

# DEPARTMENT OF NEUROLOGY

## Impact Report: 2022



I am honored to lead the Department of Neurology at the Medical College of Wisconsin. I am very proud of the work that we do; this Impact Report will highlight our accomplishments.

Our department is comprised of over 70 faculty in Adult Neurology, Child Neurology, Adult Neuropsychology, and Child Neuropsychology; our faculty are locally, nationally, and internationally recognized for their excellence in clinical care, research, and education.

Our clinical programs provide extraordinary, specialized care. We proudly partner with Froedtert Health, Children's Wisconsin, and Clement J. Zablocki VA Hospital to provide innovative, high-quality care for all aspects of Neurologic disorders for all ages throughout Wisconsin, and beyond.

We conduct groundbreaking research from bench to bedside. Our expanding portfolio includes investigator driven basic and translational research along with clinical research trials; all of this work serves to advance knowledge and provide opportunities for the most innovative experimental care.

Our department assures the future of Neurologic care with ACGME accredited residency training programs in Adult and Child Neurology and fellowships in Neuropsychology, Neuroimmunology, Clinical Neurophysiology, Epilepsy, Headache, Vascular Neurology, NeuroEndovascular Surgery, Movement Disorders, and Neurocritical Care.

We are committed to diversity, equity and wellness among our faculty, staff, and trainees, and creating an environment of curiosity, safety, and inclusivity.

Please enjoy this Neurology Impact Report. For more information about our faculty and department, I invite you to visit [www.mcw.edu/departments/neurology](http://www.mcw.edu/departments/neurology).

**Dominic Fee, MD, FAAN, FAANEM, FACNS**  
*Associate Professor and Interim Chair*

[mcw.edu/departments/neurology](http://mcw.edu/departments/neurology)

**Support research at the Medical College of Wisconsin Department of Neurology** and the

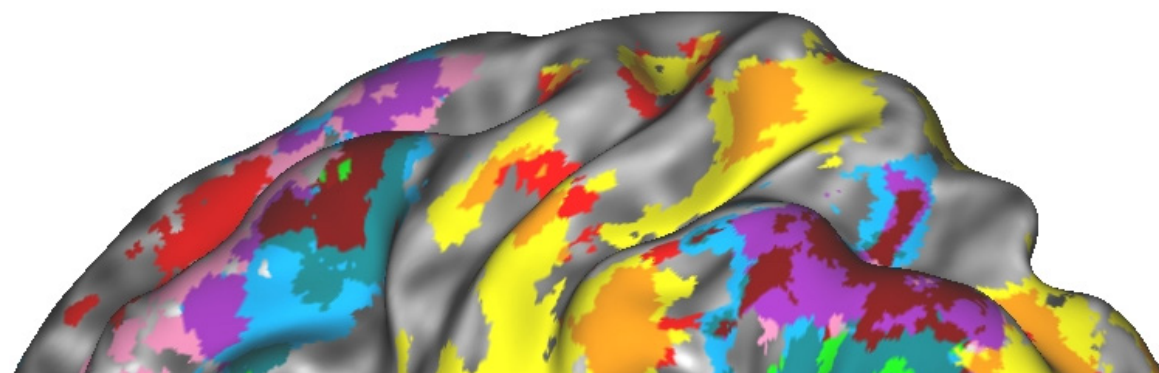
translation of knowledge into therapies to control, treat, and prevent the conditions that impact our community. Interested in donating to further research?

Please contact us at Department of Neurology, [414.955.5235](tel:414.955.5235) or [neurology@mcw.edu](mailto:neurology@mcw.edu).

*Thank you!*

- SHAPE
- SOUND
- MOTION
- COLOR
- MANIPULATION

Brain areas encoding information about different aspects of word meaning (Fernandino et al., 2015).



# ALS



The **Medical College of Wisconsin ALS program** at **Froedtert Hospital** has been designated a **Center of Excellence** by the ALS Association since 2006 and remains a top tier center for patient care, education, and research. The ALS program serves most of Wisconsin, adjacent areas in Illinois, and the western UP of Michigan.

The ALS program is directed by **Drs. David Shirilla** and **Dominic Fee**. **Dr. Paul Barkhaus** started the first multidisciplinary clinic to serve veterans in the **VA system** which has also been designated by the ALS Association as a **Center of Excellence**.



