Innovations in Neurosciences
2017
Innovations in Neurosciences

2017
Dear colleagues and friends,

As our state’s only academic health center, Oregon Health & Science University (OHSU) is devoted to health sciences education, research and outstanding medical care for patients from Oregon and beyond. We have learned that transforming the health of Oreganians often lights the way to improving health care everywhere.

OHSU is internationally recognized for its work in neuroscience, translational research and clinical studies, and provides the most comprehensive care for neurological conditions in our region.

Additionally, OHSU is an epicenter of education and training for the next generation of clinicians. Our innovative educational programs change how neuroscience physicians receive training across the United States. These programs are also implemented further afield in global health.

We are incredibly proud to occupy the top tier of discovery. OHSU’s neuroscience research vision is to stimulate bold discovery in the most critical facets of brain science and to accelerate the translation of these breakthroughs into new and better treatments.

We believe OHSU is a unique place for neurosciences because of our collaboration, creativity and patient-centered values. We are proud to share with you some annual highlights of the innovations that are transforming how we provide care to people affected by brain diseases.

Sincerely,

Dennis Bourdette, M.D., F.A.N.A., F.A.A.N.
Roy and Eulalia Swank Research Professor; chair, neurology

Nathan R. Selden, M.D., Ph.D., F.A.C.S., F.A.A.P.
Mario and Edith Campagna Professor; chair, neurological surgery
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Based in Portland, we have more than 1 million patient visits each year, operate the top-ranked adult and children’s hospitals in Oregon, and secure competitive research funding of nearly $400 million. As a public corporation serving the best interests of Oregon and the region, we also provide outreach that improves health in communities across the state and services to the most vulnerable Oregonians.

### Research

- **OHSU award dollars:** $410 million
- **NIH funding ranking:** 28th
- **Amount of funding focused on clinical trials:** $65 million

In 2016, OHSU disclosed 151 new innovations and filed 165 patent applications.


OHSU placed in the top 20 of the Nature Index 2017 Innovation ranking, which measures the quality and quantity of research by institutions and universities worldwide.

### Community service

OHSU has more than 200 community health care programs, reaching out to vulnerable groups in urban areas as well as underserved rural communities throughout the state, and in 2016 had a community benefit contribution of $378 million.

### Education

OHSU helps educate over 4,500 students and trainees each year.

### Facilities and employees

- **Employees:** 15,958
- **OHSU occupies more than 7.8 million square feet of space on approximately 350 acres.**
OHSU Brain Institute facts, figures and highlights

The OHSU Brain Institute is a national leader in neuroscience patient care, research and education. We utilize the power of world-class advanced imaging facilities to treat the most complicated medical and surgical problems of the human nervous system. Our teams leverage telemedicine to extend highly subspecialized neuroscience care programs to patients across our region and nation in a wide variety of areas.

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<td>221 neuroscience diagnoses</td>
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<td>40,286 patients for neuroscience in FY17</td>
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<td>10 telemedicine locations for neuroscience in FY17</td>
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<th>Neuroscience physicians and staff</th>
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<td>121 neuroscience clinicians in FY17</td>
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<td>135 residents, fellows and graduate students for neuroscience in FY17</td>
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<th>Research and funding</th>
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<tr>
<td>Over 300 neuroscience researchers</td>
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<td>9 research centers and institutes</td>
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<td>Over $70 million in current neuroscience research funding</td>
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<th>Neuroscience accolades, accreditations and recognitions</th>
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<td>Ranked as a top 50 hospital for neurology and neurosurgery by U.S. News &amp; World Report</td>
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<td>2016 Get With The Guidelines-Stroke — Gold Plus</td>
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<td>Center of Excellence, National Parkinson Foundation</td>
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<td>First Joint-Commission-Designated Comprehensive Stroke Center in the state of Oregon</td>
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<td>Level 4 Comprehensive Epilepsy Center</td>
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<td>One of 31 NIH Alzheimer’s Disease Centers in the country</td>
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▲ The OHSU Brain Institute leadership team: Marc Freeman, Ph.D., director, OHSU Vollum Institute; Dennis Bourdette, M.D., chair, neurology; Bita Moghaddam, Ph.D., chair, behavioral neuroscience; George Keepers, M.D., chair, psychiatry; Nathan R. Selden, M.D., Ph.D., chair, neurological surgery.

