NEURO-ONCOLOGY
Dartmouth-Hitchcock Norris Cotton Cancer Center

CLINIC PROFILE
Neuro-Oncology Center of Excellence

The Neuro-Oncology program at Dartmouth-Hitchcock Norris Cotton Cancer Center is recognized for its innovative approaches, advanced technology, and exceptional staff. In the serene setting of rural New Hampshire, Ivy League physician scientists and biomedical engineers have amassed resources and knowledge unmatched in North America:

- Access to emerging therapies and procedures in a leading cancer research center through all phases of clinical trials.
- A National Cancer Center (NCI)-funded $10 million neurosurgical operating suite with real-time, intraoperative MRI/CT.
- Advanced 3-D imaging technology at an institution that has pushed the horizons of radiology since 1896.
- A unique pairing of a linear accelerator with an adjacent hyperbaric chamber to explore the benefits of the oxygenation of tumor cells to enhance benefits of radiation.
- A close-knit interdisciplinary team working side-by-side to coordinate complex care plans involving many subspecialties.

Dartmouth-Hitchcock Medical Center, the Best of Both Worlds

Norris Cotton Cancer Center is headquartered at Dartmouth-Hitchcock Medical Center (DHMC), a teaching and research hospital of The Geisel School of Medicine at Dartmouth. DHMC provides advanced care for complicated conditions like brain cancer for patients from New England, New York, and beyond.

The Referral Process

Our practice is to see patients within days of diagnosis. Following this appointment, we keep the referring physician and the primary care team informed of the treatment plan and clinical course.

Please let us know if you are interested in participating in our interdisciplinary Neuro-Oncology tumor board. The staff at Norris Cotton Cancer Center is committed to working closely with you. You will be supplied with a detailed treatment summary. If at any time you have any questions, please call (603) 650-6312 to speak with the treating physician.

To refer a new patient by telephone, call (603) 650-6312
To refer by fax: (603) 653-0610
A Pioneer in Diagnostic Imaging

The first step in developing an evidence-based long-term treatment plan for each patient is a complete diagnostic workup.

Dartmouth was home to the first clinical X-ray ever performed in the U.S. Today, traditional X-rays are supplemented by fluoroscopy, advanced magnetic resonance imaging (MRI), magnetic resonance spectroscopy (MRS), computed tomography (CT), ultrasound, nuclear imaging (PET, PET-CT, and SPECT), interventional radiology treatments, and 3-D imaging. As one of America’s premier radiological centers, we leverage all of our medical imaging abilities to diagnose Neuro-Oncology patients.

Brain cancer differs from other types of tumors because diagnosis and treatment may affect cognitive and behavioral changes in a patient. Our neuropsychologist assesses the extent of any impairment during the course of the disease, and makes recommendations that can enhance patients’ quality of life. The neuropsychologist collaborates with a speech pathologist to design cognitive rehabilitation when indicated.

Molecular Pathology Analysis of Tumor Samples

Pathology plays an increasing role in understanding cancer. The advanced technology of our molecular pathology laboratory allows us to perform sophisticated tests to diagnose and characterize brain tumors. Immunohistochemistry, cytogenetic testing, and molecular profiling, as well as genomic sequencing are now part of clinical practice. Tissue samples can provide discriminating information to diagnose, classify, and prognosticate lesions so treatment can target specific mutations.

Treatment Planning

The Neuro-Oncology program team reviews each patient’s case in terms of history, radiologic studies, and pathologic diagnosis at tumor board.

The team, in consultation with the patient and family, identifies the most effective treatments. We incorporate decision aids into our practice to help patients make informed decisions about treatment options.

A New Generation of Radiation Oncology

With new technology, radiation oncologists use radiation therapy as an alternative to standard surgery.

- Stereotactic radiosurgery with the Trilogy™ system combines high definition X-ray and CT imaging with precise radiation delivery so a radiation oncologist can perform radiosurgery.
- Computer-assisted volumetric resection using OR navigation allows for more precise surgery.
- Computer-assisted stereotactic radiosurgery, together with laser instruments, can help physicians locate and target deep brain tumors more accurately than traditional techniques.
- Intensity-Modulated Radiation Therapy (IMRT), known as 3-D conformal radiation therapy, uses computer-generated images to plan and deliver tightly focused radiation beams to cancerous tumors while preserving healthy brain tissue.

Advanced imaging provides information about the blood supply to brain tumors.
Intraoperative MRI and CT
Dartmouth’s Center for Surgical Innovation is a high tech pavilion. The skilled integration of equipment, mechanical systems, and configuration allows the surgeon to have access to an overhead rail-mounted MRI and CT scanner within configurable operating rooms. This outstanding intraoperative imaging before, during, and after complex procedures greatly improves precision and safety—by increasing the assurance of the completeness of resection. Advanced functional imaging allows for strategic brain tumor biopsy, real-time imaging during resection of brain tumors, and the opportunity to check for brain shift following a craniotomy.