# 5

**Clinical trials in the past two years**

# 60

Topics Published

Dr. Barkhaus collaborates with a national consortium in writing the popular patient-oriented series **ALSUntangled**.

# 22

**Publications in the last two years**

# MUNIX

Motor Unit Number Indexing (MUNIX) is a novel neurophysiological tool to estimate motor neuron loss in ALS and related disorders. This was developed at MCW by Drs. Barkhaus and Nandedkar and is becoming an internationally used surrogate marker for ALS progression in treatment trials.

# HEADACHE

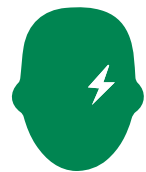
Largest number of **headache medicine providers** for any institution in Wisconsin with **4 board certified or eligible headache medicine physicians, 3 advanced practice providers, and a pain psychologist**.



**TENSION**



**MIGRAINE**



**CLUSTER**

The Chronic Migraine program led to an **84% reduction in migraine disability days (MIDAS)** and a **91% improvement in migraine quality of life score (MSQOL)**.



**Only dedicated multi-disciplinary program for the treatment of chronic migraine** in the state.



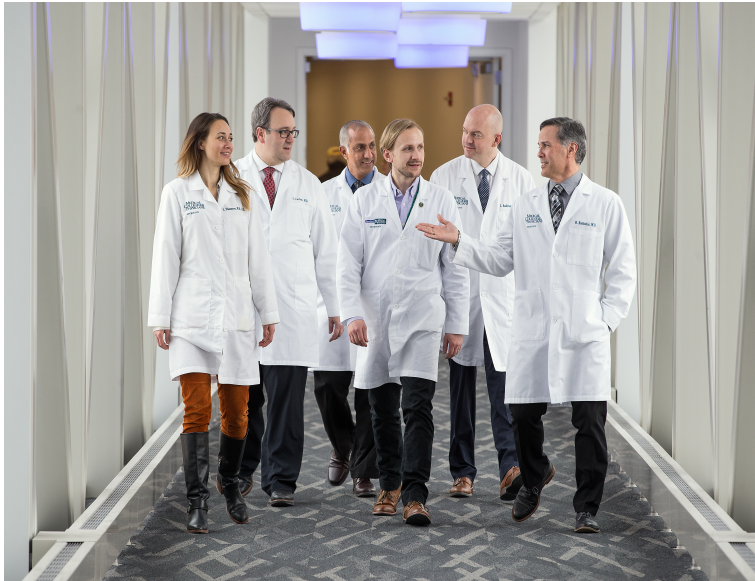
**Only UCNS accredited fellowship in headache medicine** in Wisconsin

# EPILEPSY



The **Medical College of Wisconsin** is home to comprehensive epilepsy programs for both adults and children.

The **Froedtert Hospital Comprehensive Epilepsy Program** and the **Children's Wisconsin Comprehensive Epilepsy Program** are accredited by the NAEC as **Level 4** epilepsy centers. These centers provide patients access to multidisciplinary care teams with a full range of diagnostic and therapeutic options including both medical and surgical options.



## Neuromodulatory Devices

Treatment Resistant Epilepsy

**297** VNS devices implanted from 2010 to 2020

Devices implanted in 2021

**27** VNS      **8** RNS      **3** DBS

Only **magnetoencephalography (MEG)** program in Wisconsin.

