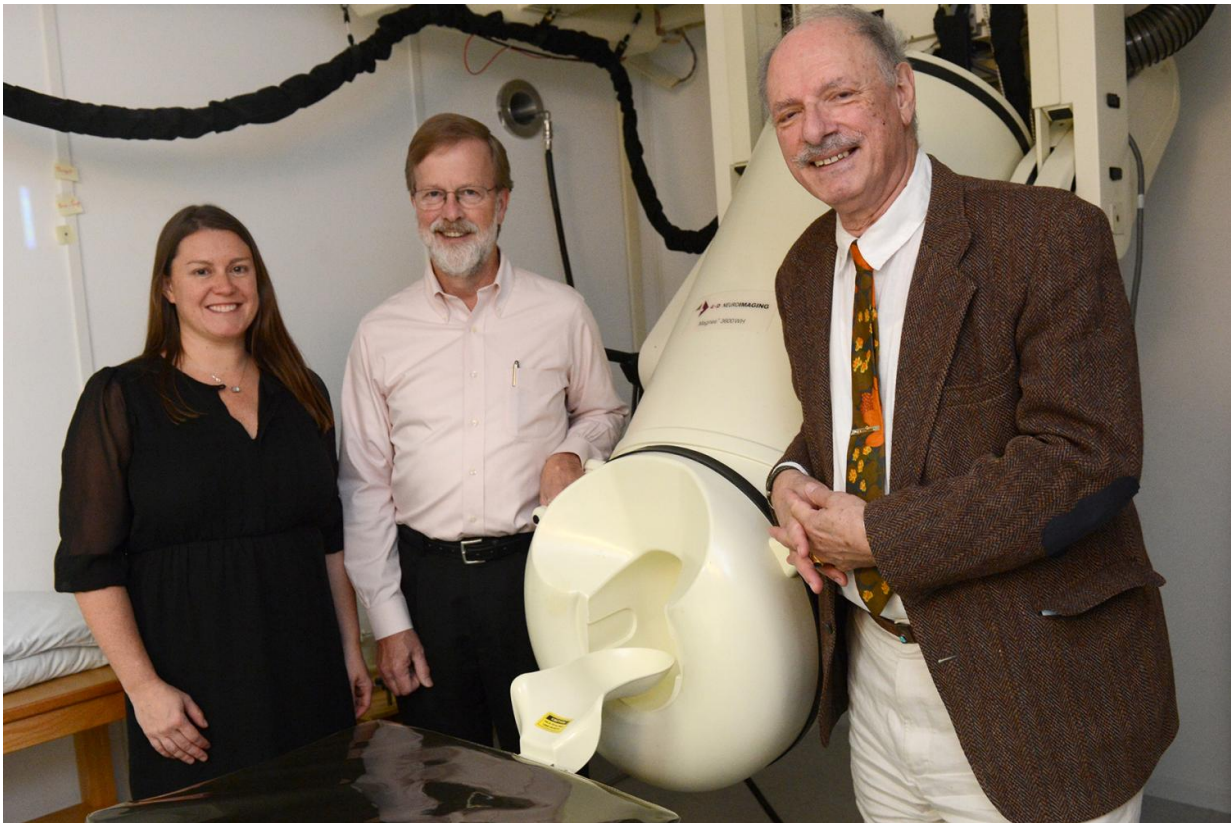


# Studies point to gene-based brain glitches in ill Gulf War vets

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(From left) Drs. Lisa James, Brian Engdahl, and Apostolos Georgopoulos (director) are with the Brain Sciences Center at the Minneapolis VA. They are seen here next to the center's MEG scanner. Credit: April Eilers

Veterans Affairs researchers have found that certain forms, or alleles, of

a gene known to play a key role in the immune system appear to offer protection from Gulf War illness (GWI). Further, they discovered how such protection is manifested in the brain.

Three VA-funded studies by scientists with the Minneapolis VA Health Care System support the theory that GWI stems from abnormal immune responses that lead to neurological-cognitive-mood (NCM), pain, and fatigue symptoms.

The research focused largely on the [human leukocyte antigen](#) (HLA) gene, located on chromosome 6. The findings suggest that certain alleles of HLA genes offer protection from GWI, while a lack of those alleles has made veterans vulnerable to developing GWI symptoms.

