CAPITOL HILL FORUM ON

GULF WAR ILLNESS

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Welcome & Introductory Comments

Anthony Hardie

National Chair & Director

Veterans for Common Sense

CAPITOL HILL FORUM ON

GULF WAR ILLNESS

Co-Hosted by:

Veterans for Common Sense

Vietnam Veterans of America

Blinded Veterans Association BVA

Burnpits 360 Veterans Organization

Cease Fire Campaign

Fleet Reserve Association Loyalty Protection Service

Military Veterans Advocacy

The Quinism Foundation

NVLSP National Veterans Legal Services Program

Reserve Organization of America

Sergeant Sullivan Circle — Addressing the Toxic Wounds of War — in Honor of Marine Sgt. Thomas Joseph Sullivan (1975-2000)

Serving Our Heroes — United Soldiers and Sailors of America

Veterans & Military Families for Progress

Veterans Health Council — veteranshealth.org

Veteran Warriors — One Family, One Fight!

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Lea Steele, PhD

Professor, Beth K. and Stuart C. Yudofsky Chair in Behavioral Neuroscience
Baylor College of Medicine

Former *Scientific Director*
Research Advisory Committee on Gulf War Veterans' Illnesses (RAC-GWVI)
U.S. Department of Veterans Affairs

Author of the *Kansas Case Definition* of Gulf War Illness

Long-term Effects of Military Service in the 1990-1991 Gulf War

Gulf War illness: Overview and Research Update

Lea Steele, PhD
Baylor College of Medicine

Gulf War Illness

Overview

- Background: the 1990-1991 Gulf War
- Big Picture Questions: Gulf War Illness
  - ***What is it?***
  - ***What caused it?***
  - ***Who is affected?***
- Scientific advances in GWI research

1990-1991 Gulf War:
Operations Desert Shield/Desert Storm

Aug 2, 1990 - Iraq invaded Kuwait

Jan 16, 1991 - Air strikes began

Feb 24, 1991 - Ground combat began

Feb 28, 1991 - Cease fire declared

- 697,000 U.S. troops
- 37 countries in Allied Coalition
- Brief combat period; decisive victory
- 6 weeks air strikes, 4 day ground war

1991: Returning Veterans Report a Range of Difficult Symptoms, Not Explained by Any Known Diagnoses

"Gulf War Syndrome": Widespread reports of unexplained, persistent health problems

- *Chronic headaches*
- *Widespread pain*
- *Memory and concentration problems*
- *Persistent, unexplained fatigue*
- *Chronic diarrhea*
- *Difficulty breathing, respiratory problems*
- *Unusual skin rashes*
- *Other unexplained problems*

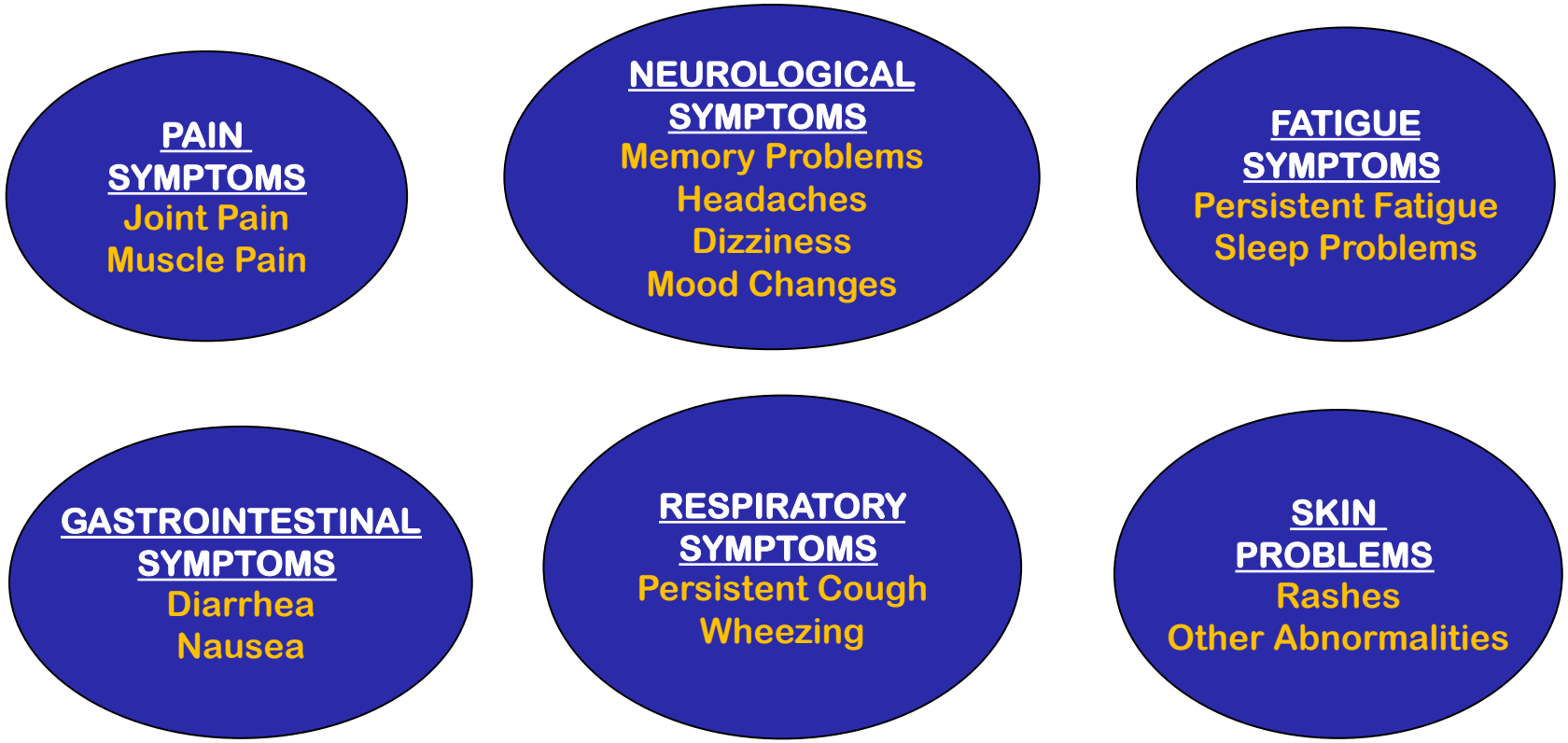
Now referred to as Gulf War Illness; consistent complex of chronic symptoms that still affect Gulf War veterans, 30 years after the war.

How is Gulf War illness Defined?

2 Case Definitions Recommended by National Academy of Sciences (IOM, 2014)

– CDC-defined Chronic Multisymptom Illness (Fukuda et al, 1998)

– Kansas Study-defined Gulf War illness (Steele, 2000)



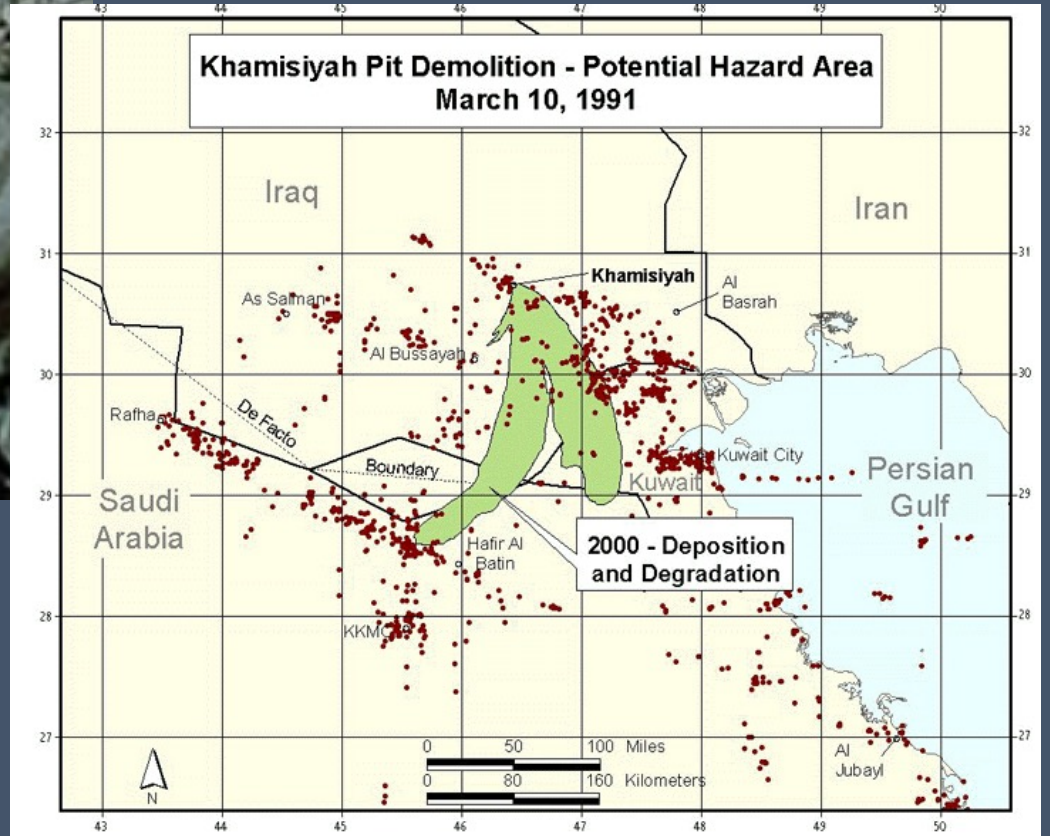
30 Years After Desert Storm:
What Have We Learned About Gulf War Illness?

- GWI affects about one third of 697,000 U.S. veterans who served in the 1991 Gulf War
- Highest rates in enlisted personnel (vs. officers), ground troops (Army, Marines)
- Few veterans with GWI have recovered over time
- Studies have identified multiple brain, immune, and other biological differences in veterans with GWI; detailed insights from animal studies
- Studies consistently show that GWI is not due to combat stress or any psych disorder
- Cause of GWI: Consistent findings from multiple large veteran studies, animal studies point to a group of neurotoxicant exposures during Gulf War deployment
- Most consistently identified: high levels of pesticide use, anti-nerve gas pills (PB), low-level chemical weapons not ruled out

Chemical Weapons

- Multiple chemical alarms, reported incidents during the 1990-1991 Gulf War.

- Best documented: Demolition of large Iraqi weapons depot near Khamisiyah Iraq; DOD models indicate > 100,000 U.S. troops potentially exposed to sarin, cyclosarin



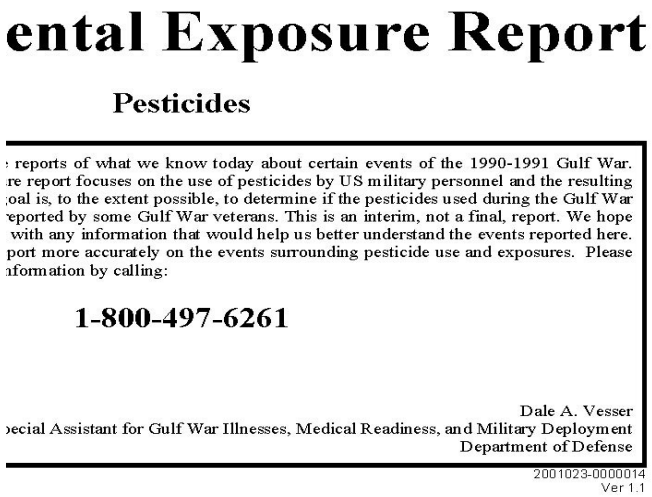
PB: ***Pyridostigmine Bromide or NAPP pills (anti-nerve gas pills)***
Required use directed by unit command (3x/day) as protective measure against effects of nerve agents. Widely used (~50% of troops) only in the 1990-91 Gulf War.