**41** MEG studies for 2021

## Epilepsy Surgery

Treatment Resistant Epilepsy

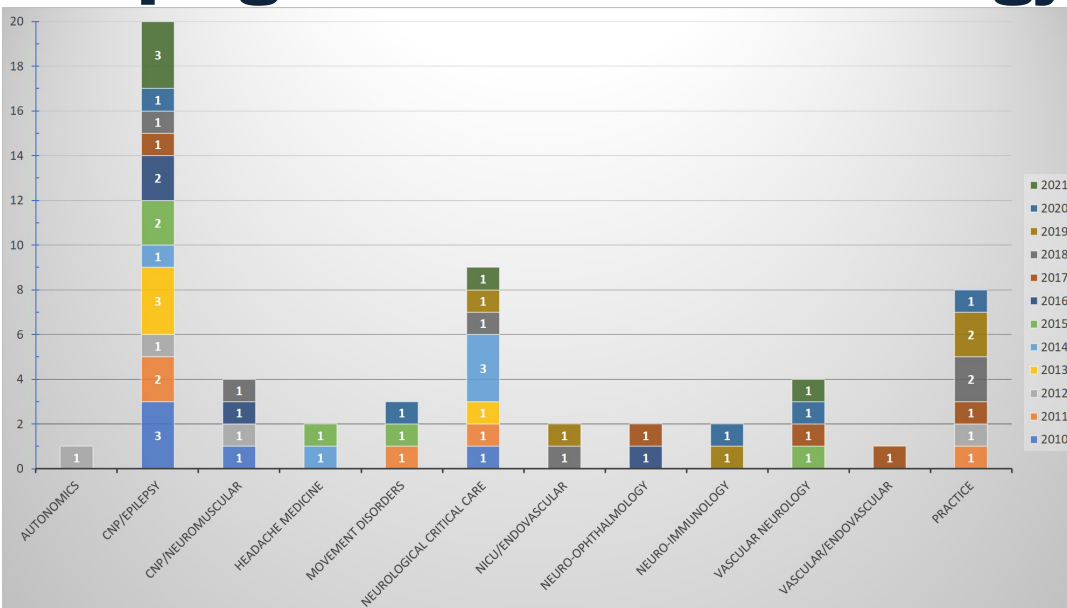
**178** epilepsy surgeries from 2010 to 2020

Epilepsy Surgery for 2021

**6** Single Stage Surgeries  
**14** Intracranial EEG Studies  
**32** Intra-operative ECoG/Awake Mapping

# ADULT NEUROLOGY RESIDENCY

## Shaping the Future of Neurology



Our residency graduates have gone on to fellowships in virtually all major subspecialties of Neurology

**> 800**

Applicants for Match (March 2021)

# MEMORY DISORDERS

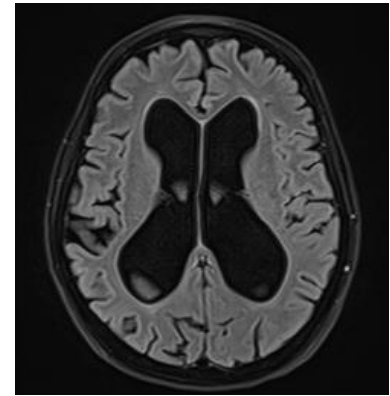
## Imaging Biomarkers in Mild Cognitive Impairment (MCI)

Drs. Malgorzata Franczak and Laura Umfleet, along with colleagues in neurology and neuroradiology, are conducting innovative research using cutting-edge brain **MRI biomarkers** to identify and study novel physiological mechanisms that predict cognitive dysfunction in patients with **preclinical and prodromal dementia**.

This work will inform future interventional studies to reduce the morbidity in the aging population.

## The Gut-Brain Interactome

Recently, the memory disorders group has assembled a research team with expertise in evaluation the human gut **microbiome**, Alzheimer's Disease dysconnectivity, and Alzheimer's Disease symptomatology. Ongoing efforts will leverage shared innovative gut-brain models and state-of-the-art neuroimaging techniques to yield new discoveries in Alzheimer's Disease.



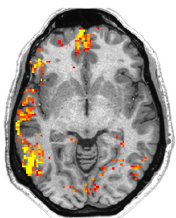
## NORMAL PRESSURE HYDROCEPHALUS (NPH) PROGRAM

was established in 2009 by Dr. Franczak and is the only NPH program in the state of Wisconsin. The NPH program serves patients in Wisconsin, northern Illinois and Iowa.

