Biomedical Informatics Research Network

a testbed for a biomedical knowledge infrastructure

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BIRN Overview

- Federated database of neuroimaging data
- Fusion of diverse data sources
- Grid access to computational resources
- Datamining
- Scalable, to extend to all NCRR Centers for a full range of biomedical studies

Challenges

- Large data sets
  - ISCAR - information storage, curation, archiving, and retrieval
  - Bandwidth issues
  - Quality control of data only analyzed by machine (audit requirements)
- Data sharing issues (privacy,etc.)

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More Challenges

- Federated DB
  - Integration of disparate sources
  - Accessing legacy systems
  - Knowledge distillation
- Project Coordination
  - Encouraging collaboration
  - Balance centralization vs distribution
  - Role of standards
  - Sociology (ie.,credit, ownership, intellectual property)
  - Project subdivision and optimization

BIRN Project Objectives:

1) establish a stable high performance network linking key NIH / NCRR-supported Biotechnololgy Research Resources (P41) and General Clinical Research Center (GCRC) sites - using Internet 2 & beyond

2) establish distributed and linked data collections for the test bed projects

3) enable distributed heterogeneous "grid-based" computing resources

4) enable data mining from multiple data collections

5) develop a stable software and hardware infrastructure that will allow centers to accumulate larger studies than can be carried out at one site.

BIRN Phases

- Phase I — neuroimaging federation
  - Mouse BIRN
  - Morph BIRN
  - FIRST BIRN
- Phase II — Neuroscience, including physiology, genetics, proteomics
- Phase III— Biomedical Research with broad participation of 25 NIH funding Institutes

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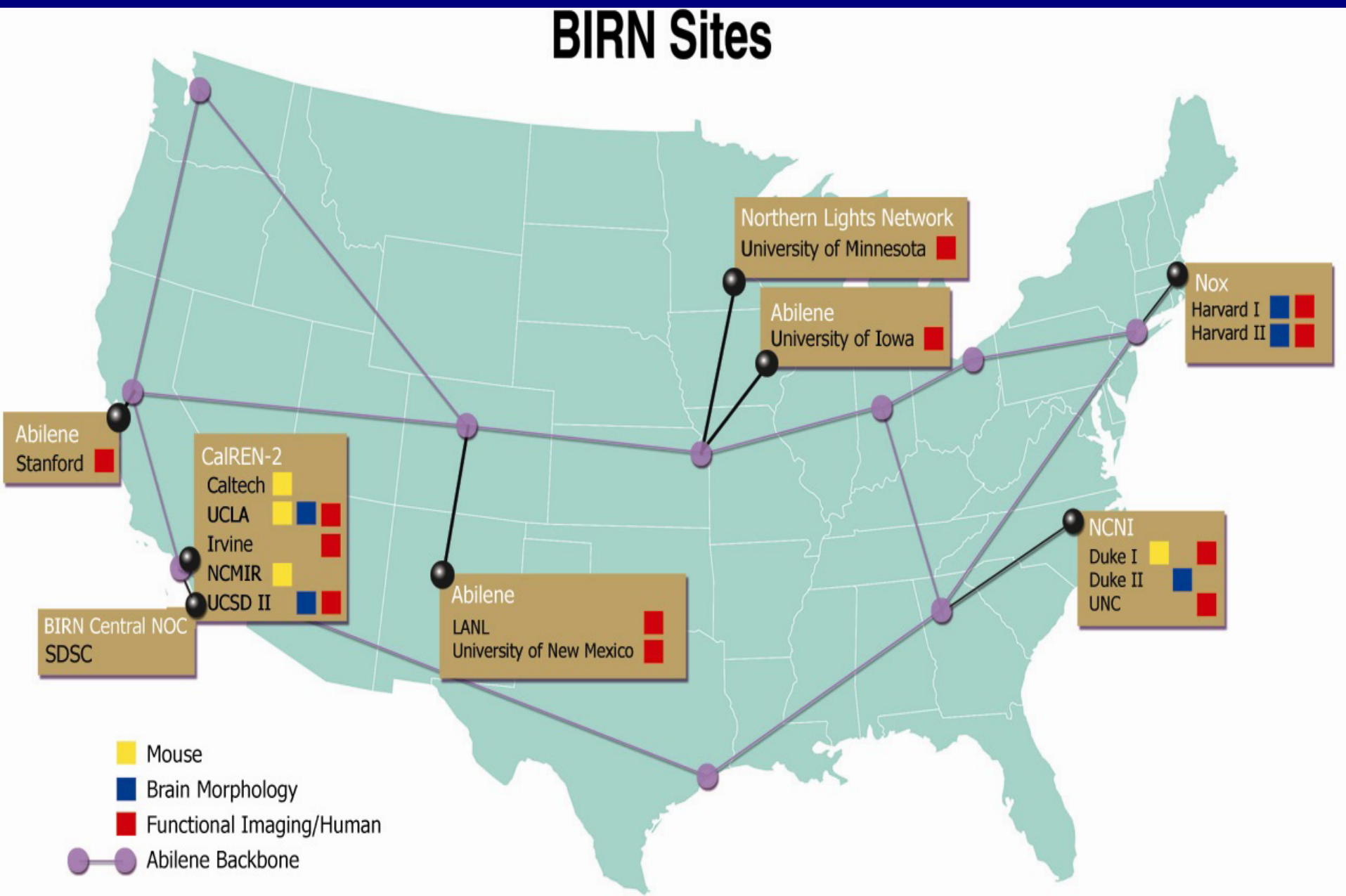
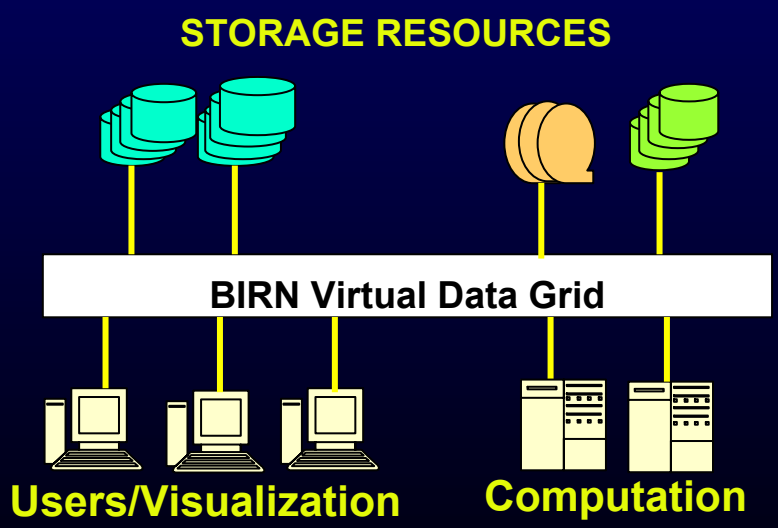
BIRN Sites