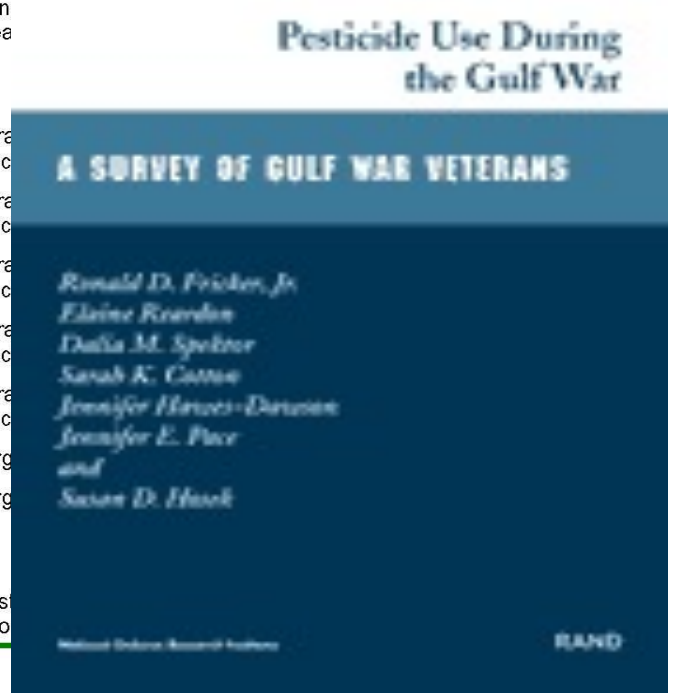
Heavy, extended use of multiple pesticides, insect repellants

Table 2. Pesticides and Insect Repellants Identified as Pesticides of Potential Concern by the Deployment Health Support Directorate

Compound	*Use*	*Chemical Class*	*Purpose*	*Application*
Pesticides and Repellants Used by the General Military Population				
DEET, 33% cream, stick	Personal use repellant	Dialkylamide	Repel flies and mosquitoes	By hand to skin
DEET, 75% liquid	Personal use repellant	Dialkylamide	Repel flies and mosquitoes	By hand to skin, uniform, netting
Permethrin, 0.5% spray	Personal use repellant	Pyrethroid	Repel flies and mosquitoes	Sprayed on uniforms
d-Phenothrin, 0.2% aerosol	Area use repellant	Pyrethroid	Knock down, kill flies and mosquitoes	Sprayed in tents, other enclosed areas
Methomyl 1% crystals	Fly bait	Carbamate	Attract and kill flies	Plac latri
Azamethiphos, 1% crystals	Fly bait	Organophosphate	Attract and kill flies	Plac latri
Dichlorvos, 20% pest strip	Pest strip	Organophosphate	Attract and kill mosquitoes	Hun area
Pesticides Used by Pesticide Applicators				
Chlorpyrifos, 45% liquid	Sprayed liquid	Organophosphate	Kill flies, mosquitoes, flying insects	Spra crac
	rayed iid	Organophosphate	Kill flies, mosquitoes, flying insects	Spra crac
	rayed iid	Organophosphate	Kill flies, mosquitoes, flying insects	Spra crac
	rayed iid	Carbamate	Kill flies, mosquitoes, flying insects	Spra crac
	rayed wder	Carbamate	Kill flies, mosquitoes, flying insects	Spra crac
	g	Organophosphate	Kill flies, mosquitoes	Larg
	g	Organophosphate	Kill flies, mosquitoes	Larg
	louser	Organochlorine	Kill lice, other insects	Dust also

posure Report: Pesticides (2003)[1632]





Advances in Gulf War Illness Research: Bottom Line

- *Gulf War Illness is a serious, debilitating medical condition. Most prominent risk factors are neurotoxicant exposures during 1991 Gulf War deployment*
- *Hundreds of thousands of Gulf War veterans affected; few have recovered*
- *Significant advances have improved understanding of the causes and biological processes that underlie the symptoms of GWI*
- *Urgent need remains for effective treatments; many veterans ill for 30 years!*
- *Focus on treatment research has yielded a rapid growth in new studies; results beginning to emerge*


Thank you
Lea.Steele@bcm.edu

James O'Callaghan, PhD

Lab Chief, Molecular Neurotoxicology Laboratory
Health Effects Laboratory Division
U.S. Centers for Disease Control and Prevention-NIOSH

WHY ANIMAL MODELS OF GWI?

1. **Direct examination of the brain tissue is a key advantage**

2. **Persistent molecular (molecules), cellular (specific brain cell types) and functional effects (e.g. behavior) associated with individual and combined exposures/conditions encountered in the Gulf War can be evaluated**

3. **Specific hypotheses can be tested**

4. **Therapeutic interventions can be evaluated**

STUDYING GWI: HUMAN TO ANIMAL TO HUMAN

1990-1991

Model wartime exposures in animals
- Nerve agent
- Pesticides
- Stress
- Vaccines and preventative meds
- Others

Validate:
- Animal model
- Biomarkers of illness

- Infer treatments
- Identify underlying cause of illness

Present Day

Images from Military.com and Boston University School of Public Health

CAPITOL HILL FORUM ON
GULF WAR ILLNESS

Kimberly Sullivan, PhD

Research Associate Professor, Department of Environmental Health
Boston University School of Public Health

Director, Boston Biorepository, Recruitment, and Integrative Network (BBRAIN) for GWI

Former *Associate Scientific Director*, Research Advisory Committee on Gulf War Veterans' Illnesses (RAC-GWVI) , U.S. Department of Veterans Affairs

GWIC

Gulf War Illness Consortium *(CDMRP #GW120037)*

- 16 collaborators from 9 study sites including US and Australia

- Designed to bring preclinical (cell and animal) and clinical (human) researchers together to speed development of understanding pathobiology of Gulf War Illness (GWI), identify diagnostic markers of GWI and to develop treatments.

- Our focus - study brain-immune pathways and chronic release of chemical messengers and excitatory neurotransmitters from immune cells of the brain that lead to chronic inflammation. These messengers include cytokines and glutamate.

Boston GWI Consortium affiliated studies Timeline

2013

CDMRP # GW120037
GWI Consortium

2014

CDMRP # GW130100
PET imaging of neuroinflammation in GWI

CDMRP # GW130045
Lipid markers of neuroinflammation

2015

CDMRP # GW140140
CNS autoantibody in GWI

CDMRP # GW140086
GW hiPSC Stem cell study

2016

CDMRP # GW150116
GW women's health study

PON1
CDMRP # GW150037
biomarker study

2017

CDMRP # GW160053
BChE biomarkers of GWI

CDMRP # GW160096
Epigenetic studies Of GWI

CDMRP # GW160151
Tau markers in GWI

CDMRP # GW160032
Machine learning in GWI

2018

CDMRP # GW170068
Gut microbiome study

CDMRP # GW170055
BBRAIN

CDMRP # GW170044
GWICTIC

CDMRP # GW170103
CNS autoantibody screening in GWI

NIEHS # 1808884709R001
HMGB1 in GWI

2019

CDMRP # GW180150
Mitochondrial Functioning in GWI

CDMRP # GW180099
GW White matter brain imaging study

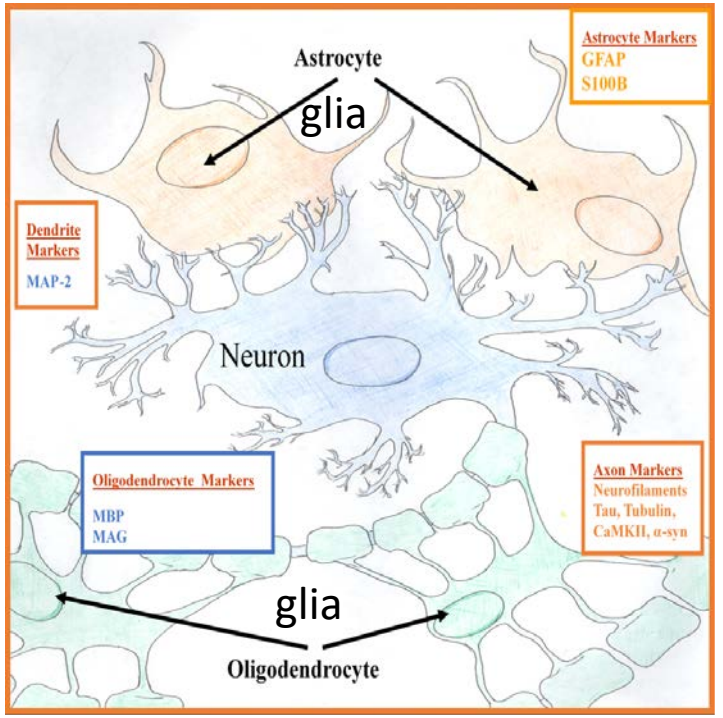
CDMRP # GW180103
PET imaging of microglia and astrocytes

CDMRP # GW180121
CNS autoantibodies and brain imaging outcomes

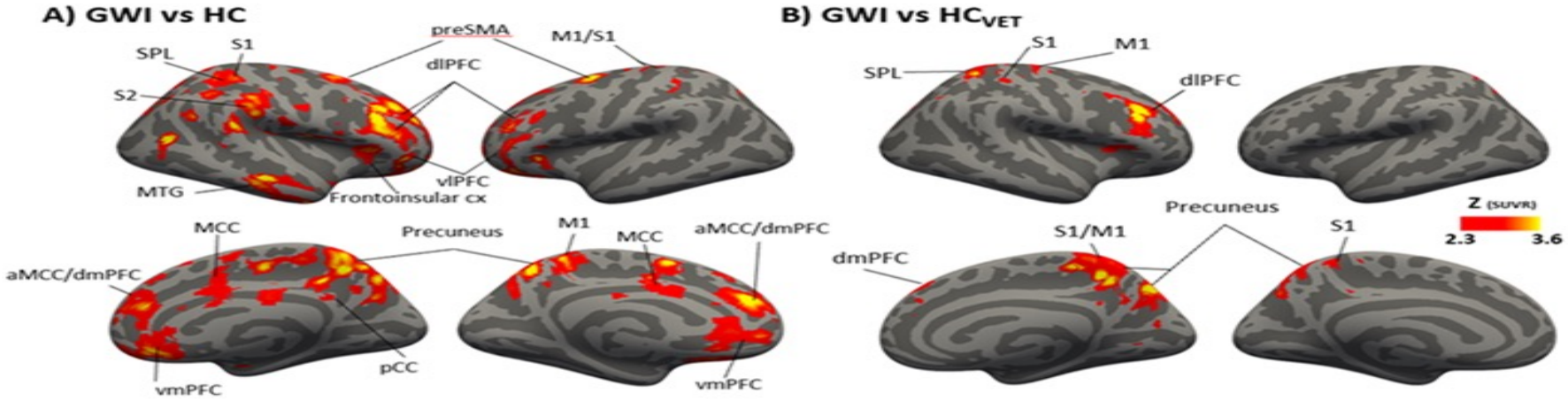
https://sites.bu.edu/gwic
https://sites.bu.edu/bbrain