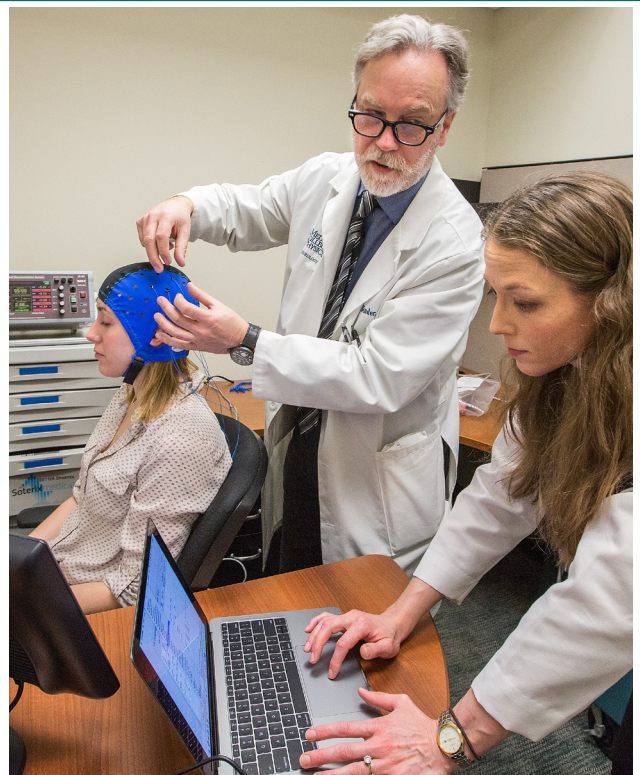
# NEURO-IMAGING RESEARCH

MCW Neurology faculty are world leaders in research on how the brain processes language and speech. The **Language Imaging Laboratory**, directed by Dr. Jeffrey Binder, has been **continuously funded by the National Institutes of Health for over 25 years** and has produced landmark studies on how the brain perceives speech sounds, recognizes written words, and retrieves word meanings. For more information go to [www.neuro.mcw.edu](http://www.neuro.mcw.edu).

## FATES



Dr. Binder and MCW faculty recently led a nationwide study called **fMRI in Anterior Temporal Epilepsy Surgery (FATES)**, which tested these methods at 9 centers across the country and established the first standardized protocol for mapping language regions in the brain prior to surgery.



Other major NIH-funded studies led by Dr. Binder and colleagues include the **Epilepsy Connectome Project**, which aims to understand changes in brain network connectivity induced by epilepsy and **Concept Representation in the Human Brain**, which aims to understand how knowledge about the meaning of individual words is organized in the brain and how brain damage from stroke affects these networks.

# CHILD NEUROLOGY:

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Our Child Neurology program is the largest in Wisconsin with 14 faculty and 10 advance practice providers with expertise in general neurology, neurogenetics, neuroimmunology, epilepsy, neurocritical care, neonatal neurology, and neuromuscular medicine. The practice covers 6 remote sites throughout Wisconsin.

Our **neonatal neurology** program includes a dedicated inpatient service with discharged neonates following up in a structured 3 year outpatient multidisciplinary program to maximize their developmental outcomes (DREAM clinic). Additionally, the program interfaces with the prenatal high-risk obstetrics department for prenatal consults.

The **neurocritical care** program includes a multidisciplinary pediatric stroke and **neurovascular** program which includes both acute ischemic strokes but also other interventional procedures. The dedicated inpatient service also has a post-hospital discharge clinic (BRAIN clinic). Our **neuromuscular** program includes both an inpatient and outpatient service. Our clinics include a multidisciplinary **Muscular Dystrophy Association and Parent Project Muscular Dystrophy Certified clinics** as well as a multidisciplinary



**Brachial Plexus and Nerve Injury Clinic.** Our group participates in NIH, industry, and investigator sponsored trials ranging from addressing acute flaccid myelitis to the use of near infra-red spectroscopy in epilepsy to exploring genetic modifying therapies in neuromuscular disease.

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# CHILD NEUROLOGY RESIDENCY:

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Our child neurology residency is unique in that it incorporates child neurology experience throughout the entire training process. After a year of internship as pediatric residents, they are paired with a basic science research lab where they spend a year (PGY2) on a specific project and topic before returning to their clinical training in child neurology.

Recent projects have included:

- Neurovascular injury secondary to TBI: Investigating markers of reactive gliosis
- Endoplasmic Reticulum (ER) stress in a cellular model of SMA
- Developmental time course of mechanical and thermal hypersensitivity using evoked stimuli and non-evoked ongoing assays for spontaneous pain

The program, accepting 2 residents per year, has had residents go on to practice in both academic and non-academic practices with specializations ranging from general neurology to headache medicine, neuromuscular medicine, neurogenetics, and epilepsy.

