



## An Innovation in Neurosurgical Simulation

Ultrarealistic model designed with special-effects team allows more effective training in minimally invasive technique.

INTEREST IN MINIMALLY INVASIVE procedures has surged across nearly all fields of medicine due to their potential benefits, including less manipulation of delicate tissues, lower blood loss and risk of infection, and shorter recovery times for patients. However, says **Alan Cohen**, director of Johns Hopkins' Division of Pediatric Neurosurgery, there's no training method that truly mimics the circumstances in which these techniques take place.

"If you're the patient, you don't want the doctor to be operating on you as a test case, but the conventional ways to teach minimally invasive techniques are suboptimal," says Cohen, whose research lab focuses on developing new minimally invasive instruments and methods.

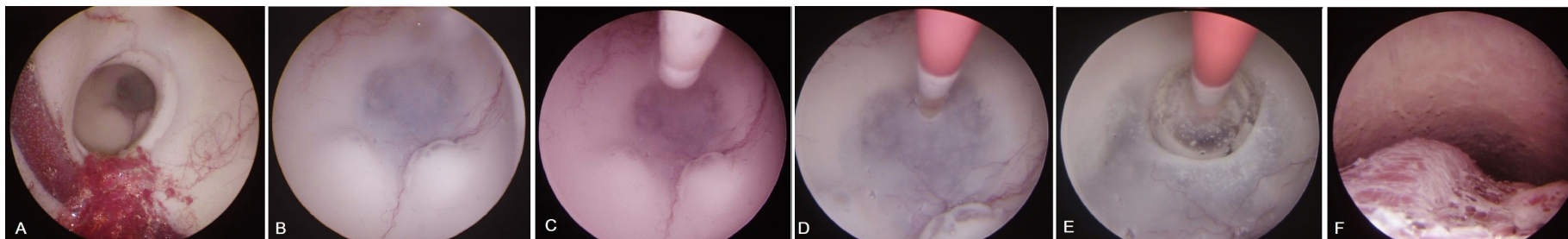
Cadavers, which typically play a large role in surgical training, aren't the best fit, he explains—not only are they scarce, expensive and not reusable, they also rarely simulate a patient's exact condition. Additionally, the brains of cadavers are stiff and don't

pulsate like living brains.

In work done at the Simulator Program at Boston Children's Hospital, Harvard Medical School, Cohen and his colleagues sought a better way to train by combining the expertise of a variety of fields: neurosurgery, simulation engineers, three-dimensional printing, and special effects from Hollywood. The result is an extremely realistic model that can be used repeatedly to simulate different conditions. The effort to create this model took place over years through a collaboration with a Hollywood-based team that focuses on special effects makeup and specialty costumes, often using 3D printing.

Leaning on Cohen's and his colleagues' expertise on the inner anatomy and using their own expertise on outer appearance, the team crafted a model of an approximately 14-year-old child's head with hydrocephalus resulting from aqueductal stenosis between the third and fourth ventricles. The model's brain and blood vessels pulsate and cerebrospinal fluid

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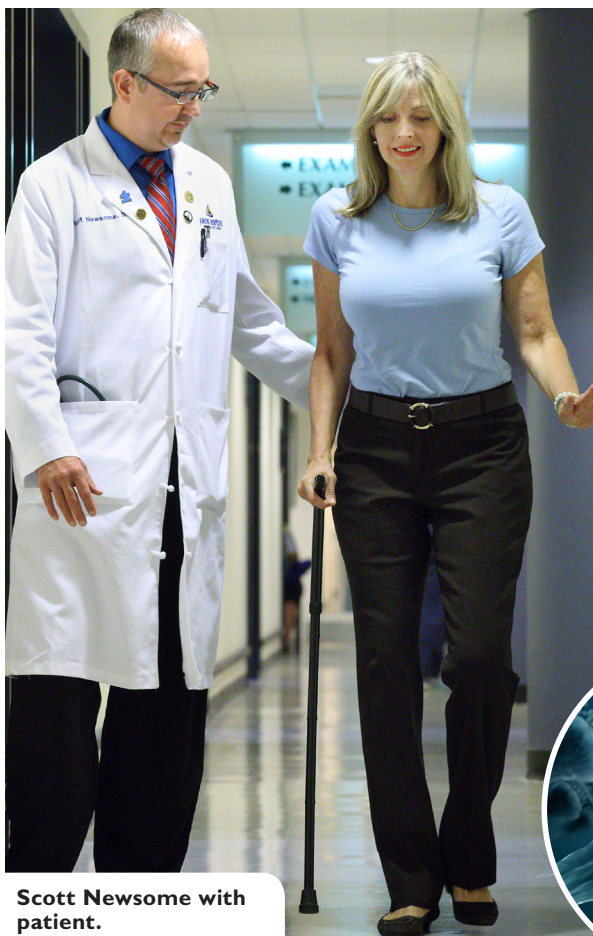