Key Biomarker Research Accomplishments

- PET imaging of chronic inflammation in GWI
- Blood markers of chronic inflammation, excitatory neurotransmitter glutamate and CNS autoantibodies
- Machine learning brain imaging studies
- Human induced pluripotent Stem Cells for studying brain cell changes

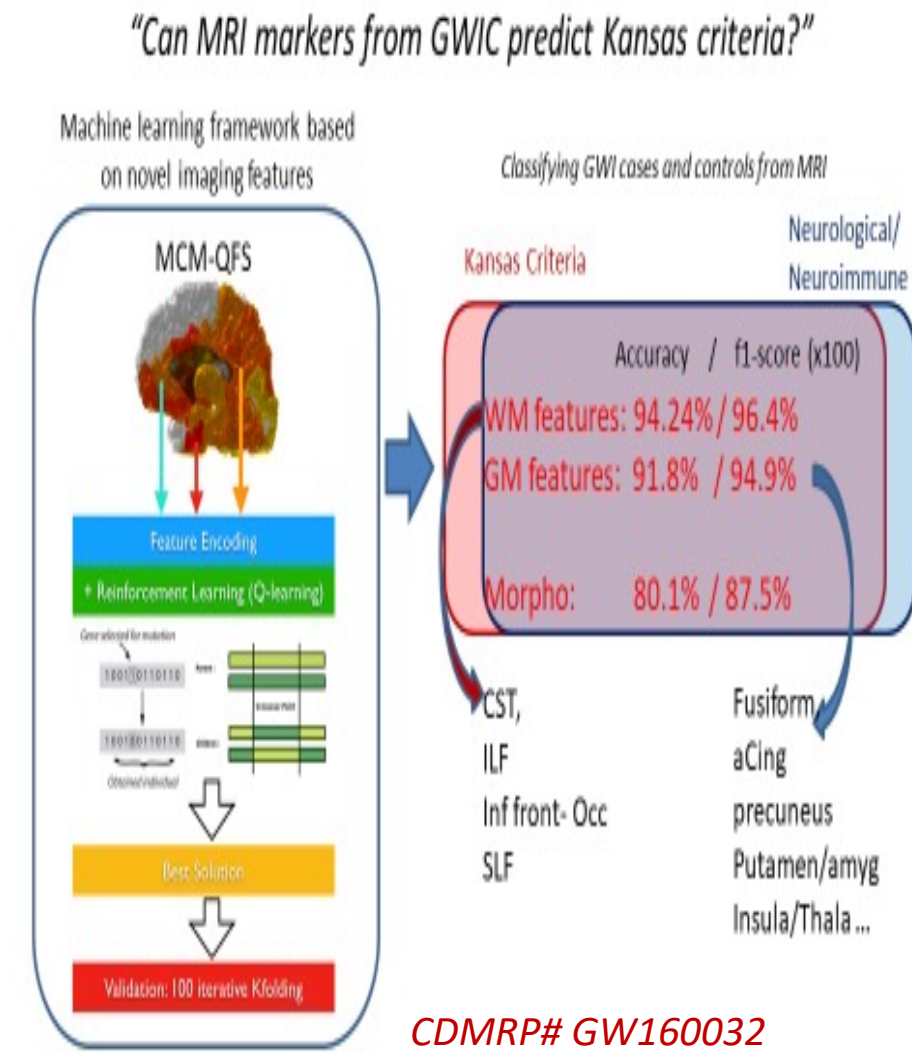


Abou-Donia et al., *Brain Sciences* 2020

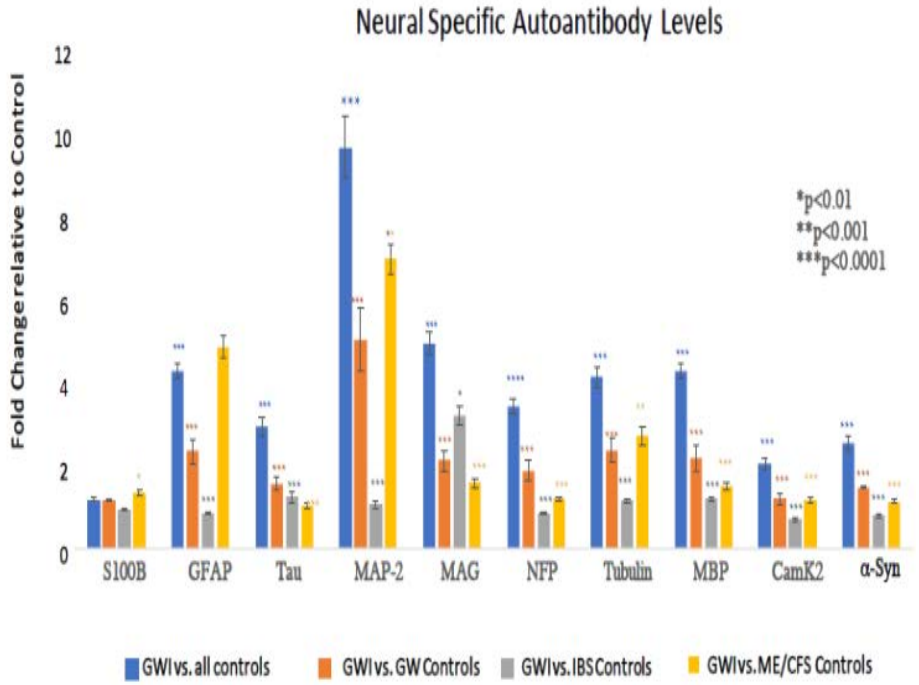


Alshelh et al., *Brain, Behavior and Immunity* 2020

A diagnostic test for GWI?

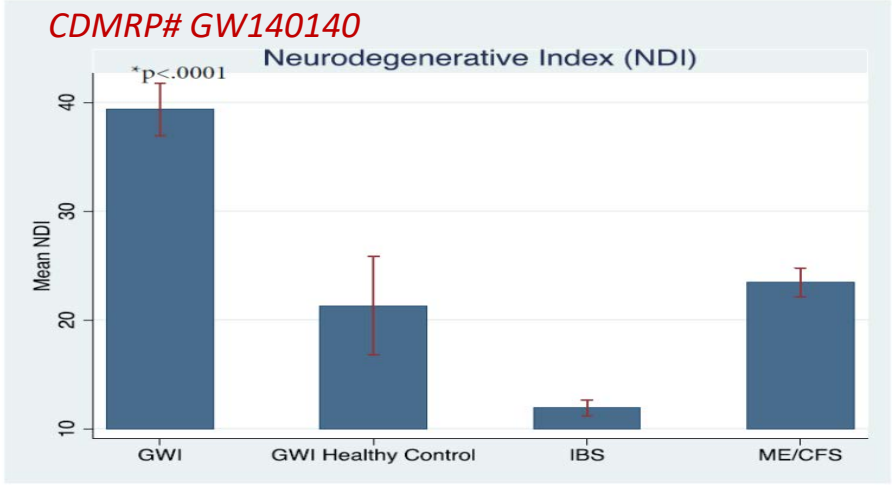


CDMRP# GW160032



90% GWI cases score above 30 on AA Index Score

CDMRP# GW140140



Guan et al., *Brain Sciences* 2020

Abou-Donia et al., *Brain Sciences* 2020; 2021

BBRAIN

Boston Biorepository, Recruitment and Innovative Network

CDMRP #GW170055

Boston Biorepository, Recruitment and Integrative Network (BBRAIN) for GWI

- Building Scientific Collaborations in GWI Research Community
- Due to the highly successful GWIC research collaborations, the next step was to increase this highly valuable resource by replenishing GWIC samples and by increasing the diagnostic and treatment capability by including investigators from 8 additional study sites in addition to the current GWIC sites
- BBRAIN includes investigators from 10 study sites around the country so far..
- Additional researchers are applying for funds to share more samples with BBRAIN in the coming years

BOSTON UNIVERSITY

NOVA SOUTHEASTERN UNIVERSITY

Drexel

CDC

CENTERS FOR DISEASE CONTROL AND PREVENTION

U.S. Department of Veterans Affairs

BBRAIN

Boston Biorepository, Recruitment and Integrated Network for GWI

BBRAIN: a repository for GWI investigators

Veterans of the 1991 Gulf War continue to experience chronic symptoms including fatigue, memory and concentration problems, muscle and joint pain, headaches and gastrointestinal problems known as Gulf War Illness (GWI). Preliminary evidence shows that GWI is related to immune dysfunction, neuroinflammation, cognitive decrements, CNS autoantibodies, lipidomics/ proteomics, axonal transport/ microtubule stability, mitochondrial function and oxidative stress, gut microbiome and genetic/genomic/epigenetic susceptibility.

BBRAIN is designed to act as a retrospective and prospective biorepository for GWI through a collaboration of investigators at our resource sites (Boston University School of Public Health, the Bronx VA, the San Francisco VA, and the Miami VA). We are collecting blood, plasma, serum, saliva, stool, and urine samples from 500 Gulf War veterans as well as demographic surveys and cognitive test data. We will combine demographic, health, and exposure data with cognitive test outcomes and brain imaging data (MRI, DTI, fMRI, PET imaging) from 10 collaborating institutions into a centralized catalog available for data mining and sharing. We will also be including de-identified previously collected survey, clinical, and preclinical data compiled from the 10 participating GWI investigators to be made available to the BBRAIN repository.