Advanced Neurosurgical Treatments
Dartmouth is a leading institution in North America on the use of fluorescence-guided neurosurgery to selectively tag brain tumor tissue with fluorescent dye. This technology allows surgeons to visually discriminate between normal and tumor tissues to improve the accuracy of a tumor resection.

Neurosurgical Pituitary Procedures
We also offer sophisticated, minimally invasive approaches for pituitary tumors.

- Transsphenoidal Microneurosurgery: A direct approach through the nostrils to enter the sphenoid sinus behind the nose for resection of pituitary tumors. The tumor can then be removed while the normal brain structures are protected.

- Endoscopic pituitary surgery: A minimally invasive approach to reach pituitary tumors without cutting the face or the skull. A neurosurgeon inserts an endoscope, equipped with a microscope, camera, and light, through the nose to remove the tumor.

A Glowing Pink Brain Tumor is Easier to Remove
To better differentiate between tumor cells and healthy tissue, surgeons give patients an oral dose of the chemical 5-aminolevulinic acid (ALA). An enzyme metabolizes ALA, producing the fluorescent protein protoporphyrin IX (PpIX). Tumor cells have metabolisms that are different than normal cells—so they accumulate more PpIX—and therefore fluoresce or “glow” when exposed to blue light.

A team of Dartmouth researchers and surgeons developed a probe and later a wide-field imaging system that combines violet-blue and white light to simultaneously analyze both the concentration of PpIX and four other tumor biomarkers.

Our imaging technology reads how light travels when it hits the tissue, sends quantitative information to a computer, runs it through an algorithm, and identifies which tissue is cancerous and which is not.

This allows us to do more precise and radical surgical excision of a malignant brain tumor while leaving healthy tissue unharmed.
Shared Decision Making

The stakes are high when facing treatment for a brain tumor. The risks associated with treatment can be serious, such as changes in mental functioning, fertility, or balance. Through shared decision making, we use validated clinical tools to help patients and families explore treatment options. Shared decision making is a process that occurs over a series of counseling sessions at the clinic and requires patients and families to review and discuss materials at home. Though the process can vary depending on each case, patients and families often take the following steps to make a decision.

- Evaluate benefits and risks of each treatment option.
- Clarify personal values as they relate to the risks and benefits.
- Determine if they have enough information and support to make a decision.
- Make a decision.
- Check the certainty of their decision.

This process helps ensure that patients are confident and comfortable with their choices.

Supporting Patients and Families

Each patient in the Neuro-Oncology program is treated in a patient-centered environment that respects and appreciates the individual and family. We offer a wide array of education, support, and expressive arts programs to help soothe anxiety and manage pain while improving coping skills.

"Think about how scary this can be for the patient. Many patients diagnosed with brain cancer are people who have been healthy all their lives. Abruptly they start having headaches or have a seizure, prompting diagnostic tests that show brain cancer. It comes from nowhere. It's shocking. This is the mental and emotional state of patients initially diagnosed with brain cancer."

- Camilo Fadul, MD, Neuro-Oncology Program Leader

Patients and families can take advantage of free classes like mindfulness meditation, expressive arts, and Tai Chi as part of our Patient and Family Support Services program. We also offer support groups, massage, and Reiki.

"I enjoy going to see my team. They are friendlier than you expect a doctor to be. They greet me like, 'Hey how are you doing?' It's nice to see you.' I think they are happy to see me and I feel the same way. I have gotten to know them a little bit too. It helps that the care has turned out so well I speak highly of them to everyone."

- Ben, 28 years old, New Hampshire

"I've felt pretty well cared for throughout the process and have tremendous respect and gratitude for Dr. Fadul and the other folks I received treatment from. When I was first diagnosed and considering options, I checked out a lot of experimental therapies—clinical trials. It turned out the one I chose was Dr. Fadul's own program. It seemed intuitively sensible to me. I was very glad that I went through the study. I think it helped me out."

- Tony, 52 years old, Vermont

"I enjoy going to see my team. They are friendlier than you expect a doctor to be. They greet me like, 'Hey how are you doing?' It's nice to see you.' I think they are happy to see me and I feel the same way. I have gotten to know them a little bit too. It helps that the care has turned out so well I speak highly of them to everyone."

- Camilo Fadul, MD, Neuro-Oncology Program Leader

Patients and families can take advantage of free classes like mindfulness meditation, expressive arts, and Tai Chi as part of our Patient and Family Support Services program. We also offer support groups, massage, and Reiki.