The new model simulates a child's head with hydrocephalus resulting from aqueductal stenosis between the third and fourth ventricles. The model's brain and blood vessels pulsate and cerebrospinal fluid circulates, as illustrated in the figures above.

RESEARCH

# New Center for Stiff Person Syndrome

**M**ANY PATIENTS START out with occasional “charley horses” in their legs or spasms in their backs. But eventually, these relatively mild symptoms progress to extreme rigidity and spasticity throughout their bodies, leading to gait and mobility issues that prompt dangerous falls. After multiple appointments with specialists, and often years after the onset of their initial symptoms, some of these patients end up in the office of Johns Hopkins neurologist **Scott Newsome** with a diagnosis of stiff person syndrome.



Scott Newsome with patient.

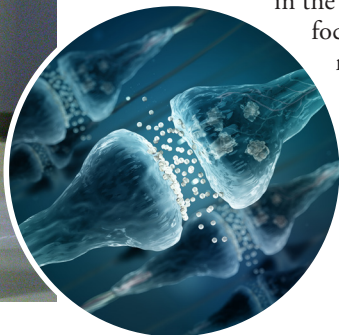
Stiff person syndrome is truly a “one in a million” disease, explains Newsome. Because of this extremely rare incidence, he adds, clinicians know little about the best ways to treat it.

That’s why he and his colleagues recently decided to launch a center for this disease within Johns Hopkins—which sees more patients with this disease than any other medical institution in the world—to both treat patients and to study them with the goal of developing better treatments in the future.

To reach the diagnosis of stiff person syndrome, Newsome and his colleagues run patients through a comprehensive battery of tests, both to look for distinct signs of this condition and to rule out other diseases that can present in a similar way. Besides a physical exam and history, the team often performs electromyography, MRI, lumbar puncture, a malignancy workup, and blood tests.

One telling result is a positive test for anti-GAD65 antibody, an antibody against an enzyme that helps process glutamate to the inhibitory neurotransmitter GABA. About 80 percent of patients diagnosed with “classic” stiff person syndrome have this autoantibody, thought to be a key factor in its pathogenesis. Many treatments for this disorder, such as GABAergic agonists or immune-modifying therapies such as intravenous immunoglobulin, are aimed at combating this possible cause. Other treatments, such as acupuncture, aqua therapy, and cognitive behavioral therapy, address chronic pain and other symptoms that can greatly reduce a patient’s quality of life.

Finding a way to shut off this autoimmune response is a fundamental goal for **Tory Johnson**, a researcher in the new center whose work is focused on autoimmune central nervous system diseases. Taking



A TELLING CLUE TOWARD DIAGNOSIS IS A POSITIVE TEST FOR ANTI-GAD65 ANTIBODY, AN ANTIBODY AGAINST AN ENZYME THAT HELPS PROCESS GLUTAMATE TO THE INHIBITORY NEUROTRANSMITTER GABA (REPRESENTED AT LEFT.)



Finding a way to shut off the autoimmune response in stiff person syndrome, among other autoimmune central nervous system diseases, is a fundamental goal for Tory Johnson.

advantage of the large cohort of stiff person syndrome patients seen at Johns Hopkins, she and her lab are currently working on a project to characterize the exact epitopes that each patient’s immune system recognizes and develop a methodology to turn off that harmful response, all while leaving the rest of the immune system intact. She and her lab also plan to search for other autoantibodies that could be responsible for this disease in the minority of patients who aren’t anti-GAD65 antibody positive.