Sparking progress

Neuroscience is a large enterprise at OHSU, spanning 20 entities and involving more than 300 researchers. To enhance collaboration and communication across this large network, OHSU assembled a neuroscience leadership team in 2016.

Five distinguished faculty leaders (representing neurology, neurological surgery, psychiatry, behavioral neuroscience and molecular neuroscience) meet regularly to foster partnership and engagement across the neurosciences community at OHSU, collaborating scientific institutions and corporate partners. This leadership team sets scientific priorities while modeling a cross-disciplinary, collaborative spirit to spark progress. The team receives input from an advisory council of OHSU neuroscience faculty.
Battling brain tumors

The OHSU neuro-oncology and neurological surgery teams strive for inventive ways to attack brain tumors while preserving patient cognitive function and quality of life. OHSU brain tumor experts are leaders in advanced surgical techniques, innovators in clinical trials, and pioneers in sneaking chemotherapy treatments across the body’s blood-brain barrier. OHSU elevates brain tumor care by focusing on immune system therapy, unusual diagnostic agents, advanced brain mapping and state-of-the-art surgical technology.

Surgeon-led clinical trial explores immunotherapy delivery

Dual-trained in neuro-oncology and neurological surgery, Seunggu Jude Han, M.D., is focusing on innovative new approaches to one of medicine’s toughest diseases. Han is one of very few specialists nationally trained to surgically remove brain tumors and to design and carry out trials of chemotherapy and other brain tumor treatments. At OHSU, he serves as the surgical co-director of neuro-oncology clinical research at the Knight Cancer Institute.

Han recently helped design protocols for the multicenter Phase 2 Medicenna trial that will focus on combining cytokine immunotherapy and catheter-based delivery for recurrent glioblastoma treatment.

“Our goal is to evaluate if we can activate the immune system locally, based on successes in catheter-based chemotherapy,” Han said. “We can visualize the procedure in the intraoperative MRI suite to ensure we infuse the correct amount and only into the tumor. We can make an adjustment on the spot if needed. This approach capitalizes on advances in immunotherapy, bypassing systemic toxicity.”

OHSU is one of 10 trial centers nationally that is currently enrolling patients in this potentially breakthrough trial. Top-line results are anticipated in 2018.

STS chemoprotection is a game-changer for solid brain tumors

Cisplatin is very effective in treating tumors in children with solid brain tumors. However, patients often experience hearing loss as an outcome of platinum chemotherapy. Tracking

ORPHAN DRUG DESIGNATIONS

The following are examples of orphan drugs translated by the OHSU Blood-Brain Barrier team into neuro-oncology treatments:

Co-investigators Prakash Ambady, M.D., and Edward A. Neuwelt, M.D., are currently evaluating maintenance immunotherapy targeting B-cell lymphoma to block relapse and improve progression-free survival as part of a multicenter trial. Ambady designed two investigator-initiated clinical trials to evaluate the role of ferumoxytol steady-state imaging in differentiating pseudoprogression from true tumor progression in glioblastoma and in lung cancer brain metastases.

the outcomes of these patients, the hearing loss proved to have a negative impact on school and life success.

At OHSU, Edward A. Neuweit, M.D., director of the Blood Brain Barrier and Neuro-Oncology program in neurology showed that cisplatin plus sodium thiosulfate (STS) significantly reduces the incidence of cisplatin-induced hearing loss without reducing the effectiveness of chemotherapy for children with localized disease. In the clinical trials, patients had 50 percent less hearing loss with the addition of STS.

Disrupting the blood-brain barrier to enhance chemotherapy

Because of the protective nature of the blood-brain barrier (BBB), chemotherapy is often less effective for brain tumors and for cancer in other parts of the body. In many cases, an intravenous chemotherapy dose high enough to breach the BBB is toxic to the body.

Our team has shown that transiently opening the BBB with an intra-arterial infusion of high-concentration mannitol is a safe and effective way to increase delivery of chemotherapy to brain tumors. Patients with primary central nervous system lymphoma who receive enhanced chemotherapy delivery with BBB disruption show extended long-term survival with maintenance of cognitive function.

A novel diagnostic strategy with multiple applications for brain tumor

Even with the recent advancements in imaging, understanding brain tumors still requires some educated guesswork. Conventional MRI with gadolinium-based contrast agents (GBCA) allows visualization of most types of tumor tissue, but limited visualization of a tumor’s response to therapy.