# MS & NEUROIMMUNOLOGY

Our **comprehensive MS center** is designated as a partner in care by the **National MS Society** and a member of the Consortium of MS centers.



**National Multiple Sclerosis Society**  
Partner in MS Care

We have the **only fellowship training program** in neuroimmunology and MS in Wisconsin



## 16 Active Clinical Trials

- Trials of existing therapeutic agents
- Trials of novel therapeutic agents
- Integration of technology in the assessment of multiple sclerosis
- Active collaborations with the Engineering Department of Marquette University

We are a national destination for patients with multiple sclerosis (MS), central nervous system autoimmune inflammatory disease, inflammatory optic neuropathies, chronic relapsing inflammatory optic neuropathies (CRION), neuromyelitis optica spectrum disorders (NMOSD) including anti-MOG disease, autoimmune encephalitis (AE), and Susac disease.

# MOVEMENT DISORDERS



**>100**

Quarterly average number of new patients seen in Movement Disorders

**47**

Number of patients undergoing DBS implantation since July 2019

**>225**

Patients followed with DBS for Movement Disorders

# NEUROMUSCULAR



**Dr. Michael Collins** is an internationally-recognized authority on **vasculitic neuropathies**. He has chaired numerous workshops and committees on these disorders.

**12** publications since 2019

The comprehensive Neuromuscular Diseases Program at **MCW** integrates both pediatric and adult patients with diverse neuromuscular disorders that are seen in dedicated **Neuromuscular Clinics** and the **Muscular Dystrophy Association (MDA) Clinics**. As they reach adulthood, the pediatric patients are transitioned from the **MDA Clinic** at **Children's Wisconsin** to the adult clinic at **Froedtert Hospital**.



The Neuromuscular Diseases Program at MCW is one of the few such programs in the country to perform and read their muscle biopsies. The new and state-of-the-art **Froedtert Hospital** electroneuromyographic (EMG) laboratory is certified by the American Association of Neuromuscular and Electrodiagnostic Medicine (AANEM). Over 2,500 basic EMG and advanced clinical neurophysiologic procedures (e.g., single fiber EMG and laryngeal EMG) are performed annually at **Froedtert Hospital**, **Children's Wisconsin**, and the **VA Medical Center**.

**Dr. Matt Harmelink**, pediatric neuromuscular specialist, leads an expanding program utilizing cutting-edge therapies for such diseases as **spinal muscular atrophy** and **Duchenne muscular dystrophy**. The improvements and availability of genetic testing has facilitated making diagnoses in rare disorders. The NMDP program has also started a **collaborative program** with Plastic Surgery in the assessment and management of **brachial plexus disorders** in infants.

## Diversity

The department established the Diversity, Inclusion and Wellness Committee (DIW) in the fall of 2020. Since then, the committee has conducted an internal gap assessment and identified areas of opportunity for learning and development. In FY22, the DIW committee rolled out an anonymous survey – Questions You Were Too Afraid To Ask – to further encourage curiosity and respectful discussions. With the approval of a diversity specific budget within the department in FY23, the committee will plan one educational event per quarter to continue to raise awareness on this important topic. More specific accomplishments and milestones can be found on the Department's Diversity, Inclusion and Wellness Report.



During Pride Month, we openly celebrate our LGBTQIA+ community members, when once they were silenced and scorned. We will also take this opportunity to educate about the history, lives, and issues that face this community.

We are sending out a one-question survey providing you with a safe zone to ask the **questions you are too afraid to ask**. We have heard from many in the department who have questions related to the LGBTQIA+ topics—but feel uncomfortable asking or don't know how to ask the questions properly. Here is your opportunity to ask those questions. The Diversity, Inclusion & Wellness Committee will then work with the experts in the topic areas to provide you the answers.

**Examples of questions you may have:** Why is trans-centric healthcare important to the trans community? What is pansexual? How do I find out someone's pronouns? What is the history of Pride Month? As an ally, what can I do to get involved or help?