Using this combined research and personalized medicine approach, Newsome says, is pivotal for achieving the best outcomes now and in the future for this disease. “This is the first and only stiff person syndrome center in the world,” he says. “At the end of the day, everything we do here will strive for improving lives for people with this condition.” ■

To refer a patient, call 410-614-1522

NEW FACULTY

## 9 New Faculty Members Join the Departments of Neurology and Neurosurgery

**T**he Departments of Neurology and Neurosurgery and have recently grown by nine new faculty members, expanding the volume, scope and expertise of these groups.

In July of 2017, **Justin Caplan** joined the faculty of the Department of Neurosurgery. Caplan specializes in the treatment of cerebrovascular disorders of the brain, head, neck and spine, such as aneurysms, arteriovenous malformations, arteriovenous fistulas, Moyamoya disease, carotid artery stenosis and stroke. He is fellowship trained in cerebrovascular neurosurgery and endovascular neurosurgery, allowing

him to offer patients the full spectrum of the latest surgical and endovascular techniques in treating these diseases. Caplan also focuses on treating acoustic neuromas and other tumors of the skull base, including meningiomas. Additionally, he offers minimally invasive treatments of Tarlov cysts.

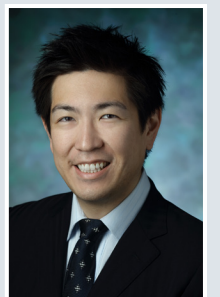
**Sheng-fu “Larry” Lo** joined the Neurosurgery faculty in October 2017. A neurosurgeon specializing in primary and metastatic tumors of the spinal column, sacral tumors, spinal cord tumors, disorders of spinal alignment and degenerative spine disease, he focuses his research on understanding the biology and clinical outcomes of spinal

tumors, and new surgical procedures and innovative technology to improve patient safety and spinal fusion. His research has received numerous awards including the Neurosurgery Chairman’s Award for Improving Patient Safety.

Six faculty members have joined the Department of Neurology, including pediatric epilepsy specialist **Christa Habela**, cerebrovascular specialist **Michelle Johansen**; pediatric stroke specialist **Lisa Sun**; new director of the Johns Hopkins Headache Center **Nauman Tariq**; neurology researcher **Leah Rubin**; neurology data researcher **Carlo Colantuoni**; and vascular specialist **Barney Stern**. ■



Justin Caplan



Larry Lo

## MULTIPLE SCLEROSIS

# A Deeper Understanding of MS and Vitamin D

**W**HEN JOHNS HOPKINS neurologist **Ellen Mowry** was beginning her fellowship in 2007, she already knew about the possible link between vitamin D and multiple sclerosis (MS). A study that came out around that time connected low vitamin D levels in U.S. military members with a higher risk of MS. Those findings supported previous observations that MS prevalence is higher the farther populations live from the equator, where sunlight exposure is lower, resulting in lower vitamin levels.

Today, she and her colleagues at the Johns Hopkins Multiple Sclerosis Center have strengthened the understanding of the relationship between vitamin D and MS and use these findings to improve patient care.

In a recent talk at the Americas Committee for Treatment and Research in Multiple Sclerosis 2017 meeting, she presented an overview of research in this area led by herself and colleagues at other institutions. These include work that Mowry and her team published in 2010 showing that children with pediatric-onset MS

who had low blood concentrations of vitamin D levels are more likely to experience relapses than those with higher levels of this vitamin. Later research showed that low circulating vitamin D is associated with more areas of demyelination revealed by MRI.

She also collaborated with MS Center Director Peter Calabresi on a study he led to understand how differences in vitamin D supplementation dose might affect patients' immune regulation. The findings of that 2015 study show that patients on a higher dose of vitamin D experienced beneficial immunomodulatory effects, which could in turn lead to better outcomes for this autoimmune disease.

She's currently leading the VIDAMS (Vitamin D to Ameliorate MS) trial, a multicenter effort to understand how vitamin D supplementation, along with a standard MS drug, might affect MS progression.