At OHSU, brain tumor specialists use iron nanoparticles called ferumoxytol as a novel MRI contrast agent. Intravenous ferumoxytol crosses the blood-brain barrier and allows imaging of therapy-induced changes in tumor vasculature and blood flow, as well as improved detection of the inflammatory response to therapy.

There are not many programs able to bring new concepts from the laboratory to a phase 3 trial. The Blood-Brain Barrier Program at OHSU allows staff to cross roles. Our productivity demonstrates the importance of working across disciplines, which constructs a platform for researchers from different fields to collaborate. This multidisciplinary approach to brain tumors also allows us to embrace ideas and explore perspectives beyond the current standard of care.

Prakash Ambady, M.D.
Neurologist and Neuro-Oncologist

The BBB disruption technique has proven safe in multi-institutional clinical trials. To date, OHSU and eight other centers in the BBB Consortium have performed over 7,300 BBB disruption procedures in over 700 patients. OHSU remains one of the most active and leading BBB disruption and intra-arterial chemotherapy centers for brain tumors in the world.

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While few centers offer either functional brain mapping or advanced 3.0 Tesla intraoperative magnetic resonance imaging — OHSU stands out for having both.

PRAKASH AMBADY, M.D.
NEUROLOGIST AND NEURO-Oncologist
Transcending the education model

OHSU is shaping neurosurgical education through innovative resident boot camp courses and hands-on simulation experiences. The models, designed and developed at OHSU, are being promulgated nationwide.

Surgical crisis simulators in neurosurgery boot camps

With blood spurting and alarms sounding, a surgeon only has seconds to respond in a catastrophic simulation developed by OHSU to be as immersive and realistic as possible.

“Using simulators is relatively new in neurological surgery and very powerful for learning the skills needed to respond in a surgical emergency,” said Nathan R. Selden, M.D., Ph.D., OHSU’s chair of neurological surgery and the founding director of national boot camp courses designed to improve the safety and effectiveness of neurosurgical training in the United States.

These courses use relatively simple, inexpensive, model-based simulators to teach surgical residents.

“We recognized that it is possible to go through an entire residency without encountering certain catastrophic surgical crises,” Selden said. “These young surgeons need to diagnose problems, make complex decisions and perform technical tasks flawlessly — all at the same time — during periods of high stress. By creating this immersive environment to practice the technique under stress, we are making a whole generation of surgeons safer and more capable.”

Surgical simulation evaluates team communication

OHSU neurosurgeon Jeremy N. Ciporen, M.D., translates years spent around a baseball diamond into a team-based approach in the operating room. “A lot of errors in the operating room are not just technical, but in communication,” he said. Ciporen has designed a cadaver-based, high-fidelity surgical simulation model that demands both technical proficiency and team-based communication to successfully solve the problem: catastrophic bleeding from the carotid artery during skull base endoscopic surgery.

“It’s incredibly cost effective and the anatomy is real, which raises the visceral experience of the simulation,” Ciporen said. “Each resident pair performs three simulations. After each one, the attendings debrief their residents separately, then we come together to improve teamwork and communication before they enter the next session.”

In the Multidisciplinary Crisis Management of Cavernous Carotid Injury simulation, neurosurgery learners’ anatomic examination scores improved by more than 250 percent. With repeated simulations, the amount of time to control the carotid injury and the amount of blood lost decreased significantly.

Ciporen and Selden presented OHSU-designed neurosurgical simulation models to the American College of Surgeons’ annual simulation in medicine conference in 2017.

Hands-on course for functional neurosurgery attracts global participation

OHSU neurosurgeon Ahmed M.T. Raslan, M.D., recognized an opportunity to provide a focused, hands-on functional neurosurgery course to residents, led by experts in each area of the field. He also wanted to make access to all this expertise free of charge to the trainee.

Raslan organized the first Stereotactic and Functional Neurosurgery Course for residents and fellows in 2016. It quickly became a sensation. In 2017, 18 national and four international experts led the second course, encompassing the entire spectrum of stereotactic and functional neurosurgery. OHSU will host the 2018 course from April 4–6. OHSU offers this robust curriculum free each year to 25 senior residents and fellows in OHSU’s state-of-the-art simulation laboratory, VirtuOHSU.
VirtuOHSU Simulation and Surgical Training Center

OHSU’s innovative simulation laboratory supports a significant role in developing new education models for neurosurgery. The primary goal of VirtuOHSU is to provide a controlled setting for simulation of technical skills and invasive procedures. This highly versatile space supports open, laparoscopic, endoscopic and microscopic technical skills training using virtual reality, synthetic tissues, dry laboratory trainers, animal tissues or cadaveric tissues.