**Your questions will be submitted anonymously through a Qualtrics Survey.** We will keep the survey open indefinitely to provide you the safe space to ask questions that may come up in your work life throughout the year. The questions do not have to be limited to the Pride Month or the LGBTQIA+ topics, they can be anything related to diversity and inclusion.

With the questions you ask, the Neurology Diversity, Inclusion and Wellness Committee will create opportunities to inform and educate through future:

**Lunch and Learn Sessions**—with guest speakers who are subject matter experts to answer the questions.  
**Newsletter articles** written by those knowledgeable experts.

We will "look for the gold" in your question and assume positive intent, but please note that we reserve the right to reword any questions to frame them with affirming language or discard any question not in the spirit of education, advocacy or acknowledgement.

Thank you for participating in this survey. We appreciate your openness to the survey and your bravery in asking the questions.

With gratitude,  
The Neurology Diversity, Inclusion and Wellness Committee



# NEURO-ONCOLOGY

**1,000+** Patient cases are presented each year at the weekly comprehensive multi-disciplinary brain tumor board.

**11** Clinical trials currently open for patients with **brain tumors**

**12** Publications in the past year from the **Neuro-oncology Translational Research Team**

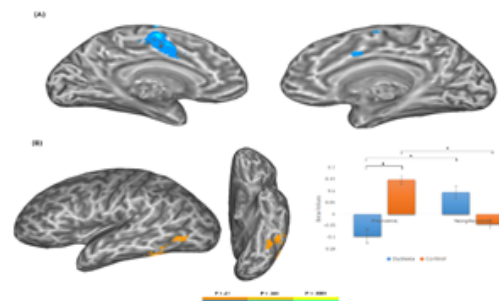
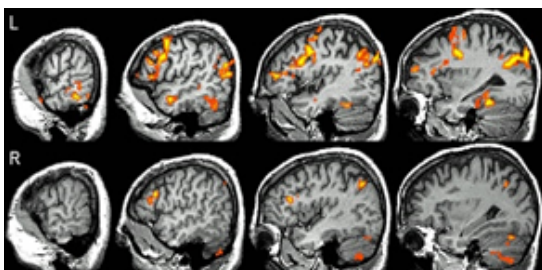
The **Neuro-oncology team** administers and hosts one of the largest **brain banks** of its kind to support **brain cancer research**. Because of the generosity of patients and their families, the **Neuro-oncology team** participates in **ground-breaking research** funded by the **National Cancer Institute** and the **National Institutes of Health**.

# NEUROPSYCHOLOGY

**>100** fellows trained in the >40 year history of the Neuropsychology Fellowship Program

Active research in multiple areas with **over 100 publications** in the past 5 years

- Technology and psychometrics in neuropsychological assessment - **Dr. Umfleet**
- Cognitive outcome in the pediatric brain tumor - **Dr. Koop**
- Performance and symptom validity - **Dr. Vogt**
- Congenital heart disease and cognition across the lifespan - **Drs. Loman and Umfleet**
- Neuropsychological outcomes in preschool age children with medical disorders - **Dr. Heffelfinger**
- Acute effects, recovery and outcome from traumatic brain injury in civilians, athletes and military service members - **Drs. Brett, McCrea, and Nelson**
- Aphasia Research and Recovery - **Dr. Pillay**
- Neuroimaging, the microbiome and neurodegenerative conditions - **Dr. Umfleet**
- Neuroimaging & cognitive outcome after epilepsy surgery - **Drs. Swanson, Janecek, Koop, Pillay, and Conant**
- TBI and neurological sequelae later in life - **Dr. Brett**
- Post COVID cognitive outcome - **Drs. Bobholz, Swanson, and Umfleet**
- Functional neuroimaging of typical and atypical reading development - **Dr. Conant**
- Concept representation in the human brain - **Drs. Conant and Pillay**
- How to operate a pediatric neuropsychology practice during the COVID-19 pandemic: Real tips from one practice's experience - **Drs. Heffelfinger, Koop, Loman, and Vogt**