Says Mowry, "By developing a better understanding of how vitamin D is important in this disease process, it could lead us to identify new targets that could offer a whole new way of treating this disease." ■

To refer a patient, call 410-614-1522



"BY DEVELOPING A BETTER UNDERSTANDING OF HOW VITAMIN D IS IMPORTANT IN THIS DISEASE PROCESS, IT COULD LEAD US TO IDENTIFY NEW TARGETS THAT COULD OFFER A WHOLE NEW WAY OF TREATING THIS DISEASE."

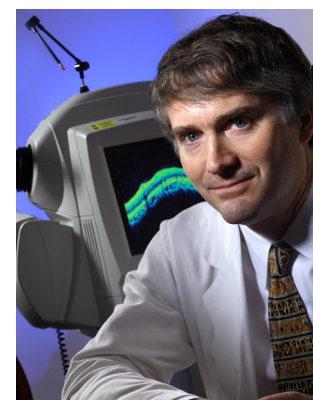
—ELLEN MOWRY

## Precision Medicine Center of Excellence in MS

Providing the best care means not only helping current patients, says **Peter Calabresi**, director of the Johns Hopkins Multiple Sclerosis Center, but future ones as well. That's why he and Ellen Mowry recently launched the Precision Medicine Center of Excellence in MS, an effort that not only aims to tailor MS treatments to a patient's specific presentation of the disease, but also to collect data from patient volunteers to help improve disease understanding—a step that could eventually lead to better treatments.

The Precision Medicine Center, which started in March of this year, has already collected a variety of information from patients, including blood samples that have yielded hundreds of different metabolites that could shed light on immune function, and stool samples that could help researchers understand the role of the microbiome in MS.

"We've come a long way with MS in the past couple of decades," Calabresi says. "This center will help us go even further."



Peter Calabresi

## An Innovation in Neurosurgical Simulation *(continued from page 1)*

“IN THE FUTURE, DOCTORS MIGHT CREATE MODELS FOR A VARIETY OF OTHER CONDITIONS WITH 3D-PRINTED PARTS THAT CAN BE SWAPPED OUT AFTER THEY’VE BEEN USED.”

—ALAN COHEN

circulates, just as they do in real patients.

A recent study, published in *Journal of Neurosurgery: Pediatrics*, showed that experienced surgeons watching blinded videos could distinguish between trainees and other well-trained surgeons performing an endoscopic third ventriculostomy to resolve this condition based on their handling of instruments, economy of movement, and other factors—an important proof of principle that the model achieves its goal of simulating real surgery.

Even the journal was fooled when Cohen and his colleagues submitted photos for publication. “They wrote back,” he says, “and said we’ve accepted the article but can’t print it without consent of the

patient.”

Cohen notes that, in the future, doctors might create models for a variety of other conditions with 3D-printed parts that can be swapped out after they’ve been used. They might also use a patient’s own MRI images to render models exactly like a patient’s own condition.

“It’s like a golfer or a batter taking a practice swing,” he says. “The more trainees and experienced surgeons can prepare, the safer and better these minimally invasive techniques will be.” ■

To learn more, call 410-955-7337



# NeuroLogic

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WINTER 2018



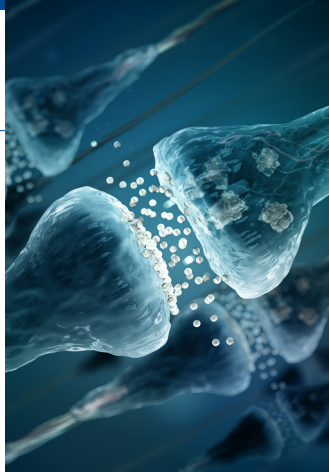
NEWS FROM THE JOHNS HOPKINS DEPARTMENTS OF NEUROLOGY AND NEUROSURGERY

Inside



1

An Innovation in  
Neurosurgical  
Simulation



2

New Center  
for Stiff  
Person  
Syndrome



3

A Deeper  
Understanding  
of MS and  
Vitamin D