Northern Lights Network
University of Minnesota
Abilene
University of Iowa
Nox
Harvard I
Harvard II
Abilene
Stanford
CalREN-2
Caltech
UCLA
Irvine
NCMIR
UCSD II
BIRN Central NOC
SDSC
Abilene
LANL
University of New Mexico
NCNI
Duke I
Duke II
UNC
Mouse
Brain Morphology
Functional Imaging/Human
Abilene Backbone

BIRN Virtual Data Grid w/SRB inside

- Defines a Distributed Data Handling System
- Integrates Storage Resources in the BIRN network
- Integrates Access to Data, to Computational and Visualization Resources
- Acts as a Virtual Platform for Knowledge-based Data Integration Activities
- Provides a Uniform Interface to Users



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Integrating Across Data Sources

- The idea
  - Different models capture correlated but distinct aspects of biological reality
  - How can we express and evaluate queries that compute data across models
- The approach
  - For each source create a knowledge-base of the anatomy of the observations
  - Attach the data of each source to the respective knowledge-base
  - “bridge” the sources by a simple ontological mapping
  - Compute the query across bridged sources

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Getting down to work - BIRN must:

1) establish Network Infrastructure..
2) establish policies and protocols for use of the BIRN infrastructure and operating guidelines.
3) build a Virtual Data Grid (VDG) for the initial projects.
4) develop the data modeling and mediation tools for complex queries.