BBRAIN Inventory

Biological Samples

- Whole blood
- Stem cells
- CSF
- Saliva
- DNA
- Plasma
- Serum
- Fecal samples
- Urine
- PBMC
- Buffy coat

Clinical Data

- Fitbit measures (heart rate, sleep, exercise)
- Cognitive tests (executive functioning; attention, vigilance, and tracking; motor function; visuospatial function; memory; motivation; mood; general intellectual abilities)
- Brain imaging (PET, MRI, DTI, fMRI)

Data Sharing

Requests to access data in our repository can be made through our website:
sites.bu.edu/bbrain

Contact Us

Principal Investigator:
Kimberly Sullivan, PhD
tty@bu.edu
617-358-2598

https://wwwapp.bumc.bu.edu/BEDAC_BBrainRetro

BBRAIN
Boston Biorepository, Recruitment and Innovative Network

CDMRP # GW170055

Future Directions

GULF WAR ILLNESS CLINICAL TRIALS & INTERVENTIONS CENTER

CDMRP # GW170044

- Validate blood and brain imaging diagnostic Biomarkers of GWI
- Identify objective biomarkers of GWI with tau proteins, glutamate and cytokine markers
- Focus on these markers for current and planned targeted treatment trials including:
  - HDAC6 inhibitors, tubacin, Phosphatidylserine
  - Low glutamate diet
  - Metformin
  - Bacopa
  - N-acetyl cysteine (NAC)

Peter W. Baas, PhD

Professor, Department of Neurobiology and Anatomy
&
Director, Graduate Program in Neuroscience
Drexel University College of Medicine

Senior Editor, *Cytoskeleton*

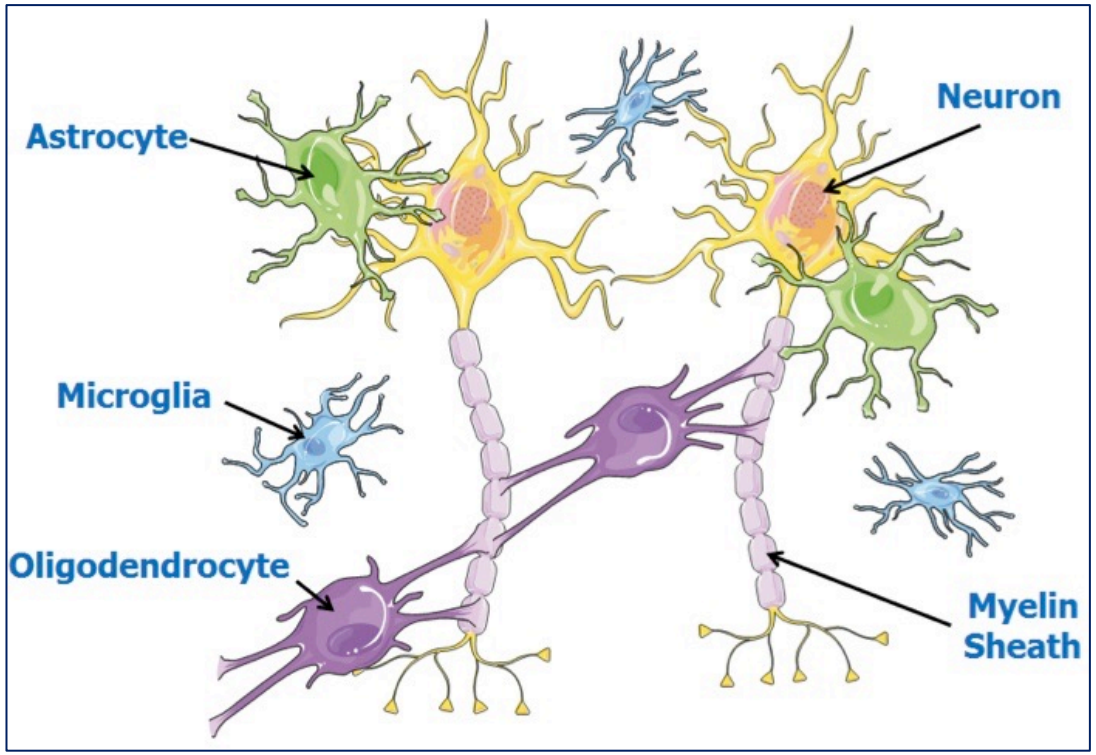
A Cellular Approach to Understanding and Treating Gulf War Illness

Peter W. Baas
Drexel University
(with many collaborations, including Liang Qiang and Kim Sullivan)

Central Nervous System symptoms
- Headaches
- Memory problems
- Fatigue
- Sleep problems

Early work
- Veteran questionnaires
- Rodent models

Our approach
- **Underlying cellular mechanisms**

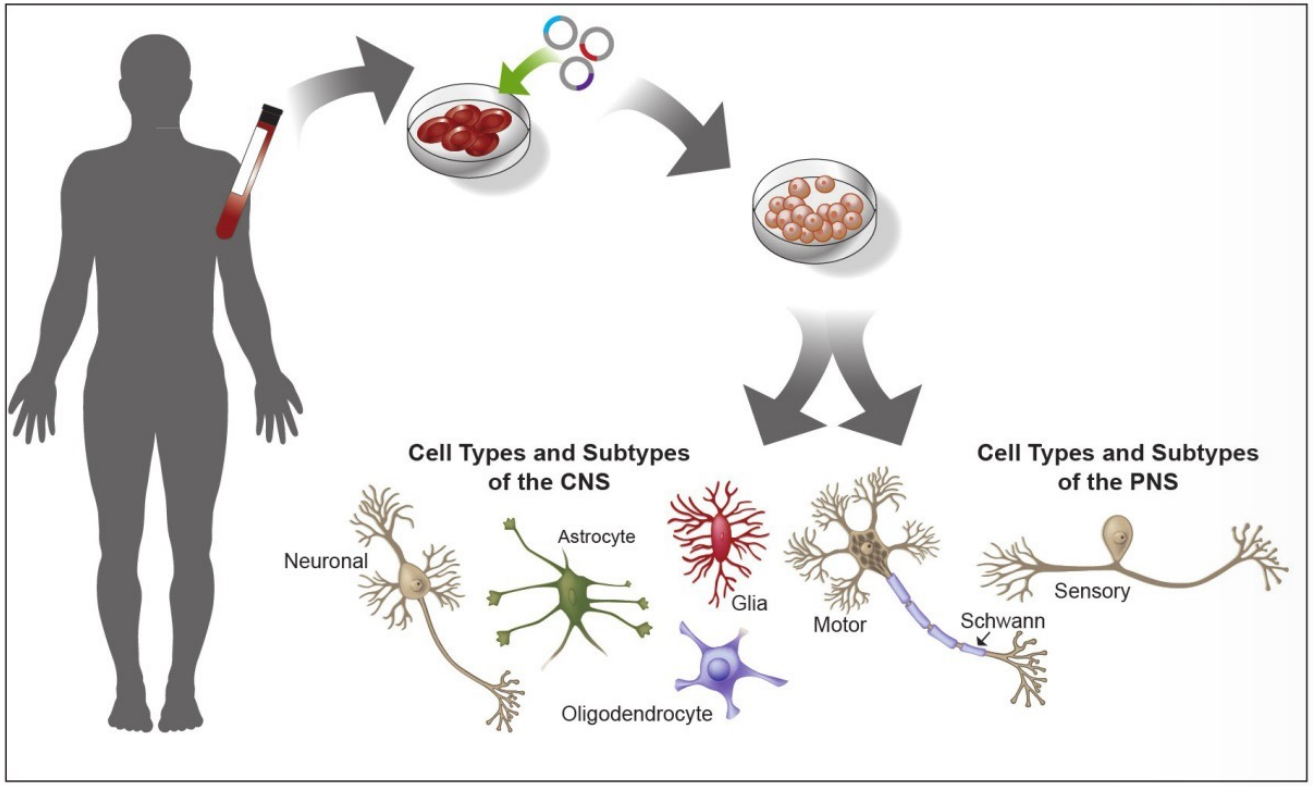


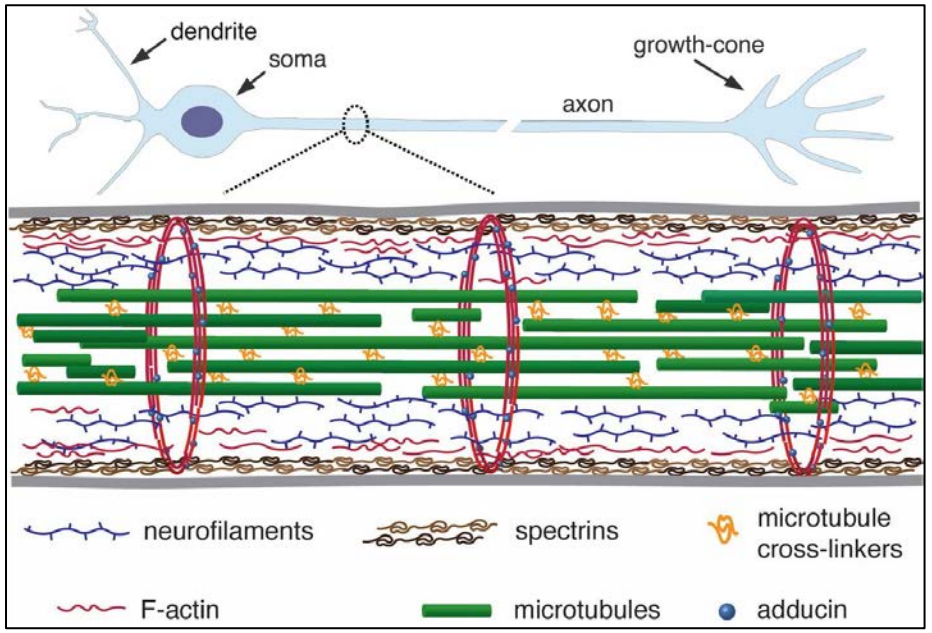
Many cell types make up the brain. How do we study them?

- Neurons transmit and receive information
- Immune Cells
- Other glial support cells, such as myelin-making cells
- **Any of these or all of these could contribute to GWI**

Human Induced Pluripotent Stem Cell Technology

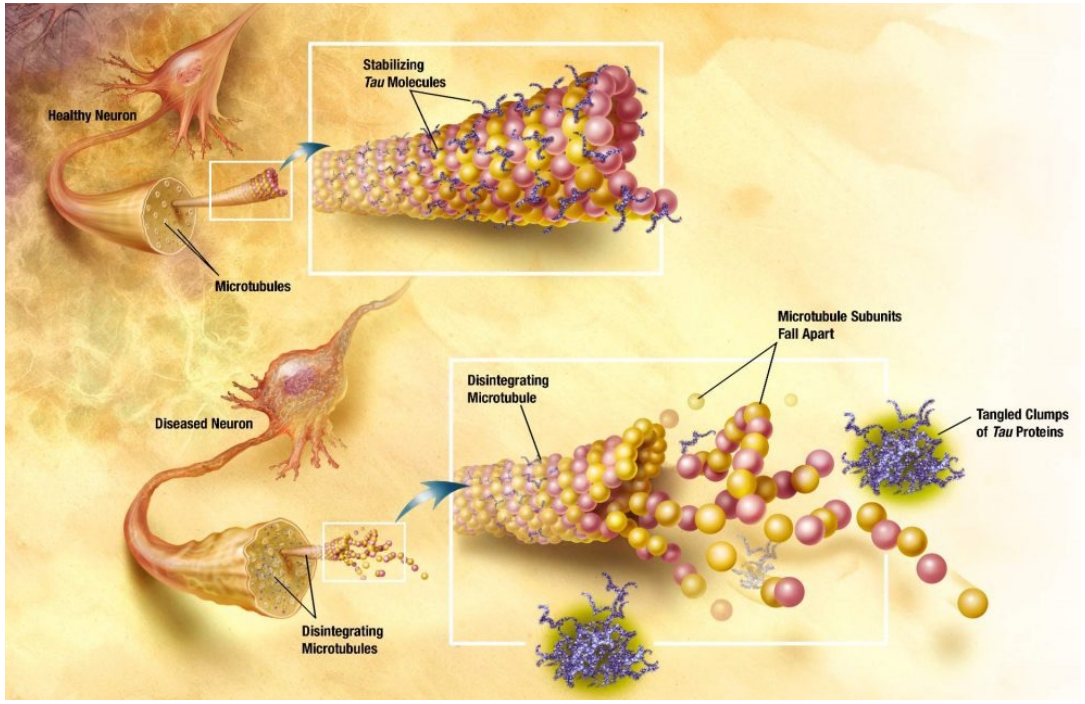
- From skin or blood of adult, stem cells are made in the lab. **We made them from blood cells of GWI veterans.**
- They can be differentiated in virtually any cell type of the body.
- They can be used to learn general principles but also “personalized” information from the individual donor.





