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Multi-Scale Investigations of Animal Models of Human Disease: The Mouse Birn Project

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The National Institutes of Health is pioneering the use of Grid infrastructure for medical research and patient care through the Biomedical Informatics Research Network (BIRN) Project. BIRN is developing and evolving the hardware, software, and protocols necessary to *share* and *mine* data for both basic and clinical research. Biomedical research groups at 15 institutions are pooling domain expertise, specialized research facilities, instrumentation and computational resources to tackle disease studies of greater scope and complexity than independently possible. Central to the project is the establishment of a scalable infrastructure consisting of advanced networks, federated distributed data collections, computational resources and software technologies. Infrastructure development is led by the BIRN Coordinating Center (BIRN-CC) at the University of California San Diego, working with three nationally distributed neuroimaging test beds; two focused on multi-site studies employing non-invasive imaging of human brains and one conducting multi-scale analysis of mouse models of neurological disease (Mouse BIRN).

The Mouse BIRN is comprised of research teams from the California Institute of Technology, Duke University and the University of California at Los Angeles and San Diego. Its goal is to acquire and mine multi-scale imaging data on the mouse brain and to integrate these with genomic data accumulated at other sites. For each animal model, correlated data is being obtained at two or more sites using whole brain MRI based imaging (Duke and Cal Tech), histological analysis (UCLA) and high resolution light and electron microcopy (UCSD). Protocols and procedures have been established whereby the same animal brain can be imaged non-destructively at Duke and Cal Tech followed by whole brain histology at UCLA or higher resolution examination at UCSD. Through these collaborations, the Mouse BIRN is studying pathological processes in models of relevance to Parkinson's disease, multiple sclerosis and drug addiction, among others.

The data acquired is driving the creation of a visualization and analysis environment where researchers can freely query, explore, analyze and annotate multi-scale and multi-modal brain maps using a distributed database mediation architecture. Each site is creating a database around the specific type of technology used. All data is referenced to an atlas-based coordinate system and to shared ontologies like the UMLS. Researchers are collaborating with scientists at the BIRN-CC to create atlas-based tools for browsing and querying this data. We believe that this explorative environment will provide unique insights into the underlying pathologies present in these animals and will provide a persistent electronic archive of imaging and analysis data from potentially valuable animals.

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