The 7,500-square-foot VirtuOHSU Simulation and Surgical Training Center hosts the following neuroscience courses each year:

- The Society of Neurological Surgeons Intern Boot Camp
- The OHSU Course in Functional Neurosurgery and Neuromodulation
- OHSU Resident Skull Base Course
- OHSU Resident Spinal Surgery Course
- OHSU Resident and Fellow Neuro Simulations Series

The brain surgery simulator developed at OHSU includes a brain, skull and dural membrane (produced using a 3-D printer) rigged to a bag containing mock blood. A computer program controls the simulation, displaying vital signs on patient monitors and recording the resident surgeon’s every move.

▲ Dr. Jeremy Ciporen in a simulation exercise.
Growth in global impact

North of Guam, Saipan is a tiny island in the Pacific Ocean. For the last decade, the only neurologist consistently serving the island has been Kim Nixon Hutchison, M.D. A general neurology and sleep medicine specialist, Hutchison lived in Saipan during 2007; she soon realized the deficit in neurology service and began a small clinic. When the year ended, she found a creative way to offer continuity of care for her Saipan patients.

Hutchison has maintained a unique, ongoing clinical practice on the island by reading EEGs and sleep studies and holding intermittent telemedicine clinics from Portland. In 2013, she began recruiting OHSU residents and faculty to accompany her on an annual visit to Saipan.

“Transpacific continuity of care supports island citizens.”

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“Transpacific continuity of care supports island citizens. It’s an experience that requires us to depend on our exam skills and critical analysis, because there is no imaging — no MRI and only a poor-quality CT scanner,” Hutchison said. “Many medical residents only experience tertiary care centers with unlimited resources. In Saipan, they see a medical system barely hanging on — much like most of the world’s health care.”

Her visiting team typically spends eight days on the island, serving about 150 patients with general and pediatric neurology needs, and providing grand rounds to local physicians to share education.

“We are providing a service that doesn’t exist on the island,” Hutchison said. “Without this option, patients have to fly to Guam or the Philippines for treatment at huge expense. I believe the biggest impact I will make in my career is through my work in Saipan, simply because they don’t have anyone else.”

OHSU’s neuroscience faculty are blazing trails between Oregon and points around the world, focusing on education, research and clinical initiatives that over time will improve human health globally.
Education at the root of preventing African plant dietary toxicity

In the war-torn, drought-starved southern and eastern provinces of the Democratic Republic of Congo, many people rely on cassava as a primary source of food. Cassava grows well in arid, poor soils, but when stressed by drought, harbors a hidden toxicity: linamarin, which breaks down into cyanide after ingestion of poorly processed cassava-derived foodstuffs. Cassava toxicity leads to an irreversible paralytic disease called konzo, named for a Congolese word meaning “tied legs.” Konzo occurs in many other parts of Africa, with an estimated 11,000 reported cases throughout the continent.

OHSU neurotoxologist Desiré Tshala-Katumbay, M.D., M.P.H., Ph.D., F.A.N.A., has been studying konzo for the last 20 years. His research team has found that the disease may also cause cognitive deficits in children. Tshala-Katumbay is working with the Congo National Institute of Biomedical Research to educate people about the cause of konzo and strategies to reduce exposure. Avoidance alone isn’t an option for many of these people who live in poverty and depend on this staple crop. However, food processing can make a difference: soaking cassava’s roots in water for several days and sun-drying reduces toxicity.

Tshala-Katumbay divides his time between laboratory research, field neuroepidemiology research and in-the-field education of Congolese citizens, physicians and scientists to address issues of public health. Global extensions of his research lines include studying the impact of climate variations on food crop (cassava) toxicity and the biological effects of cyanide, a highly lethal chemical warfare agent.

Partnering for capacity-building

Botswana is a developing country in Africa that lacks depth in neurology. In 2013, OHSU Internal Medicine pioneered a relationship with the Scottish Livingstone Hospital in Molepolole, Botswana. Starting this year, Marissa Kellogg, M.D., M.P.H., will accompany two OHSU neurology residents to the Botswana hospital, focusing on neurological cases and physician education. This will be the first of a semiannual, four-week rotation option for OHSU residents, creating an ongoing commitment to the institution.