My approach: To treat GWI, we need to understand what's going wrong inside the cells

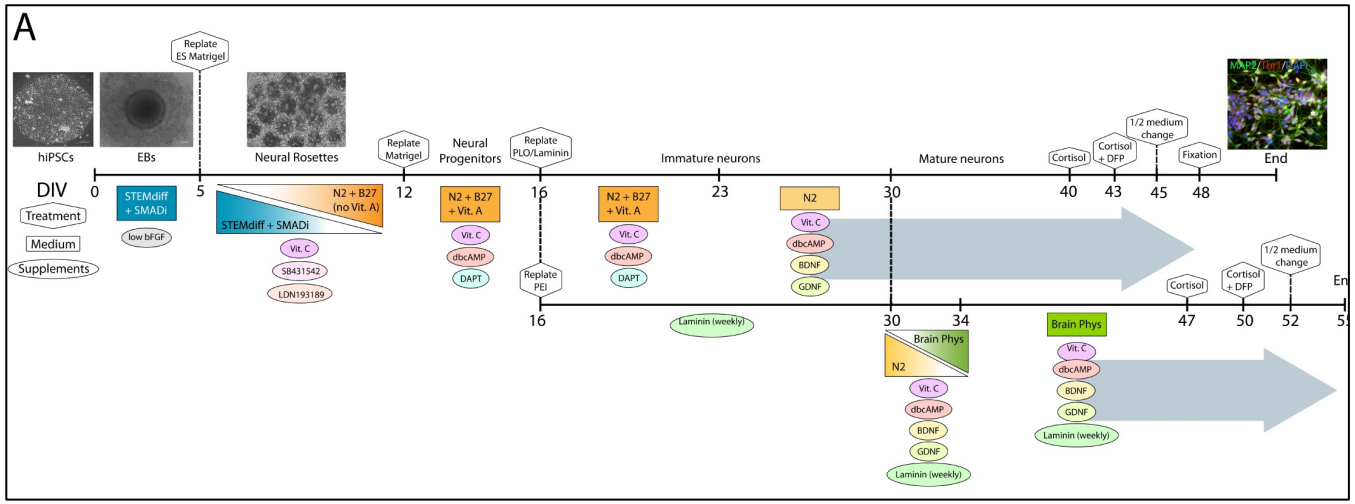
I mainly study **microtubules**, which are the principal structural elements and highways in all of the cell types of the brain but especially important for the long projections that connect neurons into network.

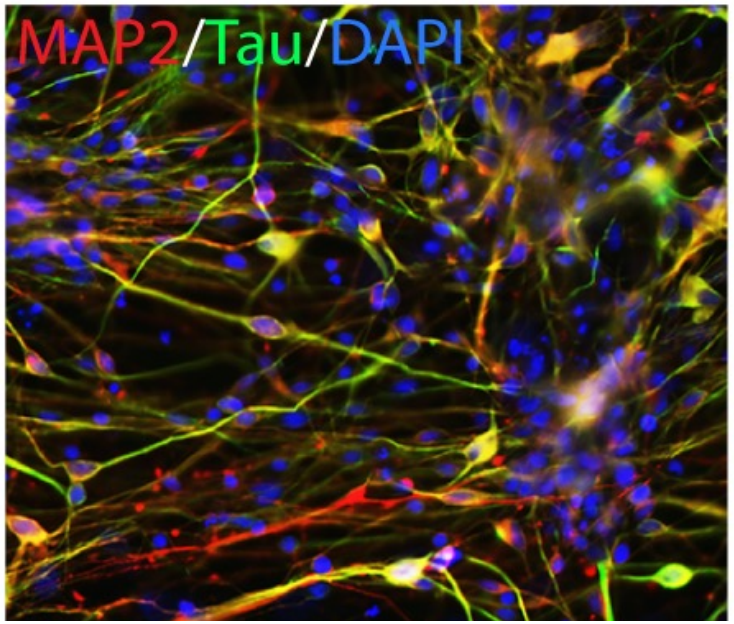


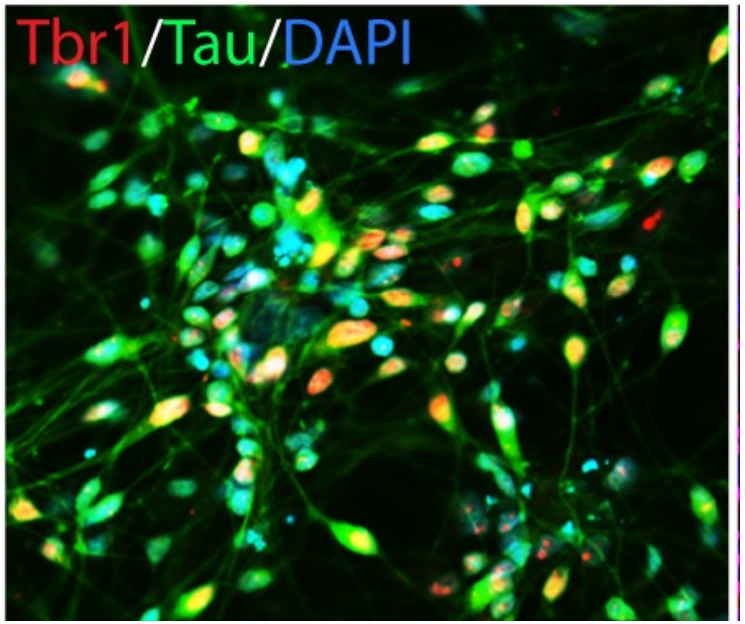
Many proteins associate with microtubules that could go awry in diseases but chief among them is **tau**, which goes awry in Alzheimer's disease and many neurodegenerative diseases

Might microtubule defects and especially tau defects be at the heart of the central nervous system symptoms of GWI?

If so, can we fix the detects with available knowledge, tools, medicines and FDA-approved compounds?



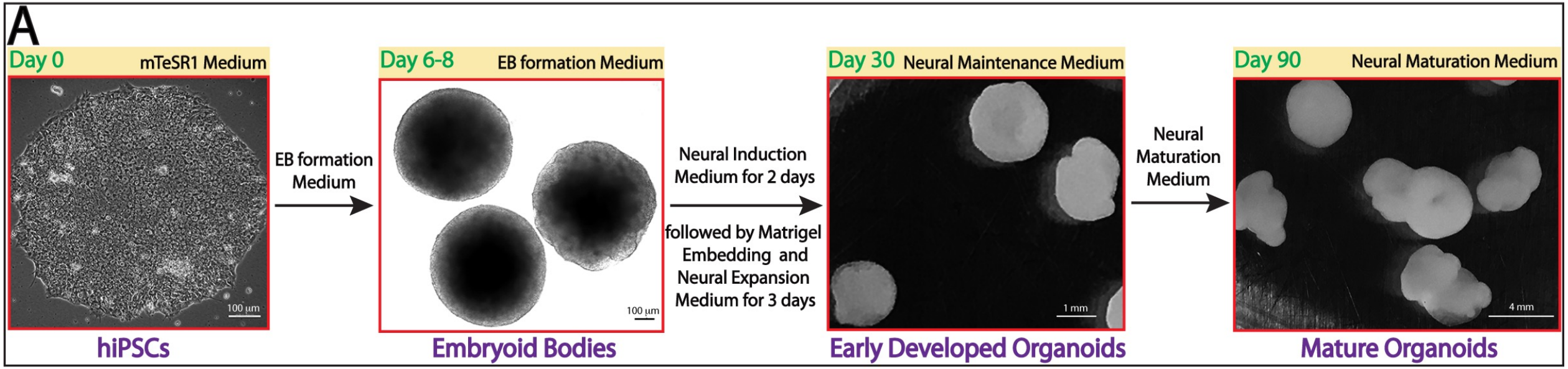


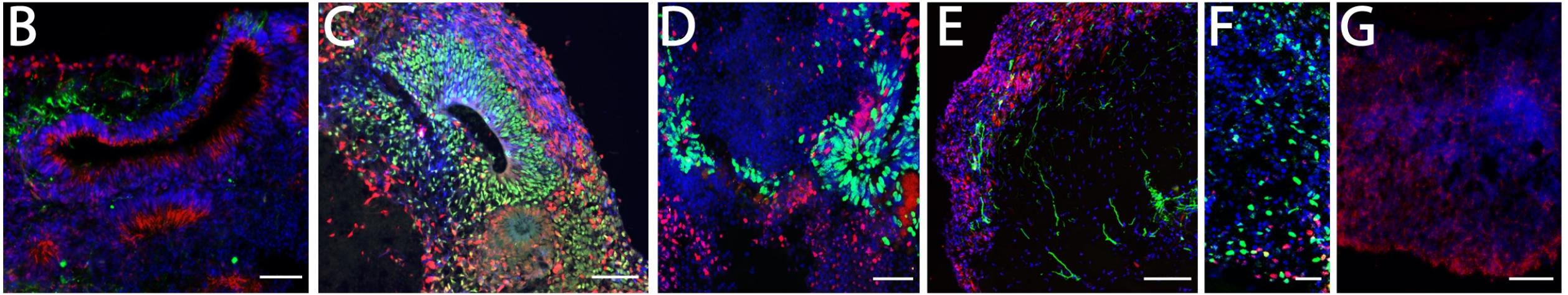


What did we find?

- Microtubules are less acetylated
- Tau levels are higher
- Phosphorylation of tau is higher
- Greater indications of neuroinflammation
- Many other aspects of the neurons such as changes in their signal transduction rates and dopamine release that might explain the GWI symptoms
- Most of what we saw is worse in cells coming from Veterans with GWI compared to Veterans without GWI, suggesting potential predisposition of some soldiers for the disease.

