



Fetal and Neonatal Care

Division of Newborn Medicine



**STELLA
KOUREMBANAS, MD**
Chief

Boston Children's Hospital's Division of Newborn Medicine is the center of the Harvard Program in Neonatology and the home of the Harvard Neonatal-Perinatal Medicine Fellowship Training Program. Specialists in the division provide state-of-the-art, comprehensive specialty care to newborn infants with a wide range of congenital and acquired conditions. We care for extremely premature infants as early as 23 weeks' gestation, up to term infants with a variety of medical and surgical illnesses.

Scheduling

Boston Children's Hospital
300 Longwood Avenue
Boston, MA 02115
617-919-2358 | bostonchildrens.org/newborn

International

For families residing outside of the United States, please contact Boston Children's International Health Center:
+1-617-355-5209 | bostonchildrens.org/international
international.center@childrens.harvard.edu

Programs

Boston Children's Neonatal Intensive Care Unit (NICU)
An innovative environment where a highly specialized multidisciplinary team provides technologically advanced therapies and family-centered care for infants from local, regional, national and international points of origin. It is also one of the training sites for neonatal-perinatal fellows in the Harvard Program in Neonatology.
617-355-8076 | bostonchildrens.org/newborn

Boston Children's Infant Follow-Up Program
Designed for infants born very prematurely, weighing less than 3.3 pounds, and at high risk for developmental and motor delays as well as other problems resulting from prematurity. Our program follows children from the time of discharge until they reach 3 to 4 years of age. The multidisciplinary Infant Follow-Up team includes pediatricians, neonatologists, pediatric psychologists, physical therapists, social workers and, if needed, pediatric neurologists.
617-355-6622 | bostonchildrens.org/followup

Community Newborn Medicine Program
Cares for ill and convalescent newborns in a family-centered, community setting. Our community-based Newborn Medicine faculty provide advanced newborn therapies in NICUs and Special Care Nurseries in several suburban medical centers that are affiliated with Boston Children's.

Training

Through a curriculum that emphasizes individual goals, our Neonatal-Perinatal Medicine Fellowship Training Program prepares post-residency fellows for a successful career in academic neonatology. Our clinical curriculum and training facilities provide the trainee with a comprehensive clinical experience in the four Harvard Hospital Neonatal Intensive Care Units: Boston Children's Hospital, Brigham and Women's Hospital, Beth Israel Deaconess Medical Center and Massachusetts General Hospital. Research training begins during the fellowship and continues during junior faculty years. Trainees can conduct research in any of Harvard University's schools or institutions.

bostonchildrens.org/fellowship

Research

The research interests of the Division of Newborn Medicine's faculty can be grouped into three broad areas:

Developmental biology

- Molecular biology of congenital myopathies
- Genomics of neonatal lung diseases
- Epigenetic mechanisms during development
- Molecular biology of histone modification

Clinical and translational investigation

- Stem-cell-based therapy for pulmonary hypertension, bronchopulmonary dysplasia and sepsis
- Advanced neuroimaging technologies to map the physiologic signature of the developing brain

Epidemiology and health policy

- Determination of the developmental outcomes of premature infants and the effects of early interventions, including postnatal weight gain as a predictor of later childhood cardiovascular and neurologic health (blood pressure and IQ)

Highlights

- Ranked no. 1 in pediatric neonatology by *U.S. News & World Report* in 2013-2014
- 24-bed tertiary NICU
- 650 critically ill infants requiring complex medical and surgical care are treated in the NICU each year
- Four community hospitals' special care nurseries are affiliated with Boston Children's
- Two community hospitals' NICUs are affiliated with Boston Children's
- Infant Follow-Up Program includes specialists from Boston Children's, Beth Israel Deaconess Medical Center and Brigham and Women's Hospital
- Newborn Medicine shares close clinical and academic affiliations with several excellent Level III maternity-based newborn units

Fetal-Neonatal Neuroimaging and Developmental Science Center



P. ELLEN GRANT, MD
Director

Boston Children's Hospital's Fetal-Neonatal Neuroimaging and Developmental Science Center brings together physician-scientists from multiple fields to further the capabilities of both neuroimaging modalities and the analysis performed on neuroimaging data. The center's clinical aim is to improve the diagnosis, care and ongoing management of children with neurologic illness or injury.