In another example, OHSU is working with a sophisticated health system in Thailand affiliated with Mahidol University and Bangkok Hospital, the largest private hospital system in Southeast Asia. In this partnership, neurology faculty will exchange visits to learn from each other. Kellogg recently traveled to Bangkok to provide a needs assessment. She will return later this year, after OHSU hosts a delegation of neurologists from Bangkok.
“Working on these global partnerships is energizing and motivating,” Kellogg said. “It’s inspiring to learn from different medical systems, but it is also a pleasure to meet like-minded physicians from other cultures. Over time, we hope to have the opportunity for these research partnerships to advance the field.”

Pursuing neurotoxic influences around the world

In many developing countries, the local food can contain chemicals that lead to debilitating neurological diseases. Like the cassava-konzo connection in Africa, Peter S. Spencer, Ph.D., F.A.N.A., FRCPath, found links between grass pea seeds and lathyrism, a crippling brain disorder. Recently, he identified the hypoglycemic amino acids in lychee fruit as the root cause of acute seasonal encephalitis among impoverished children in Asia.

Spencer has spent his career tracking neurological mysteries in the field and in the laboratory. His research interest is molecular mechanisms underlying peripheral neuropathy and motor system disease, and the impact of unique environmental factors. He spent many years investigating Western Pacific ALS-PDC (amyotrophic lateral sclerosis and parkinsonism-dementia complex) and Lytico-Bodig disease in Guam.

Raising cultural awareness for immigrants and refugees

Ten years ago, Valerie S. Palmer had a creative idea for a student education elective: a wide-ranging, global health experience in Oregon. Palmer, a senior scientist in OHSU’s department of neurology, created a six-week program that matches OHSU student teams with refugees, recent immigrants and the homeless. Students become equipped to work with people from differing backgrounds, cultures and languages, encountering health concerns arising from war, displacement, internment, malnourishment and poverty.

As an immigrant from South Africa, Palmer recognized the challenges in translation for health care work. She developed the inter-professional Community Health and Education Exchange (ICHEE) at OHSU to provide cross-cultural education for students, while also helping thousands of medically underserved people in Oregon.

Prevention on novel approaches for the prevention and treatment of Alzheimer’s disease.
Expanding epilepsy options

OHSU hosts Oregon’s only Level 4 accredited epilepsy center, delivering comprehensive clinical care for all forms of epilepsy. By participating in pivotal clinical trials and adopting new diagnostic tools and leading-edge treatments, we are expanding our care for the full spectrum of epilepsy disorders.

Stereotactic surgical techniques are an increasingly important intervention for drug-resistant epilepsy. Within the past two years, OHSU has added two surgical procedures and one diagnostic method that create new options for certain patients. We are also pioneering greater exploration of the brain as we collect extensive neurological data through stereo-EEG and deep brain mapping that may lead to new therapies and expanded access for patients in multiple areas of neurological care.

Surgically implanted device to disrupt seizures

OHSU participated in the key clinical trials for the NeuroPace Responsive Neurostimulation System (RNS) device, which led to Food and Drug Administration approval in 2013. “We began offering minimally invasive RNS surgery in 2015 and now have 22 patients with the device implanted,” said David C. Spencer, M.D., director of the Comprehensive Epilepsy Center. “There are quite a few patients whose seizures are medication resistant. Many of these patients are not good traditional surgery candidates because their seizure focus is too close to functional areas of the brain, or they have more than one focus. With these cranially implanted devices, electrical stimulation can disrupt the seizure before the patient can feel it.”

The RNS device not only works to control seizures, it also collects valuable data. Spencer believes the devices have untapped potential to further research and clinical practice. “A team led by OHSU has already published one study based on RNS data related to circadian patterns of seizures,” he said. “We’ve been able to define how the focal location may connect to circadian rhythms. For example, patients with foci in the frontal lobe had seizures at night, while those with foci in the temporal lobe had events in the morning and late afternoon. We also pioneered an early multicenter research study of patients with more than one focus to determine the patterns of firing from each focus.”

