

Neuroimaging Training in Pediatrics and Brain Development



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Goal

The goal of this postdoctoral program is to provide training in the fundamentals of neuroimaging and analysis as it specifically relates to pediatric neurological disorders, as well as applications of advanced neuroimaging for research in normal and abnormal brain development. The unique focus of this program on pediatric and developmental neuroimaging distinguishes it as the only NIBIB training program specifically aimed at improving child health; highlighting its relevance.

Abstract

- Neuroimaging is an essential tool for noninvasive studies of brain development and neurological disorders in children. As new noninvasive methodologies emerge for neuroimaging, our program: "Neuroimaging Training in Pediatrics and Brain Development" continues to provide a unique training opportunity for imaging researchers in the use of these methodologies to investigate brain development and central nervous system disorders affecting children. Three postdoctoral trainees have participated in the training program during the first five years with support from this T32 grant.
- Our postdoctoral training program serves eligible scientists from backgrounds in Biomedical Engineering, Physics, Neuroscience or other appropriate fields, to obtain integrated training in advanced neuroimaging methodology uniquely focused on translational neuroscience in pediatrics. Didactic and laboratory training experiences are included in the training plan. Trainees will follow a multi-disciplinary curriculum designed to expose them to advanced imaging methods, functional neuroanatomy, biomedical research design, biostatistics, research ethics, research management, scientific writing and other elements necessary to embark on a successful independent academic career in pediatric neuroimaging research. Trainees will also participate in two short- and one long-term laboratory rotation where they will conduct neuroimaging research under the guidance of NIH-funded training grant faculty mentors. During the second year of training, the trainees will submit a "Pathway to Independence" (K99/R00) application to NIH under the mentorship of one of the training faculty with the goal of transitioning to an independent research career in developmental neuroimaging. Cincinnati Children's Research Foundation and the University of Cincinnati comprise a preeminent environment combining all the expertise and resources needed for "Neuroimaging Training in Pediatrics and Brain Development".

Timeline showing the number of postdoctoral trainees projected for each year of the continuation. We are planning to train a total of 5 postdoctoral trainees over the next 5 year period. Each trainee will receive 2 years of NRSA stipend support from the T32 grant.

Post Doc	Year	1	2	3	4	5
A						
B						
C						
D						
E						

Theme

- Future advances in neuroimaging will depend on providing integrated training of scientists in both advanced imaging methods and in the biology and behavior of the developing brain and how these processes differ from the response of the mature or aging brain to disease and recovery. The Imaging Research Center (IRC) has a long history of training in pediatric neuroimaging that has naturally evolved into the Pediatric Neuroimaging Research Consortium (PNRC). This includes training of postdoctoral fellows and Ph.D. candidates from a number of disciplines including Biomedical Engineering (BME), Physics, Radiological Science, Electrical & Computer Engineering and Neuroscience.

Rationale

- The rationale of the program is to further develop our focus on *Neuroimaging Training in Pediatrics & Brain Development* and to train scientists at the postdoctoral level who will pursue successful careers translating neuroimaging technologies from research to treatment of pediatric brain disease in an academic setting.
- With this rationale in mind the goals of the proposed training program are:
 - To provide integrated instruction in application-oriented neuroimaging research aimed at developmental neuroscience and translation to pediatric clinical applications.
 - To provide rigorous research training that emphasizes advanced neuroimaging approaches to understanding nervous system function, development and disorders in children.
 - To inculcate the concept of collaborative, multidisciplinary research between imaging scientists and clinical pediatric neuroscientists as a team approach.

Program

The postdoctoral training program comprises didactic and research training components with a strong emphasis on development of independent thinking and writing skills aimed at producing (at least 3) scientific manuscripts and culminating in a grant application to NIH for independent funding for pediatric imaging research.