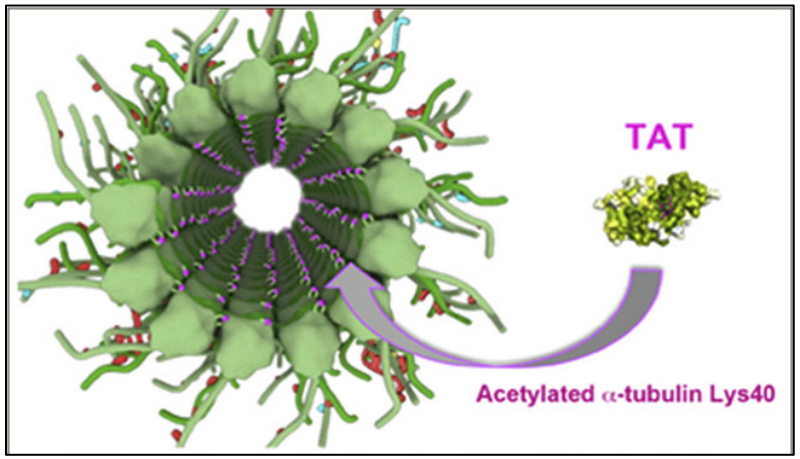
Newest Development - Now, we can make human “mini-brain organoids” from these cells

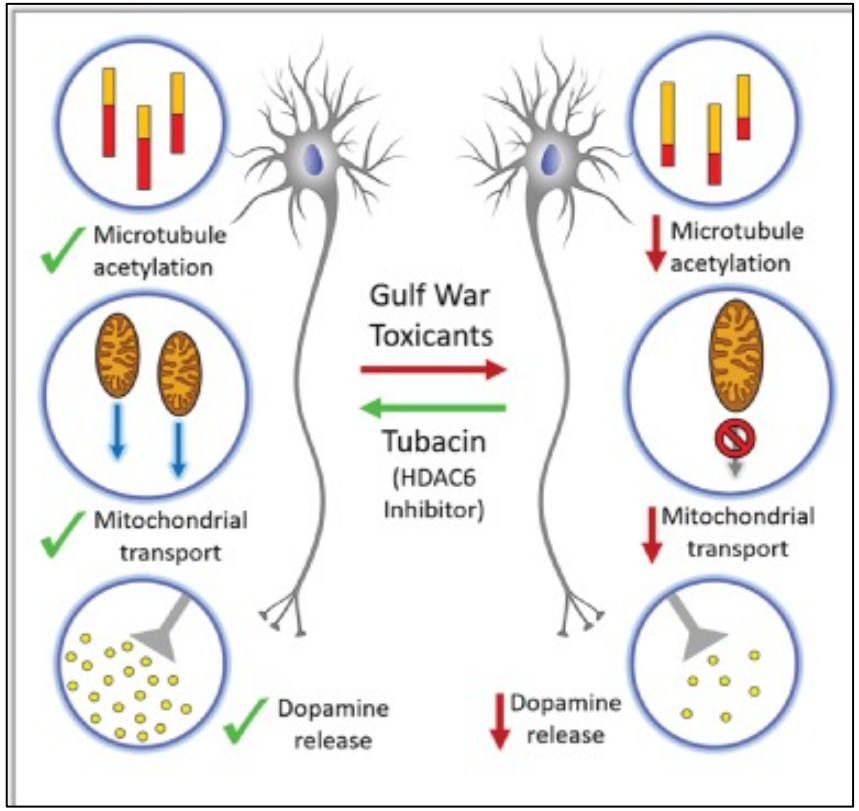




Treatments for GWI are imminent

- Tubacin/Tubastatin
- Phosphatidylserine





Focus on FDA-approved drugs and food additives that
can be rushed to the veterans, such as blending phosphatylserine or tau antisense with:

- CoQ10
- Curcumin
- Resveratrol

Tau

- Blood levels are a biomarker for GWI
- Treatments may involve antisense oligonucleotides to bring down excess tau levels

Studies and treatments all based on **cellular mechanisms**

Nancy Klimas, MD

Director, Institute for Neuro-Immune Medicine (INIM), Dr. Kiran C. Patel College of Osteopathic Medicine;
Professor and *Chair*, Department of Clinical Immunology; &
Assistant Dean for Research
Nova Southeastern University

Professor Emeritus, University of Miami School of Medicine

Director, Environmental Medicine Research & Clinical Program, Miami VA Medical Center

Director, Gulf War Illness Clinical Trials & Interventions Consortium (GWICTIC)

Nancy Klimas, MD

Director, Institute for Neuro Immune Medicine
Nova Southeastern University
and the Miami VAMC

CDMRP Program getting results – a strategy to move basic science through to effective treatment
Gulf War Illness Consortia (GWICs)
Gulf War Illness Clinical Trials and Interventions Consortium (GWICTIC)

NSU Florida
Dr. Kiran C. Patel College of Osteopathic Medicine
NOVA SOUTHEASTERN UNIVERSITY

INIM
Institute for Neuro-Immune Medicine

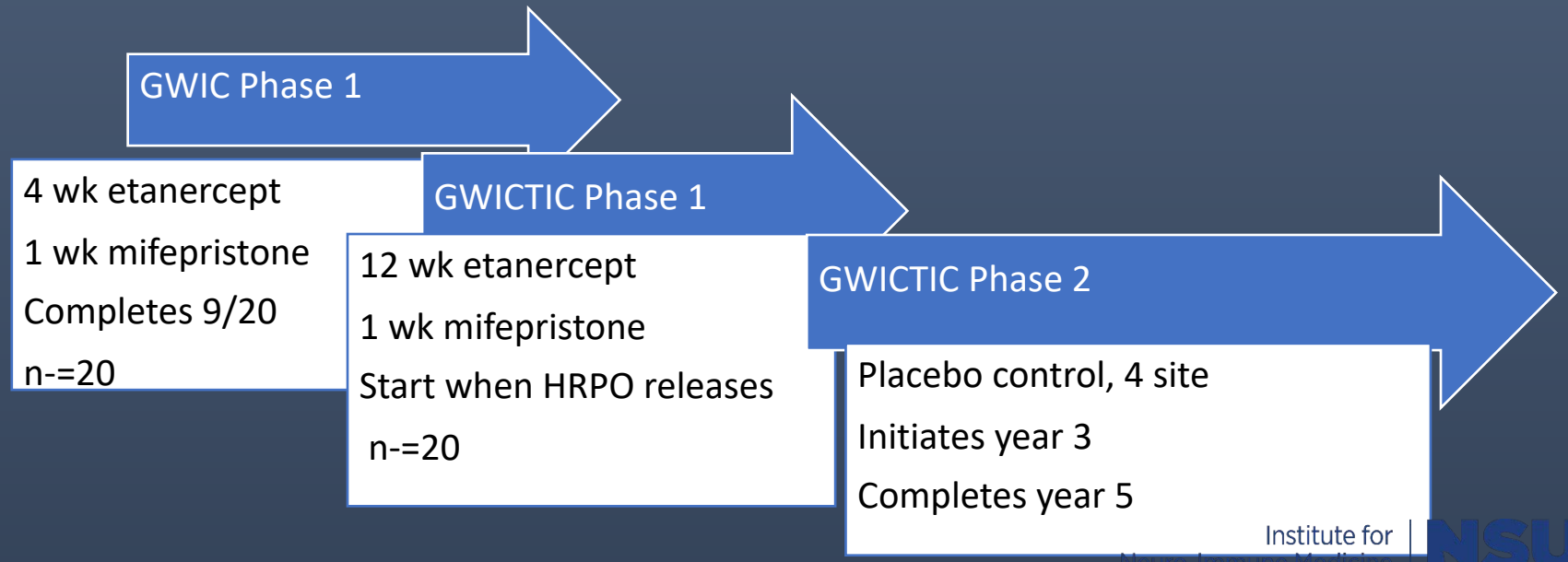
Key Findings: GWICS

- Neuro-inflammation
- Mitochondrial dysfunction
- Immune dysfunction
- Autonomic dysfunction
- Metabolic dysfunction
- Homeostatic regulatory imbalance

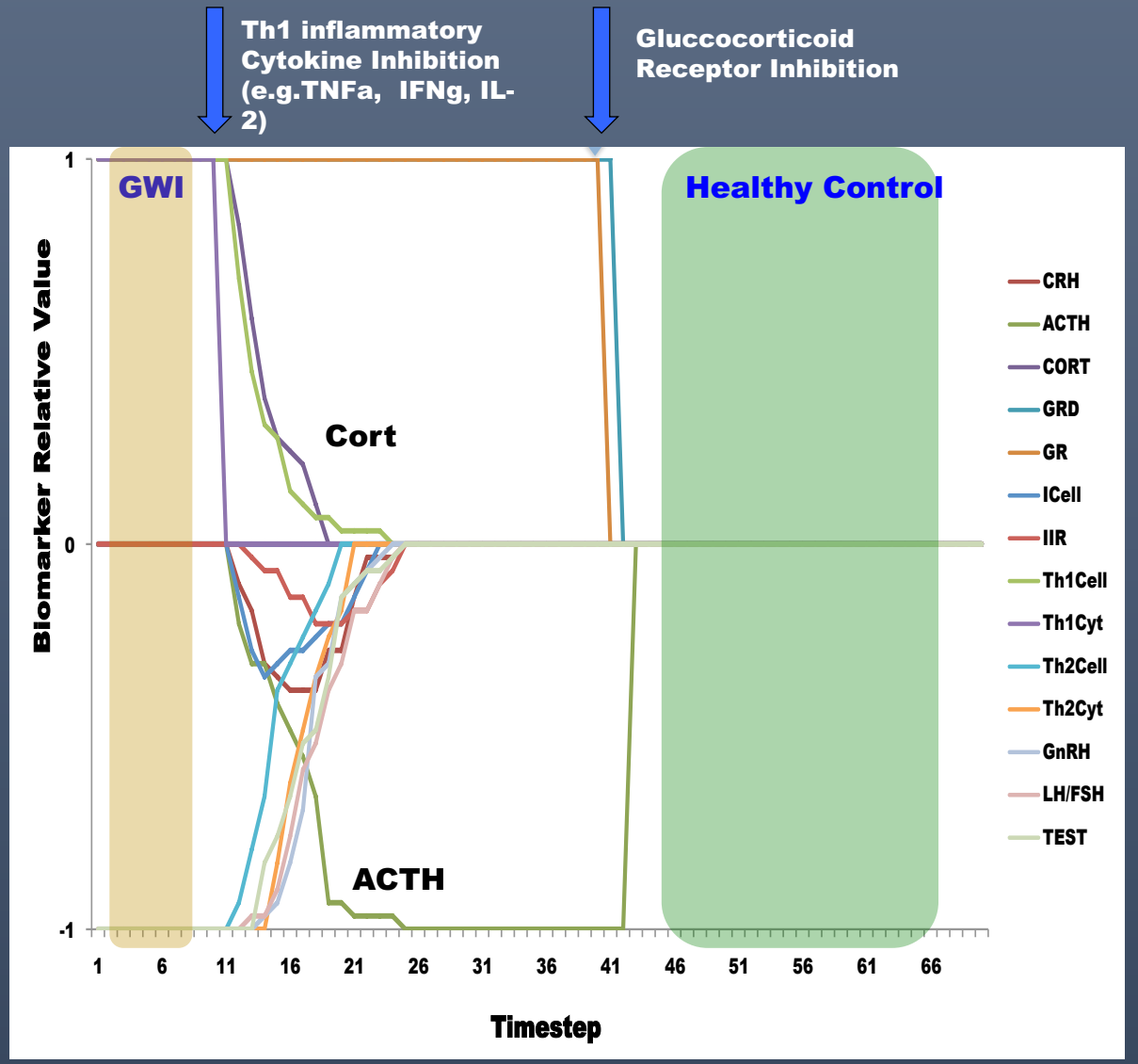
Phase 1 and 2 studies of the "reboot" strategy

In order to reduce the administrative time anticipated in a Phase 1 to Phase 2 design, we compressed the two protocols, and submitted them to the internal review panel, the IRB and to HRPO (initially for prereview, then for final review).

The design requires a Phase 1 Phase of etanercept/mifepristone that will be compared to a shorter duration of treatment Phase 1 study currently underway. The results are analyzed and the more effective strategy moves forward to the Phase 2 placebo controls study. This final design will be re-reviewed by the external review panel, IRB, and HRPO, but we anticipate a quick process, as a simple amendment.