Minimally invasive brain surgery reduces trauma and fear

Minimally invasive MR-guided laser thermal ablation may open surgery as an option for many epilepsy patients and providers anxious about more extensive operations. OHSU first offered minimally invasive laser ablation surgery for epilepsy in 2016. The new procedure requires only a single overnight stay and a tiny incision.

“We are able to inactivate abnormal tissue through a 2.5-millimeter hole using a fiber optic tube to deliver the laser energy very precisely,” said neurosurgeon Ahmed M.T. Raslan, M.D. “This minimally invasive surgical option represents a game-changer in epilepsy treatment.”

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Stereo-EEG provides significant data and better patient experience

In 2017, OHSU joined the handful of institutions offering stereoelectroencephalography (SEEG) for presurgical evaluation. We use SEEG when the patient’s seizure focus is potentially located in deep areas of the brain inaccessible to traditional subdural grid technology. We also use SEEG for some patients unable to tolerate a traditional craniotomy.

“With SEEG, we pass thin wires through tiny holes very precisely to place electrodes in multiple areas deeper in the brain than we’ve ever been able to do before,” Spencer said. “SEEG eliminates the need for before-and-after craniotomies and reduces risk and recovery periods.”

OHSU recently added cortiQ, a high-performance system for rapid functional mapping of the brain surface. CortiQ provides physicians with real-time results during presurgical evaluation for epilepsy and during intraoperative testing.

“Previously, it took many tedious hours to test patients, but this new device allows rapid collection of information to speed the process,” Spencer said.
The crucial role of neuroscience critical care

In 2006, OHSU opened a dedicated neurocritical care unit. Today, OHSU’s neurosciences ICU (NSICU) is the cornerstone of a cohesive program for treating critically ill patients with neurological diseases.

Our NSICU is a West Coast leader; it is a dedicated unit that has a 24/7 intensivist staffing model and thoroughly multidisciplinary approach. Additionally, we offer a neurohospitalist program that provides specialized neurological care for inpatients that do not require the ICU.

A team of dedicated specialists providing expert care 24 hours a day, seven days a week

Led by Ines Koerner, M.D., Ph.D., a neurointensivist and anesthesiologist, a team of eight M.D. faculty with backgrounds in neurology and anesthesiology critical care provides 24/7 coverage. The multidisciplinary team also includes:

- Physician assistants and nurse practitioners, one of whom is in the unit at all times.
- R.N.s trained in neuroscience and critical care — a nurse-led effort developed by OHSU’s nurses.
- Stroke Response Nurse Team, with dedicated R.N.s who respond to strokes throughout the hospital.
- Physical, occupational, respiratory, and speech therapists.
- A dedicated ICU pharmacist.

The most advanced technology for quick care delivery

The unit includes a portable CT scanner to minimize travel for critically ill patients. Video electroencephalography and multimodal monitoring are available for all patients, as well as intracranial pressure monitoring.

NSICU collaborations with interventional radiology

The NSICU is a valuable resource for managing one of the highest volumes of subarachnoid hemorrhage patients in the country, as well as patients with ischemic and hemorrhagic stroke. Also benefiting these patients, OHSU is a leading center for clinical trials of neuro-endovascular therapy. Interventional neuroradiologists in OHSU’s Charles T. Dotter Department of Interventional Radiology enroll more patients in clinical trials of the latest and most effective endovascular devices than almost any other U.S. center. In just one example, OHSU was the lead enroller in the country for the Analysis of Revascularization in Ischemic Stroke with EmboTrap trial (ARISEII).

“For me, collaboration is the essence of our culture in the NSICU. In the NSICU, I’m surrounded by outstanding individuals, but in this day of subspecialization, an outstanding individual can only get us so far. Our neurocritical care team is a good example of OHSU’s approach of empowering all groups involved.”

INES KOERNER, M.D., PH.D.

“Only a handful of institutions have helped pioneer this treatment, which has changed stroke therapy throughout the world,” said Hormoz Bozorgchami, M.D., a neurologist and neurointerventionalist. “Our multidisciplinary approach gives us a unique perspective to look at a wide breadth of cases, supported by the critical role of our NSICU.”

HORMOZ BOZORGHCHAMI, M.D.

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INES KOERNER, M.D., PH.D.

“Having a sophisticated NSICU and neurocritical care team provides a significant research angle, allowing for a number of studies and clinical trials. Their faculty facilitate, streamline and monitor the trials among patients in their care, which is a great support to our investigators.”