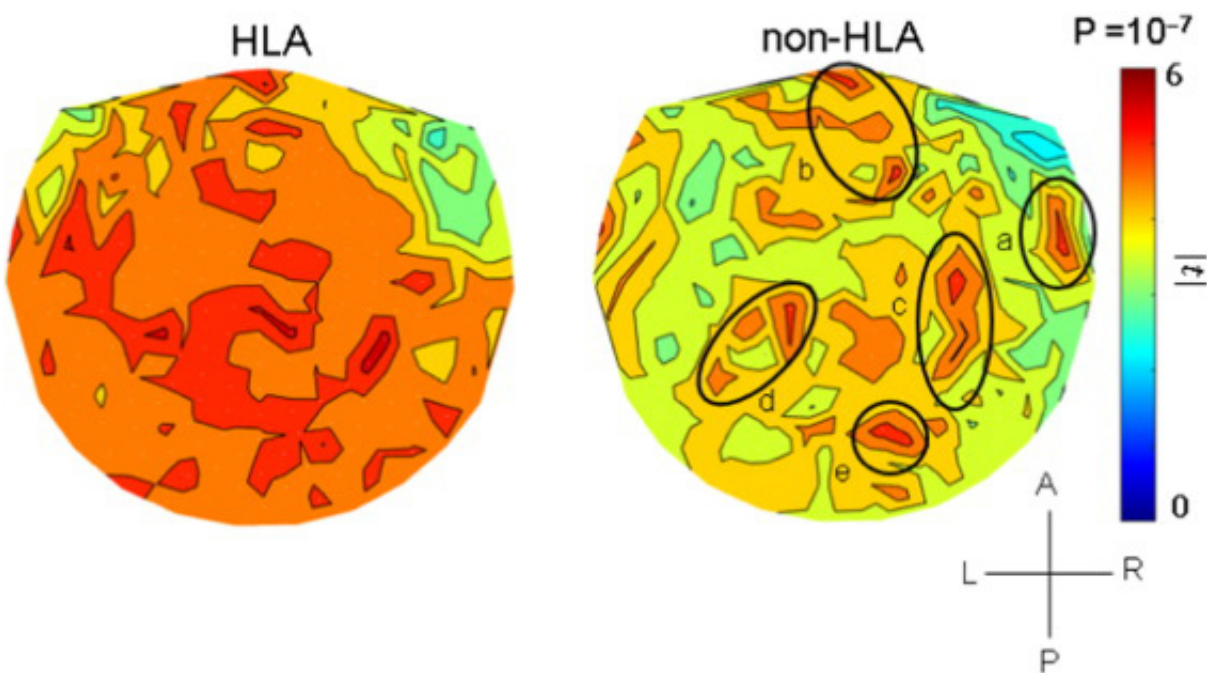
Dr. Apostolos Georgopoulos, head of the Brain Sciences Center at the Minneapolis VA, led the studies. He and his colleagues say the findings could pave the way for immunotherapy for vets with GWI, or treating symptoms by providing the missing immune protection. The ultimate goal is to give veterans with GWI more precise diagnoses and targeted treatments.

"The ideal situation would be in line with the holy grail of modern medicine, especially cancer treatment, where we are able to immunotype you and then provide targeted molecular therapy for your particular set of symptom patterns," says Dr. Brian Engdahl, a psychologist with the Brain Sciences Center who took part in all three studies. "So it is quite in line with that buzz phrase 'personalized medicine.' We want to be able to provide targeted treatment that's specific to the veterans' symptoms and genetic risk factors."

An estimated 300,000 veterans—about 4 in 10 of those who deployed to the Persian Gulf during operations Desert Shield and Desert Storm in the early 1990s—have GWI, which has long been difficult to define and

diagnose. The illness affects various organs, most notably the brain. Common symptoms include fatigue, rashes, serious body aches and joint swelling, gastrointestinal problems, memory loss, depression, anxiety, and chronic headaches. Many vets with GWI also have PTSD.

Dozens of Gulf War veterans participated in the studies, [published](#) in the past year in *EbioMedicine*, part of the British journal *The Lancet*. The first study, which included 66 vets with GWI and 16 without, found differences in HLA type, based on blood tests, that distinguished these two groups with 84 percent accuracy. Veterans with GWI, in other words, had genetic susceptibility to developing their symptoms, believe the researchers.



Brain maps based on MEG scan data highlight differences between Veterans with and without Gulf War illness. Credit: Brain Sciences Center

In a follow-up [study](#), published in October 2016, the scientists documented sharp differences in brain function between healthy and ill Gulf War veterans in the cerebellum and frontal cortex.

Forty vets with GWI and 46 without underwent a magnetoencephalography (MEG) scan, a brain imaging technique that tracks the firing of neurons. It found, with 94 percent accuracy, distinctions between the two groups in synchronous neural interactions, also known as synchrony. Such differences are "excellent predictors of GWI," the researchers write.

Synchrony is important for cognitive functions including attention, memory, and communication between nerves and muscles. Past studies have shown that cognitively healthy people display similar patterns of synchrony, while abnormal synchrony is linked to PTSD and other disorders.

The third study, also published in October, combines the HLA risk factors and the brain miscommunication patterns to explain Gulf War symptoms. Sixty-five Gulf War veterans with GWI and 16 without had MEG scans to assess [neural synchrony](#). The findings show that HLA affects neural synchrony and predicts symptom types, and they indicate that GWI is caused by the interactions of genetics and exposures.

"Our working hypothesis is that, when exposed to factors such as vaccines, chemical exposures, and stress, genetically vulnerable veterans exhibit widespread synchronicity anomalies that contribute to diverse problems included under the NCM, pain, and fatigue domains," the researchers write in that study. "Conversely, the presence of protective HLA alleles would prevent these anomalies."

Engdahl says the research provides a measure of relief to Gulf War vets who have been unable to find successful long-term treatments for GWI.

"When you see the results of a brain scan or pull up a blood test result and say, 'All that points to chronic multi-symptom illness,' they say, 'It's real, it's real, it's not just in my head, I haven't been making this up,' Engdahl says. "There's something about objective test results that line up with what you've suffered from that puts the whole picture together. The next question is what can be done about it."

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