# STROKE/ NEUROINTERVENTION

# RESEARCH



The Joint  
Commission

STROKE CERTIFICATION

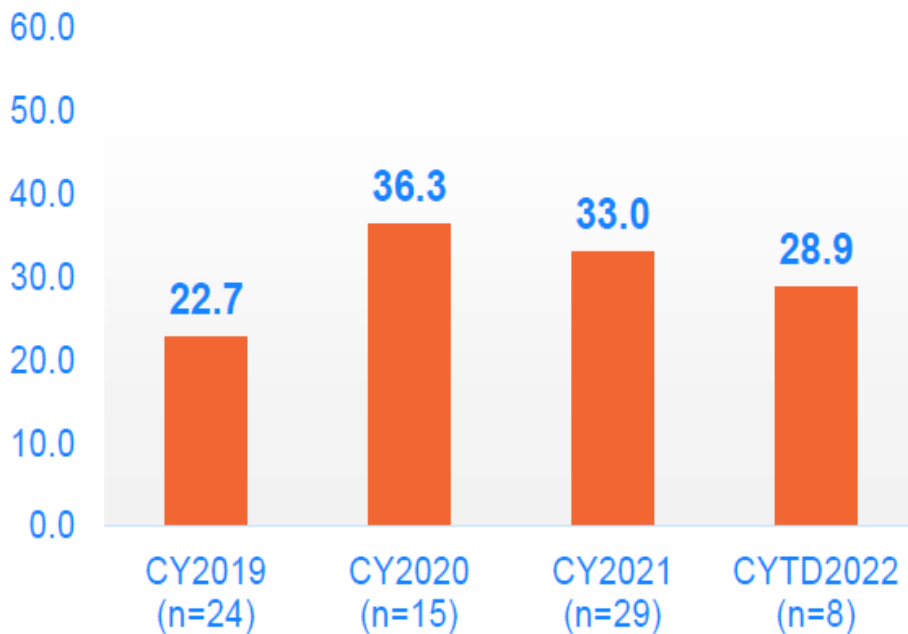


American Heart  
Association  
American Stroke  
Association

Froedtert Hospital is a **Comprehensive Stroke Center** designated by The Joint Commission with 7 specialists in vascular neurology.

**Door-to-needle (DTN): Froedtert Hospital consistently achieves some of the fastest times in the nation for acute ischemic stroke treatment with thrombolysis.**

## Door to Needle – Eligible Cases Average # of Minutes



**>180**  
Active  
Research  
Studies

- ALS
- Child Neurology
- Epilepsy
- Headache Medicine
- Language and Cognition
- Memory Disorders
- Movement Disorders
- Multiple Sclerosis & Neuroimmunology
- Neuromuscular Medicine
- Neuropsychology
- Stroke



## DEPARTMENT OF NEUROLOGY

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# DEPARTMENT OF NEUROLOGY FACULTY

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Dominic Fee, MD

## **Vice Chair, Education**

Chad Carlson, MD

## **Vice Chair, Faculty Development**

Amy Heffelfinger, PhD

## **Vice Chair, Research**

Jeffrey Binder, MD

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Christopher Anderson, MD  
Piero Antuono, MD  
Paul Barkhaus, MD  
Humberto Battistini, MD  
Patrick Bauer, MD  
Ryan Brennan, DO  
Staley Brod, MD  
Chad Carlson, MD  
Michael Collins, MD,  
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Sheila Eichenseer, MD  
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Kirti Thummala, PhD  
Aditya Vuppala, MD  
Vahab Youssofzadeh, PhD

\*VA Faculty

## **CHILD NEUROLOGY**

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Samuel Adams, MD  
René Andrade-Machado, MD  
Nancy Bass, MD  
Raquel Farias-Moeller, MD  
Pradeep Javarayee, MD  
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Hema Patel, MD  
Namrata Patel, MD  
Shannon Pollock, MD  
Avantika Singh, MD  
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Alissa Butts, PhD  
Christina Casnar, PhD  
Lisa Conant, PhD  
Anthony Correro, PhD  
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Julie Janecek, PhD  
Jennifer Koop Olsa, PhD  
Melissa Lancaster, PhD  
Michelle Loman, PhD  
Lauren Miller, PhD  
Sara Pillay, PhD  
Laura Umfleet, PsyD  
Elisabeth Vogt, PhD

## **STROKE, NEUROINTERVENTION, CRITICAL CARE**

**Interim Chief:** Dominic Fee, MD

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Marek Cierny, MD  
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