces-more-doubt/>

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June 1, 2011

The Wall Street Journal

Health Blog

Given Doubt Cast on CFS-XMRV Link, What About Related Research?

By Amy Dockser Marcus

<http://blogs.wsj.com/health/2011/06/01/given-doubt-cast-on-cfs-xmr-v-link-what-about-related-research/>

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May 31, 2011

The Wall Street Journal

Health Blog

Science Papers 'Cast Further Doubt' on XMRV's Link to Chronic Fatigue Syndrome

By Amy Dockser Marcus

<http://blogs.wsj.com/health/2011/05/31/science-papers-cast-further-doubt-on-xmrvs-link-to-chronic-fatigue-syndrome/>

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April 8, 2011

The Wall Street Journal



Paradigm Change

Health Blog

At NIH Chronic Fatigue Syndrome Conference, XMRV Debate Heats Up

By Amy Dockser Marcus

http://blogs.wsj.com/health/2011/04/08/at-nih-chronic-fatigue-syndrome-conference-xmrv-debate-heats-up/?mod=wsj_share_facebook

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March 7, 2011

The Wall Street Journal

Health Blog

XMRV and the Blood Supply: More Study Needed

By Amy Dockser Marcus

<http://blogs.wsj.com/health/2011/03/07/xmrv-and-the-blood-supply-more-study-needed/>

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March 4, 2011

The Wall Street Journal

Health Blog

Study Finds No Link Between XMRV and Chronic Fatigue Syndrome

By Amy Dockser Marcus

<http://blogs.wsj.com/health/2011/05/04/study-finds-no-link-between-xmrv-and-chronic-fatigue-syndrome/>

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February 17, 2011

The Wall Street Journal

Health Blog

XMRV: Study Shows Virus Can Cause “Persistent Infection” in Monkeys

By Amy Dockser Marcus

<http://blogs.wsj.com/health/2011/02/17/xmrv-study-shows-virus-can-cause-persistent-infection-in-monkeys/>

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January 20, 2011



Paradigm Change

The Wall Street Journal
Health Blog
XMRV: Testing the Blood Supply
By Amy Dockser Marcus

<http://blogs.wsj.com/health/2011/01/20/xmr-v-testing-the-blood-supply/>

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December 20, 2010
The Wall Street Journal
Health Blog
XMRV: How To Screen the Blood Supply
By Amy Dockser Marcus

<http://blogs.wsj.com/health/2010/12/20/xmr-v-how-to-screen-the-blood-supply/>

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December 20, 2010
The Wall Street Journal
Health Blog
XMRV: Raising the Issue of Contamination
By Amy Dockser Marcus

<http://blogs.wsj.com/health/2010/12/20/xmr-v-raising-the-issue-of-contamination/>

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December 17, 2010
The Wall Street Journal
Health Blog
XMRV: Still Waiting for a Test
By Amy Dockser Marcus

<http://blogs.wsj.com/health/2010/12/17/xmr-v-still-waiting-for-a-test/>

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December 3, 2010
The Wall Street Journal
Health Blog



Paradigm Change

XMRV: Red Cross Now Barring Blood Donors Who Have CFS

By Amy Dockser Marcus

<http://blogs.wsj.com/health/2010/12/03/xmr-v-red-cross-now-barring-blood-donors-who-have-cfs/>

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November 23, 2010

The Wall Street Journal

Health Blog

Abbott, Roche, Gen-Probe Among Those Seeking XMRV Test

By Katherine Hobson

<http://blogs.wsj.com/health/2010/11/23/abbott-roche-gen-probe-among-those-seeking-xmr-v-test/>

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November 23, 2010

The Wall Street Journal

Health Blog

Seeking New Blood-Supply Test

By Amy Dockser Marcus

<http://online.wsj.com/article/SB10001424052748704243904575630700111729446.html>

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November 17, 2010

The Wall Street Journal

Health Blog

Gearing Up for the Big Search for XMRV

By Amy Dockser Marcus

<http://blogs.wsj.com/health/2010/11/17/gearing-up-for-the-big-search-for-xmr-v/>

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November 4, 2010

The Wall Street Journal

Health Blog



Paradigm Change

What's Next for X (as in XMRV)?

By Amy Dockser Marcus

<http://blogs.wsj.com/health/2010/11/04/whats-next-for-x-as-in-xmrv/>

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October 15, 2010

The Wall Street Journal

Health Blog

XMRV On Everyone's Mind at Chronic Fatigue Syndrome Meeting

By Amy Dockser Marcus

<http://blogs.wsj.com/health/2010/10/15/xmrv-on-everyones-mind-at-a-chronic-fatigue-syndrome-meeting/>

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September 9, 2010

The Wall Street Journal

Health Blog

'World Class Virus Hunter' To Head Up the Latest XMRV Study

By Amy Dockser Marcus

<http://blogs.wsj.com/health/2010/09/08/world-class-virus-hunter-to-head-up-the-latest-xmrv-study/>

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August 25, 2010

The Wall Street Journal

Health Blog

Does X (the Virus, That Is) Mark the Spot in Chronic Fatigue Syndrome?

By Amy Dockser Marcus

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By Amy Dockser Marcus

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By Amy Dockser Marcus

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By Amy Dockser Marcus

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By Amy Dockser Marcus

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The AABB Makes It Official: CFS Patients Shouldn't Give Blood

By Amy Dockser Marcus

<http://blogs.wsj.com/health/2010/06/19/the-aabb-makes-it-official-cfs-patients-shouldnt-give-blood/>

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By Amy Dockser Marcus

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By Amy Dockser Marcus

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