"I've felt pretty well cared for throughout the process and have tremendous respect and gratitude for Dr. Fadul and the other folks I received treatment from. When I was first diagnosed and considering options, I checked out a lot of experimental therapies—clinical trials. It turned out the one I chose was Dr. Fadul's own program. It seemed intuitively sensible to me. I was very glad that I went through the study. I think it helped me out."

- Tony, 52 years old, Vermont
An Exceptional Professional Staff

Engineered for Teamwork

At Dartmouth, we fundamentally believe in the power of teams to develop clinical solutions for individuals and populations. Our operational structure and physical space nurtures team science—putting professionals from different fields in daily contact with one another to ask tough questions and find the answers. Innovation evolves when there is a wide range of perspectives at the same table.

The Neuro-Oncology team is comprised of specialists from:
- Neuro-Oncology
- Radiation Oncology
- Neurosurgery
- Neuroradiology
- Neuropathology
- Neuropsychology
- Palliative Care
- Nursing
- Social Work

Patients see each member of the team so their questions can be answered by the appropriate specialist. These visits are coordinated for their convenience, with diagnostic testing usually done the same day.

From Bench to Bedside

Researchers and clinicians collaborate to apply scientific findings to improve cancer care. Neuro-Oncology patients have the opportunity to participate in clinical research for new medications and surgeries.

From Bench to Bedside

Our researchers are conducting clinical trials to study the interaction between brain tumors and the immune system. This information will allow the development of more effective therapeutic options for glioblastomas, the most frequent and lethal primary brain tumor. These studies not only take advantage of the cellular immune response by vaccination, but also explore the humoral immune armamentarium by eliciting an antibody response.

Pushing New Advances in Imaging

Researchers from the Thayer School of Engineering and the Geisel School of Medicine at Dartmouth have spearheaded new technology in navigational tools used in the operating room, developing more precise and safer surgical procedures for patients with brain tumors. Studies using fluorescence to aid in surgical excision have allowed removal of tumor tissue that would have otherwise been left behind.

Mapping Genetic Signatures

In another area researchers are using brain tissue to identify biomarkers that can help individualize treatment plans and guide the therapeutic approach.

NEURO-Oncology Program

Dartmouth-Hitchcock
Norris Cotton Cancer Center
One Medical Center Drive
Lebanon, NH 03756
Phone: (603) 650-6312
Fax: (603) 653-0610
cancer.dartmouth.edu/brain
Brain Surgeons are Schooled in Continuous Quality Improvement

Eight years ago, Neuro-Oncology Program Leader Camilo Fadul, MD, reached out to The Dartmouth Institute for Health Policy and Clinical Practice. Dr. Fadul wanted his team to learn from the Microsystems Academy, a Dartmouth program that helps provider groups improve patient care.

Mark Israel, MD, Evelyn Schlosser, MPH, RN, and David Roberts, MD, sponsored a quality improvement team to measure best practice indicators. With a goal of reducing process variation and maximizing safety and efficiency, the group made a flow chart of how patients enter and move through the program. From this schematic chart, they selected the initial diagnostic assessment and care planning phase for the scope of their project. They established a set of 10 best-practice indicators to measure.

During the pilot, compliance rose from 66 to 91 percent. Today the team continues to isolate processes for quality improvement projects. The team is now focused on acute care with radiation and chemotherapy, adding 20 new best practice measurements to its quality dashboard. By involving patients and families, the team ensures that the measurements assessed are patient centered.
LEEDS A. JARVIS, MD, PhD
Section Chief, Radiation Oncology
Clifford J. Eskey, MD, PhD
Director, Neuroradiology

NATHAN E. SIMMONDS, MD
Medical School
MD, University of Virginia School of Medicine, Charlottesville, VA, 1993
Internship
University of Virginia Health Sciences Center, Charlottesville, VA, General Surgery, 1993-94
Board Certification
Neurological Surgery, 2003
Joined Staff in 2002
Practice Note
Brain tumors, general neurosurgery, pituitary surgery, spinal injuries, spinal tumors.

THOMAS C. SROKA, MD, PhD
Medical School
MD, Stanford University School of Medicine, Stanford, CA, 1992
Fellowship
Massachusetts General Hospital, Boston, MA, Neurology, 1994-2000
Board Certification
Neurological Surgery, 2003
Joined Staff in 2004
Practice Note
CNS oncology, genitourinary cancer, head and neck cancer, intensity modulated radiation therapy, lung tumors, prostate brachytherapy, stereotactic radiosurgery.

LESLIE A. JARVIS, MD, PhD
Medical School
MD, Harvard Medical School, Boston, MA, 1992
Education
PHD, Harvard University, Boston, MA, 1997
Fellowship
Massachusetts General Hospital, Boston, MA, Radiation Oncology, 1998-99
Board Certification
Radiation Oncology, 2010, 1999
Joined Staff in 2008
Practice Note
Breast cancer, CNS oncology, and lymphoma.