HORMOZ BOZORGHCHAMI, M.D.
Transforming spine care

As a regional magnet for spine care, we focus on clinical care ranging from patients who need refractory pain management or physical therapy to those needing complex reconstructive spine surgery. We have seven world-class spine surgeons trained in the most innovative approaches. We offer numerous minimally invasive spinal surgery techniques, including laminectomy, discectomy, fusion for spondylolisthesis or trauma, and tumor removal. We are also one of just a handful of institutions that have a consolidated neurological surgery and orthopaedic surgery spine center and are performing minimally invasive surgery for adult spinal deformity.

Functional outcomes program

Patient selection is a huge challenge in spine surgery. To ensure optimum outcomes for every individual patient, it is necessary to choose the correct surgical or nonsurgical treatment modalities.

“The success of a spine surgery is so subjective to the patient,” said Jason J. Chang, M.D. “One of the biggest breakthroughs recently is to quantify whether the surgery was worthwhile for the patient through long-term quality-of-life measurements. By collecting this information, we will further validate our patient selection through patient-centered metrics and outcomes.”

The OHSU Spine Center has integrated a patient-reported spine outcomes questionnaire into its electronic medical record system, ensuring the clearest understanding of treatment choice and response for both patient and physician.

Minimally invasive surgeries for adult spinal deformities

OHSU is one of only 10 institutions nationwide performing high-volume minimally invasive deformity procedures for degenerative kyphoscoliosis. An increasing problem among aging Americans, spinal deformity correction has historically required “open” surgeries with long incisions, greater tissue trauma and higher blood loss. OHSU Spine Center’s multidisciplinary approach teams a spinal surgeon with other experts to make these complex techniques possible.

Since spinal balance is one of the biggest predictors of overall quality of life, these surgeries will be expanding in importance as more Americans live and remain active longer.
Discovery lighting the way

Seeking the causes of brain disease is paramount to discovering new treatments and cures. The OHSU Brain Institute comprises nine research institutes and hundreds of researchers investigating Alzheimer’s disease, multiple sclerosis, Parkinson’s disease, stroke, addiction, neurodevelopmental disorders and many other areas.

To support our researchers, OHSU has invested in significant technological resources and expertise:

- The OHSU Advanced Imaging Research Center, one of only a handful of centers with both 7-Tesla and 12-Tesla MRI.
- The Center for Radiopharmaceutical Research, to develop novel radioactive isotopes for in vivo imaging, including PET-MRI.
- The Multiscale Microscopy Core, a leading-edge electron microscopy core.
- The Oregon National Primate Research Center, one of only seven such centers nationally.
- The Oregon Clinical and Translational Research Institute.
Neural mechanism for photosensitivity in chronic pain

More than 100 million Americans experience chronic pain, often unrelated to an acute, anatomic cause. Mary M. Heinricher, Ph.D., vice chair for research of neurological surgery, studies neural circuits that explain how pain can occur without injury. Most recently, her laboratory showed how light activates brain circuitry in some patients to produce abnormal pain.

“We know that the brain actively controls our sensitivity to pain,” Heinricher said. “My laboratory studies the primary brain circuits responsible for this, and we’ve shown in animal models that these circuits contribute to chronic pain. We hope our work to understand abnormal photosensitivity in patients with chronic pain may provide a window into how the brain experiences chronic pain, serving as a noninvasive marker of brain changes.”

A self-described circuit-basher, Heinricher and her colleagues are teasing out the complex brainstem circuits and molecular underpinnings of pain control.

2017 Javits Award

This year, the National Institute of Neurological Disorders and Stroke awarded Dr. Heinricher the Jacob Javits Neuroscience Investigator Award to study how light can influence pain. The highly prestigious Javits award recognizes distinguished national investigators for superior competence and sustained outstanding productivity.

In 2017, the Department of Neurological Surgery garnered five new federally funded research grants from the National Institutes of Health and the Department of Defense, plus an additional shared national grant with the OHSU Department of Anesthesiology and Perioperative Medicine. These new grants alone will bring over $10 million federal dollars to Oregon over the next five years and cement OHSU’s position as one of the leading neurosurgical research departments nationally.