BUILDING A GWI MODEL - CONTINUOUS LEARNING



Integrating basic science with clinical data… *one-two endocrine-immune punch*

GWICTIC Anticipated Outcomes

- Based on our proposed studies with combinations of synergistic approaches such as etanercept/mifepristone and antioxidants/intranasal insulin in GWI as well as single agents with multiple mechanisms of action such as bacopa
- This consortium sets to provide the infrastructure needed to backbone additional studies in collaboration with the GWICTIC investigators and other clinical investigators.
- The phase 1 bridge from preclinical to translational human studies as well as an efficient multicenter program that can move promising studies on from phase 1 to phase 2 and 3 trials will be provided to the broader research community
- Currently support 7 clinical trials, with 13 additional studies submitted last Thursday for review

CAPITOL HILL FORUM ON

GULF WAR ILLNESS

Beatrice Golomb, MD, PhD

Professor of Medicine, University of California, San Diego School of Medicine

Director, Golomb Research Group

Former *Scientific Director* and *Chief Scientist*, Research Advisory Committee on Gulf War Veterans' Illnesses (RAC-GWVI), U.S. Department of Veterans Affairs

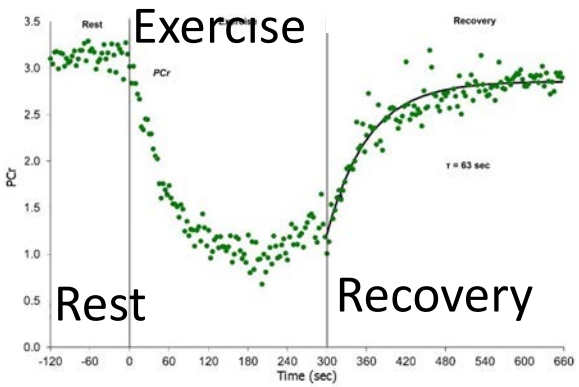
Author, RAND (for the Department of Defense), "*A Review of the Scientific Literature As It Pertains to Gulf War Illnesses Volume 2: Pyridostigmine Bromide,*" and co-author of, "*Vol. 8, Pesticides,*" and "*Vol. 1, Infectious Diseases*"

GWI-Specific Research Leads to Breakthroughs and Treatments.

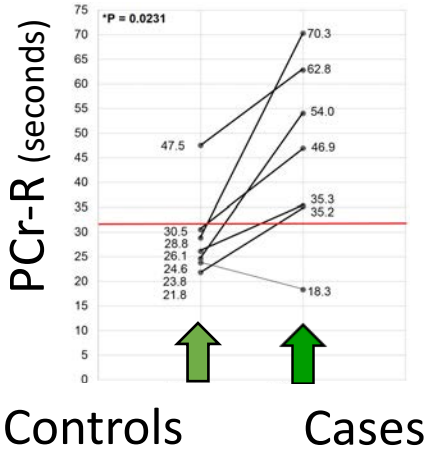
Beatrice Alexandra Golomb, MD, PhD

UC San Diego School of Medicine

August 23, 2021



First evidence of mitochondrial impairmen in GWI[1-2]



Phosphocreatine recovery time (n=30)

Control Mean (SD)	GWI Mean (SD)	P
30 (8.7)	47 (17)	**0.001**

Phosphocreatine (PCr) = backup energy source for muscle.
Levels fall with exercise. Slowed recovery = index of slowed ATP production (mito impairment).
PCr-R = recovery time constant. *Longer = worse.*

CDMRP GW120071

1. Koslik HJ…Golomb BA. Mitochondrial dysfunction in Gulf War illness revealed by 31phosphorus magnetic resonance spectroscopy: a case-control study. *PLoS ONE* 2014;9:e92887.
2. Fung A…Golomb BA. "Bioenergetics in Veterans with Gulf War Illness Versus Healthy Controls; Replication and Expansion." Gulf War Illness State of the Science Virtual Conference; 2020 August 19; Washington, D.C.

Muscle biopsy: Mito impairment. Basis for symptoms in GWI[1].

20/20 in predicted direction: p<0.0001 17/20 “borderline” significant: p<0.0001 11/20 frankly significant: p<0.0001

Ciciiox: Relation to GWI symptoms (UCSD GWI symptom survey). N=32

Symptom	Ciciiox	P	Symptom	Ciciiox	P
Difficulty Remembering	**-0.45**	**0.010**	Irritability	**-0.36**	**0.044**
Dry Skin	**-0.44**	**0.011**	Muscle Pain	**-0.35**	**0.052**
Post-Exertion Fatigue	**-0.43**	**0.014**	Joint Pain	**-0.34**	**0.059**
Anxiety	**-0.43**	**0.015**	Aches/Pains	**-0.33**	**0.069**
Concentration Problems	**-0.41**	**0.019**	Impatience	**-0.33**	**0.069**
Headache	**-0.40**	**0.024**	Need to Recheck	**-0.33**	**0.063**
Reading difficulty	**-0.39**	**0.029**	Ringing in Ears	**-0.31**	**0.079**
Low Energy	**-0.37**	**0.036**	Tiredness	-0.26	0.16
Muscle Weakness	**-0.37**	**0.038**	Sleep Problems	-0.13	0.48
x Word/Name Recall	**-0.37**	**0.038**	Cold Limbs	-0.03	0.86

Bolded correlation coefficients reflect a p-value of <0.1

CDMRP GW140045

1. Fung A…**Golomb BA**. “Bioenergetics in Veterans with Gulf War Illness Versus Healthy Controls: Replication and Expansion.” Gulf War Illness State of the Science Virtual Conference; 2020 August 19; Washington, D.C.

Mitochondrial genetics predict GWI severity[1].

Mitochondria have separate DNA inherited only from the mother.

Mito genetic feature	β* (SE)	P
Mito haplogroup U	45.4 (13.0)	**0.001**
Mito DNA mutations	49.5 (12.6)	**<0.001**

Adjusted for NAT2 g2863

*# points added if feature is present (200 point severity scale)

CDMRP GW130106

1. Bui L…Golomb BA. "Nuclear and Mitochondrial Genetics Together Determine Gulf War Illness Severity and Symptom Profile." Gulf War Illness 2020 State of the Science Virtual Conference 2020;8/18/2020

CoQ10 treatment targets mito function – improves GWI[1].

Participants: 46 with GWI.

Intervention: CoQ10 100 mg per day x 3.5 mos (vs placebo).

Led to:

Improved general health (men): p=0.04.

Improved symptoms: 19/20 direction favors CoQ10 ($p<0.0001$).

Many individual symptoms significantly better.

Improved function: >80% improved on CoQ10 (vs 40% on placebo): p=0.025.

Change in CoQ10 blood levels significantly predicted improvement.

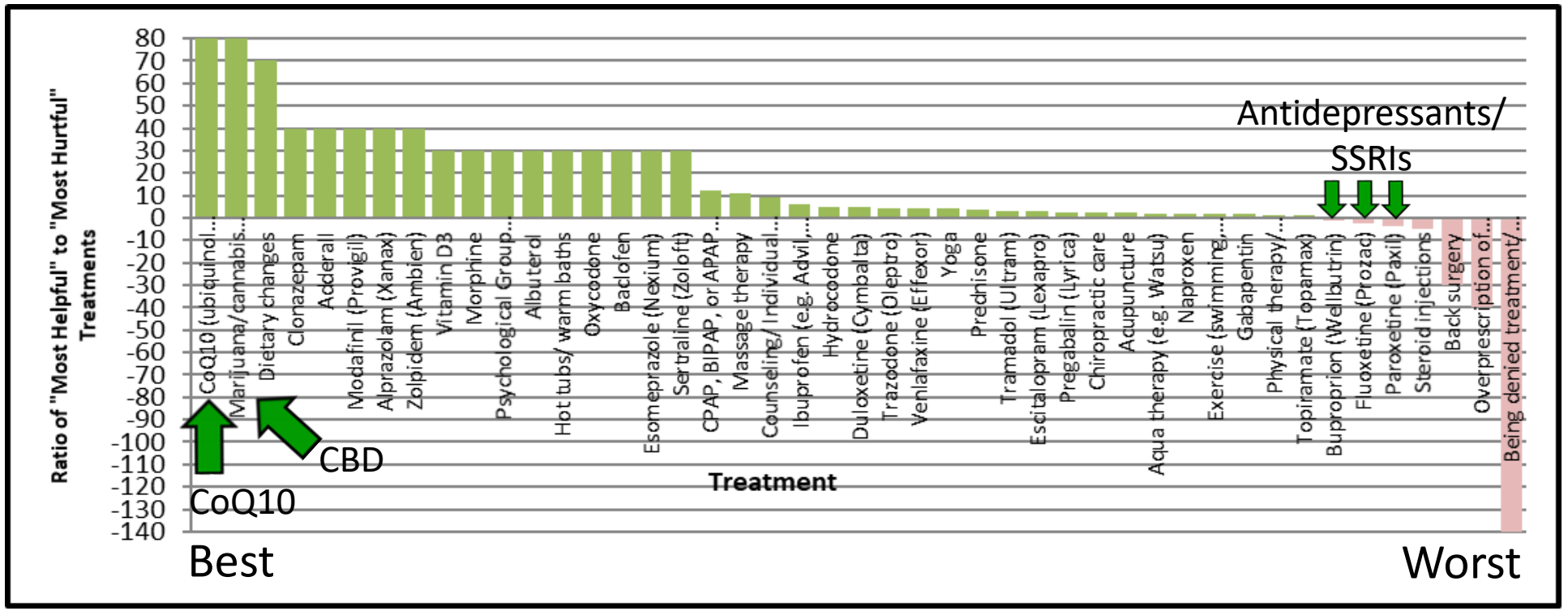
Mitochondrial cocktail trial now underway!

CDMRP GW060036

1. Golomb BA. Coenzyme Q10 benefits symptoms in Gulf War veterans: results of a randomized double-blind study. *Neural Comput* 26:2594-651

Harvest treatment experience of GWV to identify best treatments to test.

Number who cited treatment as the best of all treatments tried, divided by number who cited it as the worst.
Discounts benefits based on harms (n≈400).



Identifies promising new treatment for testing, that addresses multiple mechanisms relevant to GWI.

None of this is possible without GWIRP!

CDMRP GW110065

To Recap:

GWI-specific research leads to breakthroughs and treatments.

CAPITOL HILL FORUM ON

GULF WAR ILLNESS

Fiona Crawford, PhD

President & Chief Executive Officer, The Roskamp Institute

Research Career Scientist, James A. Haley Veterans' Hospital,
U.S. Department of Veterans Affairs

Chief Operating Officer, Archer Pharmaceuticals

Roskamp Institute
Gulf War Illness Research Program

Fiona Crawford, Ph.D.