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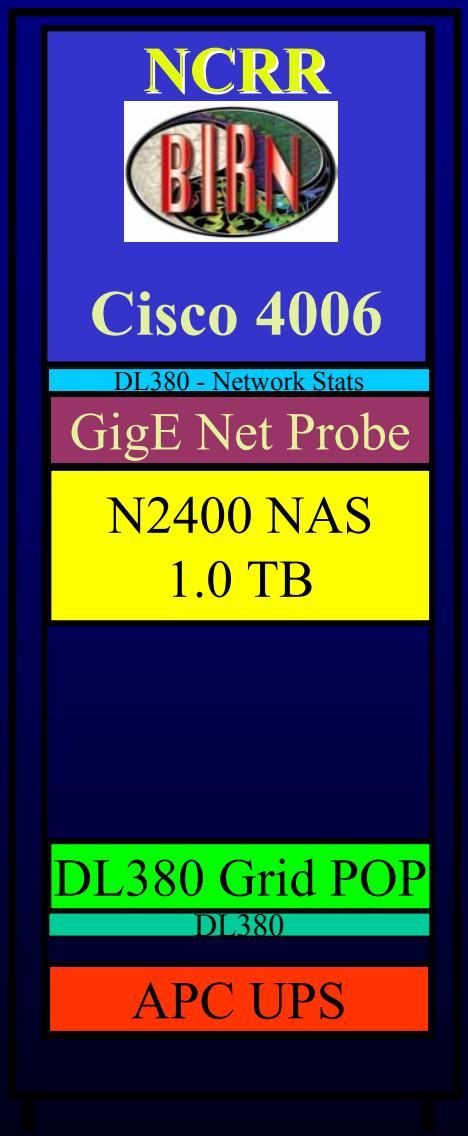
Uniform Hardware for BIRN Sites



- Gigabit/10/100 Network Switch – Cisco4006
- Network Statistics System
- Gigabit Ethernet Network Probe
- Network Attached Storage – Gigabit Ether
  - 1.0 to 8.0 TB
- Grid POP
  - SRB, Globus
  - Dual Processor Linux w/ 1GB memory
- DL 380 General purpose
  - Specialized encryption
- UPS for Rack

Two active BIRN project partnerships, so far:

- **Mouse BIRN -** *Animal Models of Disease / Multi Scale/Multi Method - MS Mouse and DAT KOM (a schizophrenic and otherwise interesting mouse animal model)*
- **Brain Morphology BIRN -** *Neuroanatomical correlates of neuropsychiatric illness (Unipolar Depression, mild Alzheimer's Disease (AD), mild cognitive impairment (MCI)*

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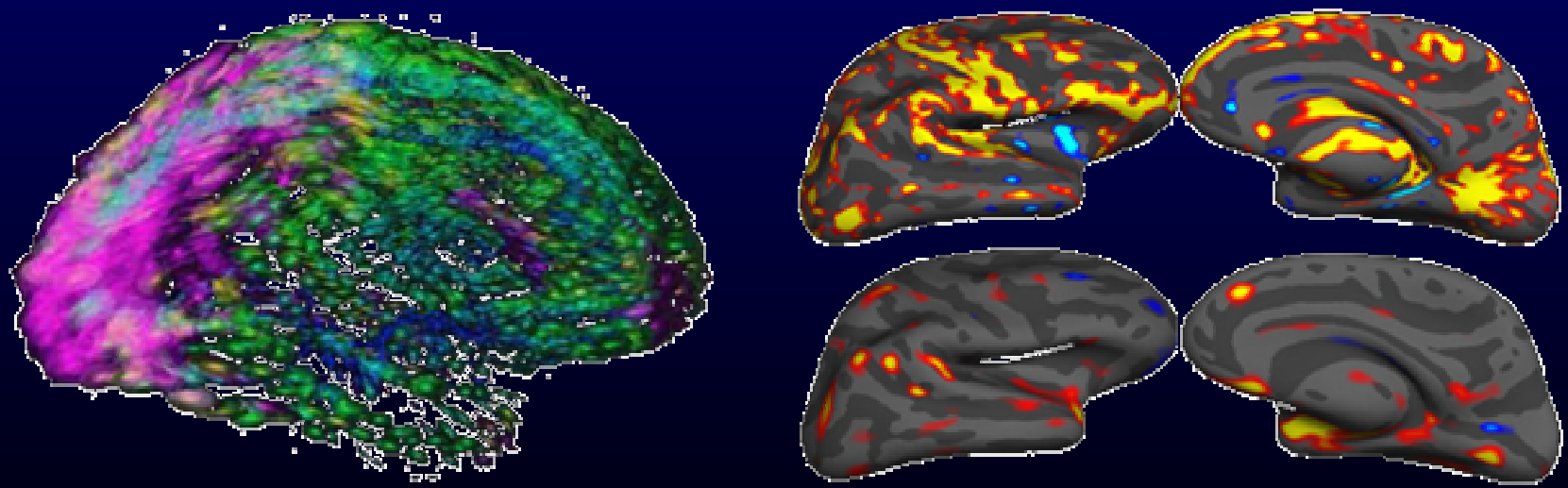
Morphology BIRN

