DoD Gulf War Illness Research Program (GWIRP)

Each year, the Department of Defense's office of the Congressionally Directed Medical Research Programs (CDMRP) assesses scientific opportunities to advance research in specific areas. The investigators supported by individual programs are making significant progress against targeted diseases, conditions, and injuries. This list is not intended to be a full representation of accomplishments, but rather a sampling of the broad portfolio of research and advances resulting from congressional appropriations.

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<th>Year</th>
<th>GWIRP Research Contributions</th>
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| 2008 | Dr. Lisa Conboy from the New England School of Acupuncture, Inc. found that acupuncture provided improvement on the Physical Functioning Subscale (PFS) of the SF-36 in Veterans with GWI. Effects were observed following 4–6 months of treatment. | Conboy L, St John M, Schnyer R. 2012. The effectiveness of acupuncture in the treatment of Gulf War Illness. *Contemp Clin Trials* 33(3):557-62.  
GWIRP Video Highlight |
| 2008 | Dr. James Baraniuk of Georgetown University found a unique alteration in brain structure and function in GWI-affected Veterans. Moreover, specific responses to exertion were identified that were able to classify GWI individuals into subgroups. | Rayhan RU, Stevens BW, et al. 2013. Increased brain white matter axial diffusivity associated with fatigue, pain and hyperalgesia in Gulf War Illness. *PLoS One* 8(3):e58493.  
GWIRP Research Highlight  
GWIRP Research Highlight  |
| 2008 | Dr. Ronald Bach from the Minnesota Veterans Medical Research and Education Foundation found that CRP, leptin, and BDNF levels are significantly higher in blood from Gulf War Veterans with multiple symptoms of chronic pain, chronic fatigue, and cognitive impairment. Further proteomic analysis revealed a coordinately expressed set of 18 CRP-related proteins in the plasma of Gulf War Veterans. This set of potential pro-inflammatory biomarkers was found to correlate with levels of the stress-related antigen Protein C. | Johnson GJ, Leis LA, et al. 2013. Elevated platelet count, CRP and thromboxane analog-induced platelet aggregation in subjects with Gulf War Veterans' Illnesses: Evidence of a chronic inflammatory state? *Blood Coagul Fibrinolysis* 24(7):736-741.  
GWIRP Research Highlight, 2011  
GWIRP Research Highlight, 2013 |
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• *GWIRP Research Highlight* |
| 2008 | Drs. Stephen Lasley and James O’Callaghan found that prior exposure to the stress hormone, corticosterone (CORT) “primed” the immune system of DFP-treated animals to mount an exaggerated response. These observations led to the creation of a murine neuroinflammation model of GWI based on combined exposure to physiological stress and a nerve agent. | • O’Callaghan JP, Kelly KA, et al. 2015. Corticosterone primes the neuroinflammatory response to DFP in mice: potential animal model of Gulf War Illness. *J Neurochem* 133(5):708-21.  
• *GWIRP Research Highlight* |
| 2009 | Dr. Beatrice Golomb from the University of California, San Diego found a prolonged phosphocreatine recovery time in Veterans afflicted with GWI as compared to non-deployed controls. This recovery time delay is suspected to be the result of mitochondrial dysfunction. | • Koslik HJ, Hamilton G, and Golomb BA. 2014. Mitochondrial dysfunction in Gulf War Illness revealed by 31Phosphorus Magnetic Resonance Spectroscopy: A case-control study. *PLoS One* 9(3):e92887.  
• *GWIRP Research Highlight* |
| 2010 | Dr. Brian Cooper of the University of Florida found that chronic exposure to chlorpyrifos, permethrin, and pyridostigmine bromide results in alterations of pain thresholds and vascular nociceptor function in a rat model. This dysfunction could cause widespread pain and contribute to the development of CNS symptoms that have been identified in Gulf War Veterans. | • Nutter TJ and Cooper BY. 2014. Persistent modification of Nav1.9 following chronic exposure to insecticides and pyridostigmine bromide. *Toxicol Appl Pharmacol* 277(3):298-309.  
• *GWIRP Research Highlight* |
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| 2011 | Dr. Alvin Terry found impaired axonal transport in the brains of living rats after treatment with chlorpyrifos, a well-known OP insecticide. The inhibition of transport was evident even 30 days after the OP dosing had ceased indicating repeated exposures to the pesticide chlorpyrifos, at doses below those associated with acute toxicity, can result in persistent alterations in axonal transport. | • Hernandez CM, Beck WD, et al. 2015. Repeated exposure to chlorpyrifos leads to prolonged impairments of axonal transport in the living rodent brain. *Neurotoxicology* 47:17-26.  
• GWIRP Research Highlight |
| 2012 | Two major multi-institutional research efforts by leading GWI investigators were initiated. Dr. Kimberly Sullivan of Boston University was awarded a consortium award for her collaborative project entitled “Brain-Immune Interaction as the Basis of Gulf War Illness Consortium (GWIC).” The objective of this study is to provide a cohesive understanding of the pathobiological mechanisms responsible for the symptoms of GWI in order to provide a targeted and efficient basis for identifying beneficial treatments and diagnostic markers. Dr. Mariana Morris of Nova Southeastern University was awarded a second consortium award for her collaborative project entitled “Understanding Gulf War Illness: An Integrative Modeling Approach.” This project will integrate clinical understanding of the disease process with basic research efforts using a novel combination of animal and mathematical models. | • CDMRP News Release |