Contact

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International

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+1-617-355-5209 | bostonchildrens.org/international
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Research

Research at the center examines the use of magnetic resonance imaging (MRI), magnetoencephalography (MEG) and near-infrared spectroscopy (NIRS) across multiple subspecialties, with an eye toward improving the technology and better interpreting the data it collects. Multidisciplinary researchers are guided by a deep understanding of the fetal, newborn, infant and toddler brain, including its rapid pace of anatomic and physiologic change, its plasticity and—in the case of very young children—its inaccessibility to standard cognitive and neurological tests. The multiple modalities employed by the center are safe and provide the most sophisticated means of monitoring brain health and development.

The translational aim of our research is to permit clinicians, with the help of enhanced hardware and software, to evaluate the structures and physiological health of brain regions that promote developing functions. This will allow clinicians to better predict function in individual children, as well as guide treatment options.

As a result of such research, Boston Children's has made or is in the process of making several improvements to its clinical care, including:

- Custom coils and sequences for MRI studies of infants and children
- Introduction into the NICU of a small MRI system to detect brain injury during the critical newborn period
- Bedside near-infrared spectroscopy equipment that, unlike commercial devices, will provide quantitative measures of cerebral blood volume, blood flow, oxygen saturation and oxygen consumption
- Limiting sedation for pediatric imaging studies
- High-performance computing capabilities and Web-based tools for clinicians and clinician-scientists to access innovative MRI post-processing tools
- Child-size MEG system

Research opportunities

Opportunities for postdoctoral research exist for neurologists, neuroradiologists, neonatologists and newborn medicine specialists, as well as for computational scientists and engineers.

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Highlights

- A nearly \$4 million project, funded by the National Science Foundation, to design and build the first MEG system for infants and young children
- The establishment of oxygen consumption measures, as opposed to oxygen saturation, as the superior marker for brain development in pre-term neonates
- A NIRS program to monitor the effects of induced hypothermia in treating brain injuries
- A NIRS program to determine early bedside markers of brain injury
- A combined NIRS and MRI program to study the effects of congenital heart disease on the developing brain
- An MRI program to measure developing connectivity
- Quantification and comparison of gyral folding patterns
- Early detection of fetal brain abnormalities
- Development of fetal motion mitigation and physiological measures for MRI
- High-resolution imaging of pathological specimens with immunohistochemical correlation
- BabyMEG—the first pediatric magnetoencephalographic system in the world—which can non-invasively measure and localize the activity of the developing brain, as if the sensors were placed above an exposed cerebral cortex
- A second-generation, whole-head BabyMEG system with 379 channels will be installed beside the NICU in 2013, fostering the development of new diagnostic methods for neonatal neurological disorders
- The establishment and maintenance of the first high-performance computing cluster at Boston Children's, used for computational research and analysis of fetal and neonatal neuroradiology, as well as for fostering collaborations across the hospital
- Innovative visualization of 3D imaging data for Web browsers and mobile platforms
- Collaborative, open-source and open-research-driven software development

Center for Bladder Exstrophy



JOSEPH G. BORER, MD
Director

Boston Children's Hospital's Center for Bladder Exstrophy is known internationally for its pre-eminent care and support of children with bladder exstrophy and their families.

Scheduling

Boston Children's Hospital

300 Longwood Avenue, Hunnewell 3
Boston, MA 02115
617-355-7796 | bostonchildrens.org/exstrophy

International

For families residing outside of the United States, please contact Boston Children's International Center:

+1-617-355-5209 | bostonchildrens.org/international
international.center@childrens.harvard.edu

Areas of expertise

- Ranked no. 1 in pediatric urology by *U.S. News & World Report* in 2013-2014
- Our Exstrophy Support Group meets several times each year, giving families a place to learn about the condition and its management and to receive emotional support. The group also gives parents and children the opportunity to meet others who have shared similar experiences.
- Boston Children's preferred method of surgical treatment is complete primary repair of exstrophy to allow earlier normal bladder function and optimal bladder growth and development. After surgical repair, the clinical team, parents and child share the responsibility of lifelong follow-up care.