The complete training program is outlined in the Table below:

Months	Didactic Component	Research Component	Written Component
Phase I 4-6 months	<ul style="list-style-type: none"> Neuroimaging Software Training Neuroimaging Seminars Series 20/26BME705 - Research Design Ethics in Human Subjects Research 	<ul style="list-style-type: none"> 1st Short-term research rotation Quarterly report #1 	<ul style="list-style-type: none"> Manuscript #1 - Supporting author IRB Protocol - Collaborator
Phase II 4-6 months	<ul style="list-style-type: none"> 20/26BME611- Imaging w/o Radiation 26NS812 - Functional Neural Systems 26GNTD730 - Ethics in Research 	<ul style="list-style-type: none"> 2nd Short-term research rotation Scientific Presentation #1 Quarterly report #2 	<ul style="list-style-type: none"> Manuscript #2 - Contributing author Grant Proposal #1 - Collaborator (R01) Manuscript reviewing
Phase III 12-18 months	<ul style="list-style-type: none"> 20/26BME712: Advanced Topics in MRI Neuroimaging Seminars Series Research management training 26 NS 842 - Neurodevelopment Regeneration and Plasticity Grant Writers' Seminars and Workshops 	<ul style="list-style-type: none"> Long-term research rotation Scientific Presentation #2 Quarterly report #3 Scientific Presentation #3 Quarterly report #4 Scientific Presentation #4 Quarterly report #6 	<ul style="list-style-type: none"> Manuscript #3 - Primary author IRB Protocol - P.I. Grant Proposal #2 - P.I. (F32 or K00/99)

Training Program Administration

Leadership Team:
 Scott K. Holland, Ph.D.
 William S. Ball, M.D.
 Joseph Broderick, MD
 Charles Vorhees, Ph.D.
 Steven Strakowski, M.D.

Post-Doctoral Committee:
 Scott K. Holland, Ph.D.
 Jeff Epstein, Ph.D.
 Hermine Brunner, M.D.
 Diana Lindquist, Ph.D.
 Jing Huei Lee, Ph.D.
 Shari Wade, Ph.D.

Administrative Coordinators:
 Co-Director: William S. Ball, M.D.
 Prog.Coord.: Susan Moore
 Bus. Dir. PNRC: Hollie Kunkel
 Bus. Mngr. IRC: Donna Lyons

Training Faculty

- Program faculty mentors have primary appointments in a number of Departments at the University of Cincinnati. Most are also affiliated with the Pediatric Neuroimaging Research Consortium at Cincinnati Children's Hospital Medical Center (<http://pnrc.cchmc.org>)
- The faculty represent a broad spectrum of research interests in neuroimaging, basic and translational neuroscience.
- The focus of the neuroimaging research of our faculty includes a strong emphasis on applications in pediatrics and brain development, but includes all aspects of Neuroimaging research in young adults
- All 16 of the faculty mentors have active research programs, and all are currently principal investigators of NIH-funded projects.
- Our faculty have strong track records in successfully training predoctoral students and postdoctoral fellows

Training Resources

- Trainees utilize resources for neuroimaging research available throughout University of Cincinnati and Cincinnati Children's Hospital Medical (CCHMC) center including:
- Imaging Research Center (IRC) at CCHMC
 - 3 Tesla Philips Achieva MRI scanners with MR compatible EEG.
 - 7 Tesla small animal MRI scanner
 - Intec small animal CT scanner
 - Extensive computer network and software for neuroimage data analysis
 - Access to clinical pediatric patient populations
 - Center for Imaging Research at UC College of Medicine
 - 4 Tesla Varian MRI scanner with MR compatible EEG
 - 3 Tesla GE MRI scanner
 - Department of Neurology at CCHMC
 - 275 channel CTF MEG scanner
 - Magstim 200® Transcranial Magnetic Stimulator (TMS) Magstim Co., New York, NY, USA)

Current Trainees and Recent Graduates

- Current Trainee - Kenneth Eaton, Ph.D in Biomedical Engineering from Duke University
 - Trained 8/1/06-present
 - Will continue postdoctoral training in Pediatric Neurology at CCHMC 2008-9
 - Preparing K99/R00 application on reliability of fMRI for longitudinal studies in children
- Recent Trainee - Mark DiFrancesco, Ph.D in Physics from Carnegie Mellon University
 - Trained 9/8/2004 - 9/1/2007
 - Currently Assistant Professor of Radiology, University of Cincinnati
 - Funded by NIH-P60-AR047784-06/ R01 and startup package
- Recent Trainee - Weihong Yuan, Ph.D in Biomedical Engineering from Rutgers University
 - Trained 4/15/2004 - 8/30/2005
 - Currently Assistant Professor of Neurosurgery and Radiology, Cincinnati Children's Hospital and UC
 - Funded by McLaurin Foundation and Cincinnati Children's Hospital Trustee Grant