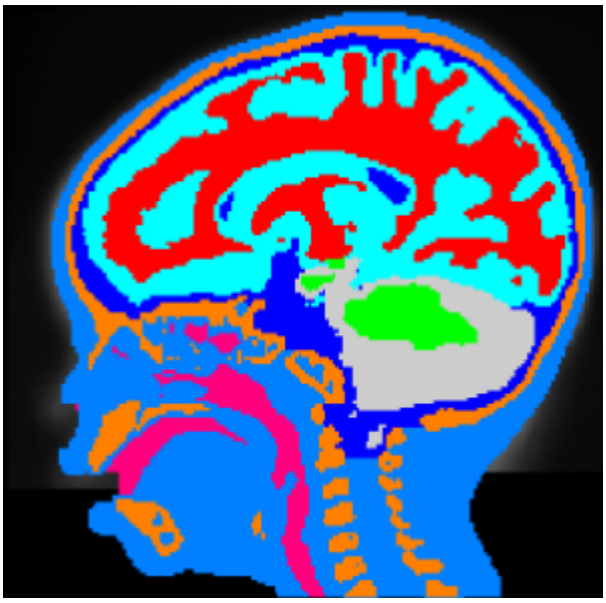
Pediatric Head Modeling Home



While it is well known that the brain undergoes rapid developmental changes from birth to early childhood, remarkably little is understood about the relationship between changes in brain size and composition and normal cognitive development. Yet we now know that several potentially debilitating neurocognitive disorders are a consequence of delays or abnormalities in brain development, making it imperative that we gain a better understanding of the relationship between cognitive and anatomical development. In children, the study of normal cognitive and brain development is best accomplished using non-invasive techniques that are not overly restrictive of movement and do not require ionizing radiation. Of available techniques, electroencephalography (EEG), particularly with the advent of high density sensor arrays, provides the ability to assess cognitive function safely and non-invasively.

Our goal is to develop age-specific pediatric head models to improve current source localization imaging in pediatric populations under the hypothesis that functional localization of cognitively important brain regions and networks requires an accurate model of head tissue geometry and conductivity. We have identified age clusters that differ significantly in measures of brain and skull development. For each cluster, we are building and testing head models that are accurate both in morphological features and in regional differences in tissue conductivity which plays a critical role in the ability to accurately reconstruct brain network activity from EEG signals. Once age-specific average head models have been developed and tested, we will validate their improved accuracy based on neurophysiological data using EEG and functional magnetic resonance imaging methods in children from infancy to young adulthood.

Research supported by NINDS Grant 1 R43 NS67726-0 and NIMH Grant 9R44MH106421-03A1