President and CEO, Roskamp Institute

Sarasota, Florida

Capitol Briefing

August 2021

Institute Research

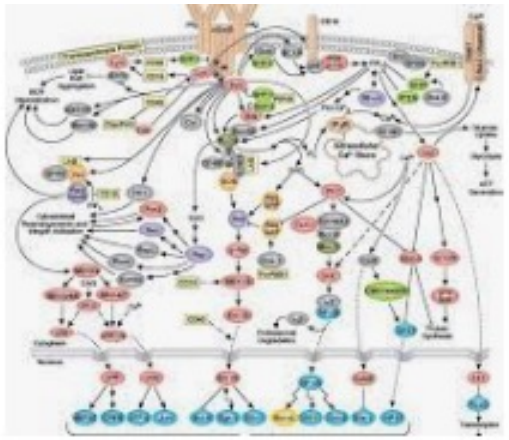
- Focus on neurological and neuropsychiatric disorders
  - Alzheimer's Disease - our AD research has provided us with a Roadmap for Clinical Translation
  - Gulf War Illness
  - Traumatic Brain Injury
  - Post-traumatic Stress Disorder
  - Red Tide Exposure (Harmful Algal Bloom)

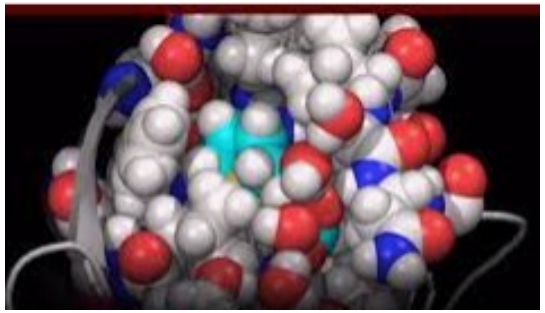
- Identification of novel treatments and diagnostics

Approach

Patient population

Development and characterization of in vitro and in vivo models





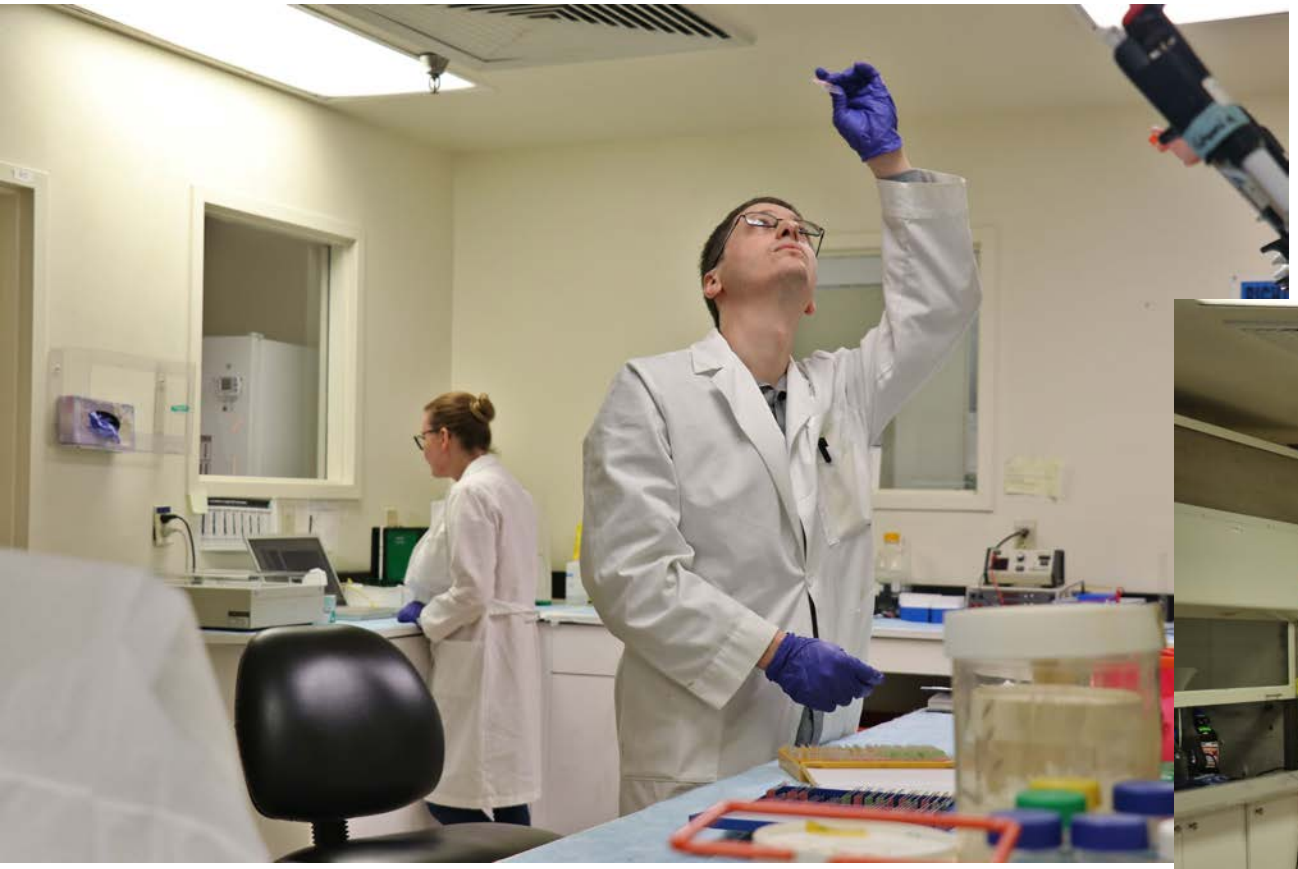
Identification of pathogenic mechanisms and molecular targets for drug development

Clinical trials of new, effective therapeutics

Pathology


Diffusion Tensor tractography reconstruction of the human brain
Control
Injured

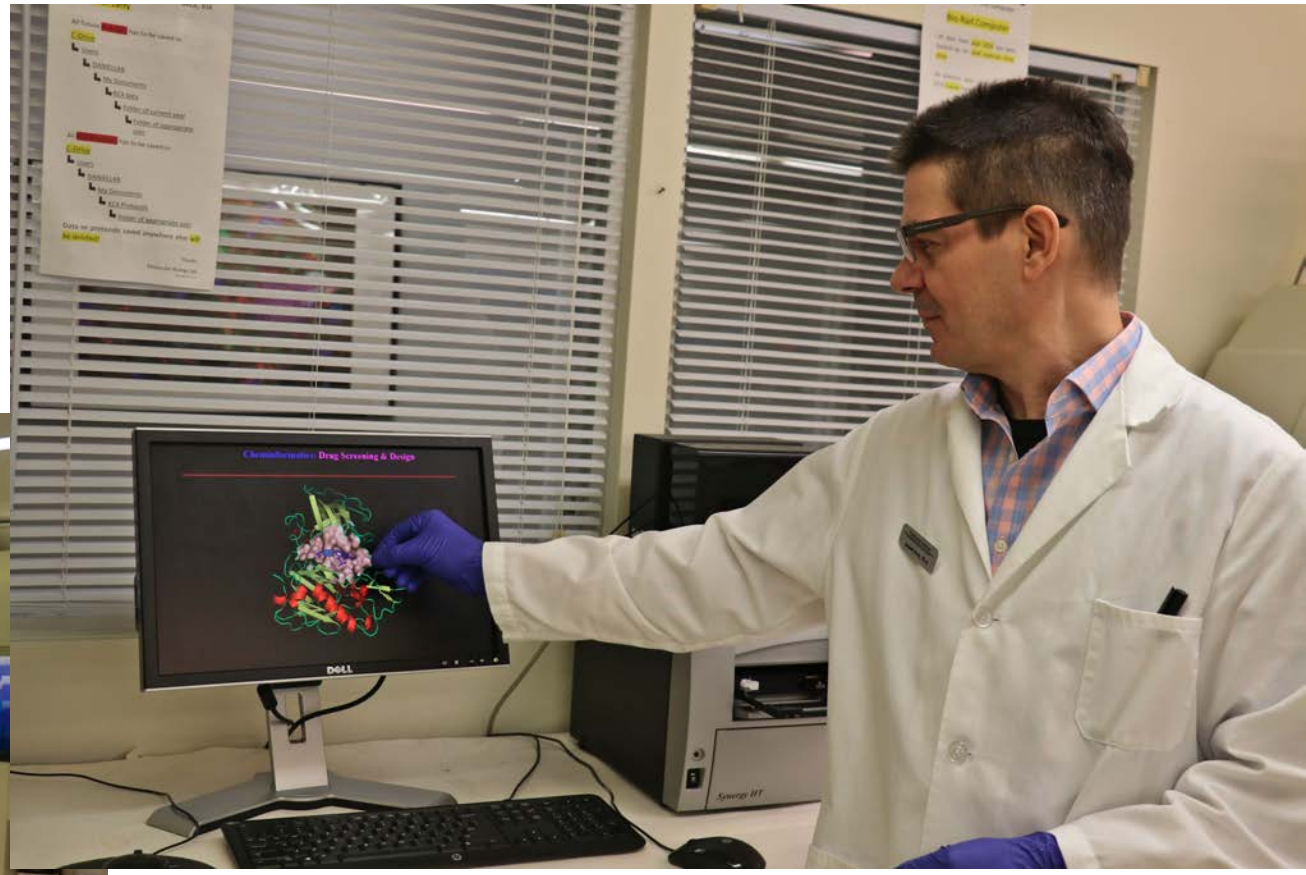
Genome/Microbiome



Cell and Molecular Biology

Mass Spectrometry – lipidomics, proteomics, metabolomics

Drug Discovery



Chemistry

Key Cellular Mechanisms in the Pathobiology of GWI

- Mechanisms
  - Lipid dysregulation
  - Mitochondrial dysfunction
  - Immune/inflammatory disturbances

- Biomarkers
  - Lipid profiles

New Treatments being tested in our Clinic

OEA (oleoylethanolamide)
targeting lipid dysregulation
Clinical Trial in GWI patients underway

NR (nicotinamide riboside)
targeting mitochondrial dysfunction
Clinical Trial starting later this year
collaboration between the Roskamp Clinic and Dr. Klimas

Closing Comments

Anthony Hardie
National Chair & Director
Veterans for Common Sense

GWIRP-Funded Gulf War Illness **Clinical Trial & Research Study Opportunities** from our Presenters:

Gulf War Illness Clinical Trials & Interventions Consortium (**GWICTIC**) (*Multiple U.S. sites*): www.nova.edu/nim/GWICTIC

Boston Biorepository, Recruitment & Integrated Network for GWI (**BBRAIN**) (*Boston & multiple U.S. sites*): https://sites.bu.edu/bbrain

Golomb Research Group (*San Diego & Nationwide*): www.golombresearchgroup.org/ParticipateInOurResearch

The **Roskamp Institute** (*Sarasota, FL*): www.RoskampInstitute.org

NSU Florida, Institute for Neuro-Immune Medicine (INIM) (*South Florida*): nova.edu/nim/research-studies/research-studies.html

CAPITOL HILL FORUM ON

GULF WAR ILLNESS

Q&A Opportunity *with the* Presenters

You may email additional questions for the presenters to: info@VeteransForCommonSense.org

CAPITOL HILL FORUM ON

GULF WAR ILLNESS

Today's recording will be available at:

- Veterans for Common Sense webpage &
- Institute for Neuro-Immune Medicine

Thank you to our distinguished speakers and co-hosts!

VETERANS for COMMON SENSE

VIETNAM VETERANS OF AMERICA

BLINDED VETERANS ASSOCIATION BVA 1945

BURNPITS360 VETERANS ORGANIZATION

CEASE FIRE Campaign

FLEET RESERVE ASSN LOYALTY PROTECTION SERVICE USN USMC USCG

MILITARY VETERANS ADVOCACY

THE QUINISM FOUNDATION

NVLSP

Reserve Organization of America

Sergeant Sullivan Circle

Veterans & MILITARY FAMILIES for Progress

Veterans Health Council veteranshealth.org

Veteran Warriors One Family, One Fight!

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