THOMAS C. SROKA, MD, PhD
Medical School
MD, University of Arizona College of Medicine, Tucson, AZ, 2007
Education
PHD, University of Arizona, Tucson, AZ, Cancer Biology, 2005
Internship
Tucson Hospital's Medical Education Program, Tucson, AZ, Transition, 2007-08
Joined Staff in 2012

LESLIE A. JARVIS, MD, PhD
Education
PHD, Stanford University School of Medicine, Stanford, CA, 2007
Fellowship
Stanford University Medical Center, Stanford, CA, Radiation Oncology, 2003-06
Board Certification
Radiation Oncology, 2009
Joined Staff in 2004
Practice Note
CNS oncology, genitourinary cancer, head and neck cancer, intensity modulated radiation therapy, lung tumors, prostate brachytherapy, stereotactic radiosurgery.

NATHAN E. SIMMONDS, MD
Residency
University of Virginia Medical School, Charlottesville, VA, Neurosurgery, 1994-2000
Practice Note
Brain tumors, general neurosurgery, pituitary surgery, spinal injuries, spinal tumors.

DAVIDE T. JARVIS
Medical School
MD, Stanford University School of Medicine, Stanford, CA, 1992
Fellowship
Massachusetts General Hospital, Boston, MA, Radiation Oncology, 1998-99
Board Certification
Radiation Oncology, 2010, 1999
Joined Staff in 2008
Practice Note
Breast cancer, CNS oncology, and lymphoma.

THOMAS C. SROKA, MD, PhD
Residency
University of Arizona Health Sciences Center, Tucson, AZ, Radiation Oncology, 2008-12
Practice Note
CNS oncology, genitourinary cancer, head and neck cancer, intensity modulated radiation therapy, lung tumors, prostate brachytherapy, stereotactic radiosurgery.

LESLIE A. JARVIS, MD, PhD
Residency
University of Arizona Health Sciences Center, Tucson, AZ, Radiation Oncology, 2008-12
Practice Note
CNS oncology, genitourinary cancer, head and neck cancer, intensity modulated radiation therapy, lung tumors, prostate brachytherapy, stereotactic radiosurgery.

THOMAS C. SROKA, MD, PhD
Residency
University of Arizona Health Sciences Center, Tucson, AZ, Radiation Oncology, 2008-12
Practice Note
CNS oncology, genitourinary cancer, head and neck cancer, intensity modulated radiation therapy, lung tumors, prostate brachytherapy, stereotactic radiosurgery.

LESLIE A. JARVIS, MD, PhD
Residency
University of Arizona Health Sciences Center, Tucson, AZ, Radiation Oncology, 2008-12
Practice Note
CNS oncology, genitourinary cancer, head and neck cancer, intensity modulated radiation therapy, lung tumors, prostate brachytherapy, stereotactic radiosurgery.
Affiliations

A teaching and research hospital of The Geisel School of Medicine at Dartmouth.

Optics in Medicine Laboratory at Dartmouth

A program comprised of researchers at the Thayer School of Engineering at Dartmouth, the Geisel School of Medicine at Dartmouth, and Dartmouth’s Arts and Sciences Graduate Programs. The Optics in Medicine Laboratory studies aspects of tissue spectroscopy and imaging using both visible and near-infrared light.

Designations

Norris Cotton Cancer Center is one of only 41 centers nationwide to earn this designation.

NCI Center of Quantitative Imaging Excellence

One of 15 institutions identified by a National Institutes of Health peer review process for excellence in conducting clinical trials in which there is an integral molecular and/or functional advanced imaging endpoint in brain and body imaging.

Dartmouth-Hitchcock Medical Center has earned the Joint Commission’s Gold Seal of Approval.

Clinical Research Memberships

The Alliance for Clinical Trials in Oncology represents the merger of three legacy cooperative groups: American College of Surgeons Oncology Group (ACOSOG), Cancer and Leukemia Group B (CALGB), and North Central Cancer Treatment Group (NCCTG).

NRG Oncology represents the merger of three unique and complementary research areas: National Surgical Adjuvant Breast and Bowel Project (NSABP), Radiation Therapy Oncology Group (RTOG), Gynecologic Oncology Group (GOG).

ECOG-ACRIN Cancer Research Group is a cooperative group that was formed by the merger of the Eastern Cooperative Oncology Group (ECOG) and the American College of Radiology Imaging Network (ACRIN).

Cancer Immunotherapy Consortium, an international association of the Cancer Research Institute, comprised of pharmaceutical/biotech companies and academic institutions that share a common interest in immunotherapy research and development. Cancer Immunotherapy Trials Network (CITN) employs the collective expertise of top academic immunologists to conduct multicenter research on immunotherapy agents capable of unleashing patient immunity to fight their cancer.