Fetal Cardiology Program



WAYNE TWORETZKY, MD
Director

In conjunction with Boston Children's Advanced Fetal Care Center, the program provides the highest level diagnostics, counseling and therapeutics for expectant mothers and fetuses affected by congenital heart disease. Our team routinely employs the most advanced and accurate fetal imaging modalities, including fetal echocardiograms, fetal ultrasounds and fetal magnetic resonance imaging.

To date, Boston Children's has performed more than 160 fetal cardiac interventions; we remain the largest and most experienced fetal cardiac intervention program in the world. Our interventions include fetal aortic valvuloplasty to prevent *in utero* progression of aortic stenosis to hypoplastic left heart syndrome, fetal pulmonary valvotomy to promote right heart growth in pulmonary atresia with intact ventricular septum, and fetal atrial septostomy in hypoplastic left heart syndrome with intact or highly restrictive atrial septum.

Scheduling

Boston Children's Hospital

300 Longwood Avenue
Boston, MA 02115
bostonchildrens.org/heart
617-355-HART (617-355-4278)
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International

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Highlights

- Ranked no. 1 in pediatric cardiology and heart surgery by *U.S. News & World Report* in 2013-2014
- More than 160 fetal cardiac interventions performed to date
- Researching and pioneering new fetal techniques and novel procedures to treat other types of potentially lethal heart disease.

Fetal-Neonatal Neurology Program



JANET S. SOUL, MD
Director

Boston Children's Hospital's Fetal-Neonatal Neurology Program is one of the country's leading and largest clinical programs dedicated to early-life neurology. It is designed for the evaluation and management of infants and children with congenital neurological problems, or those who have suffered neurological injury during the fetal or newborn period. Through regular evaluations—in combination with advanced electrophysiology, laboratory and imaging studies—neurologic disorders and developmental delays or impairments are identified as early as possible, and appropriate therapies and interventions are initiated.

Scheduling

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International

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international.center@childrens.harvard.edu

Research

The Fetal-Neonatal Neurology Program is currently involved in research focused on:

- A National Institutes of Health-funded trial of a novel medication to treat neonatal seizures
- Outcome of hypoxic-ischemic encephalopathy in term newborns, including studies of therapeutic hypothermia early prognostic indicators
- Cerebral visual impairment in children born pre-term with white matter injury
- Etiology and outcome of disorders such as neonatal intraventricular hemorrhage and stroke, intrauterine growth retardation and congenital infections
- Basic science research into the etiology and prevention of white matter injury in pre-term newborns
- *In utero* brain malformations and injuries, including dysgenesis of the corpus callosum, twin-twin transfusion syndrome, ventriculomegaly, fetal hemorrhage and stroke

Training

Our program offers a clinical research fellowship in neonatal neurology that has trained six fellows to date.

Highlights

- Ranked no. 1 in pediatric neurology and neurosurgery by *U.S. News & World Report* in 2013-2014
- Dedicated neonatal neurologists with broad clinical and research expertise
- Diagnoses and treats newborns in the intensive care units of Boston Children's, Brigham and Women's Hospital and Beth Israel Deaconess Medical Center, both as inpatients and outpatients
- Diagnoses and treats newborns whose parents were seen for fetal neurologic consultation in Boston Children's Advanced Fetal Care Center
- Works in close consultation with each child's family, primary care provider, Early Intervention Program and other community agencies
- As a multidisciplinary program, collaborates with developmental psychologists, physical therapists, communication professionals, social workers and other pediatric subspecialists at Boston Children's

Areas of expertise

Our team evaluates and cares for fetuses with a wide range of neurologic conditions, including:

- Brain malformations (e.g., holoprosencephaly, polymicrogyria and dysgenesis of corpus callosum)
- Congenital/*in utero* infections (e.g., cytomegalovirus and toxoplasmosis)
- Newborn seizures
- Hypoxic-ischemic encephalopathy and brain injury
- Stroke (fetal or neonatal)
- Periventricular leukomalacia (white matter injury) in pre-term newborns
- Intracranial hemorrhage, including intraventricular hemorrhage
- Meningitis and encephalitis in the newborn
- Congenital or newborn hydrocephalus
- Macrocephaly and micrencephaly
- Plagiocephaly and torticollis
- Brachial plexopathy (Erb's palsy)