Vollum scientists investigate the role of glia in neurodegeneration

Knockout gene holds promise for understanding neurodegenerative process

The death of nerve axons, which carry signals between brain and peripheral nerve cells, affects millions of people with peripheral neuropathy resulting from diabetes or cancer chemotherapy. Marc R. Freeman, Ph.D., director of the Vollum Institute, discovered that the deletion of the dSarm/Sarm1 gene results in long-term survival of the severed portions of nerve axons in both flies and mice. Freeman’s breakthrough may lead to a better understanding of the neurodegenerative process in these and other neurological disorders, and eventually to therapies benefitting patients.

Identifying key receptors influencing how myelin forms

The recent work of Kelly Monk, Ph.D., co-director of the Vollum Institute, firmly establishes G protein-coupled receptors (GPCRs) as regulators of myelinating glial cell development and myelin repair. These advances expand our understanding of myelinating glial cell biology and underscore the utility of targeting GPCRs to promote myelin repair in human disease. Insights from GPCR biology in myelinating glia can define new therapeutic targets to promote remyelination in disease and after injury.

Vollum Institute

Founded in 1987 as an independent research institute within OHSU, the Vollum Institute’s investigators focus on the molecular basis of nervous system function, with pioneering studies of synaptic modulation, neurotransmitter secretion, gene regulation, protein trafficking, protein structure and neuronal development. We anticipate this basic science research will have substantial impact on our understanding of conditions such as multiple sclerosis, drug addiction, autism and stroke. Currently, the Vollum faculty is exploring synaptic biology through imaging, electrophysiology and structural approaches.

Vollum scientists

Eight current or former Vollum faculty are members of the National Academy of Sciences, one of the highest honors bestowed on U.S. scientists.

Nine current or former Vollum faculty are Howard Hughes Medical Institute investigators.
Innovative technique reveals serotonin transporter structure

Eric Gouaux, Ph.D., senior scientist at the Vollum Institute and Howard Hughes Medical Investigator, is a recognized world leader in understanding neuronal receptors and membrane proteins. His work on the atomic structure of neurotransmitter transporters and ion channels has revolutionized understanding of the molecules underlying synaptic transmission in the brain. Currently, Gouaux’s laboratory uses X-ray crystallography and electrophysiology to study receptors and transporters for neurotransmitters such as glutamate, glycine, dopamine and serotonin.

In 2006, OHSU was among the first 12 U.S. institutions selected by the National Institutes of Health to receive a Clinical and Translational Research Award (CTSA) and to join the NIH’s national CTSA consortium. NIH support established OHSU’s Oregon Clinical and Translational Research Institute (OCTR), which provides the OHSU community with the infrastructure, technology and personnel required to conduct translational research and clinical trials.

The impact of the immune response of glia

When a neuron is damaged, it elicits an immune response from the brain’s support cells: glia. How and why this happens, however, is unclear. Mary Logan, Ph.D., of OHSU’s Jungers Center, is using a fruit fly model to understand more about glial reactions to brain injury. Her research group has shown that the glial engulfment receptor, Draper, is protective in a fruit-fly-based model of Alzheimer’s disease. Her laboratory has also described a novel role for the insulin-like signaling pathway in stimulating local glia after nerve damage. Both these mechanisms are required for a proper glial immune response to injury, including timely glial clearance of degenerating neurons in Alzheimer’s and other neurodegenerative disorders. Dr. Logan’s work may help uncover new molecular therapeutic targets for Alzheimer’s, stroke, brain injury and other diseases.

"One of OHSU’s compelling strengths is that our diverse basic neuroscience-related research programs fall under the larger umbrella of the campus, including the medical school. Our close association facilitates interactions with clinicians and fosters the goal of streamlining new discoveries into potential therapeutic programs."

MARY LOGAN, PH.D.

"At the Vollum Institute, our driving force is identifying the most important questions that will move our understanding of nature forward. If you ask important questions, you are going to find things of interest and relevance to disease. We believe a mechanistic approach to understanding the brain remains essential — basic research helps us understand how the brain works at the molecular level and is the foundation for effectively implementing translational research."

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The Jungers Center for Neurosciences Research

A collaborative effort of the Department of Neurology and the Vollum Institute, the Jungers Center for Neurosciences Research opened in 2006, dedicated to accelerating the pace at which promising discoveries move from the laboratory to the patient’s bedside.

Electron microscopic image of a glial cell.
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Neurological surgery


Neurology


Neurological surgery published over 70 papers in 2017;