- Combining data from multiple acquisition sites
- Increasing the statistical power for studying relatively rare populations
- Harvard (MGH and BWH), Duke, UCLA, UC San Diego



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Brain Morphology BIRN

Institutional Participants:

- Center for Neuroimaging Technologies, Harvard (Lead Institution)
  Bruce Rosen, PI
- Neuroimaging Analysis Center, Harvard
  Ron Kikinis PI
- Laboratory of Neuro Imaging, University of California Los Angeles
  Arthur Toga, PI
- GCRC @ Duke University, Durham NC
  Ranga Krishnan, PI
- GCRC @ University of California San Diego
  Ed Holmes, PI

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Brain Morphometry BIRN

- Clinical Specific Aims

  Attempt to address questions of the following type:

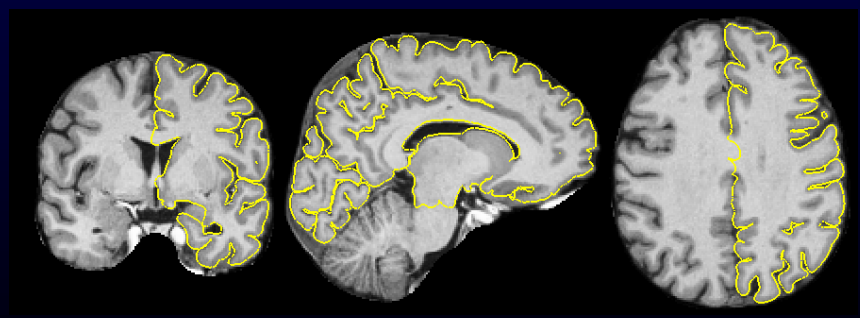
  - Do structural differences contribute to specific symptoms such as memory dysfunction or depression independent of diagnosis?
  - Do specific structural differences distinguish specific diagnostic categories?

- Technological Specific Aims

  Attempt to overcome obstacles to the use of neuroimaging data as quantitative outcome measures for clinical investigation including the issues raised by longitudinal and multi-site studies. In other words- to make the Clinical Specific Aims possible to address.

Harvard

UCLA



Duke

UCSD

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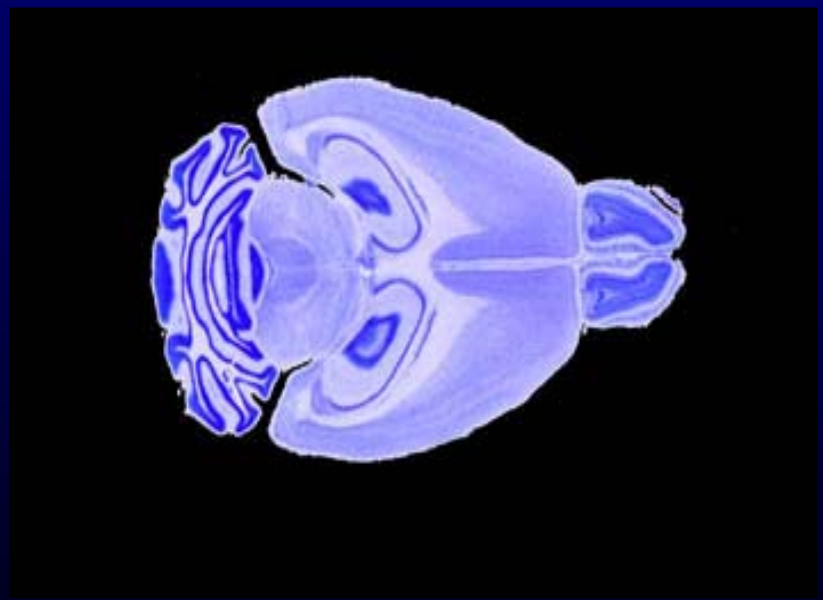
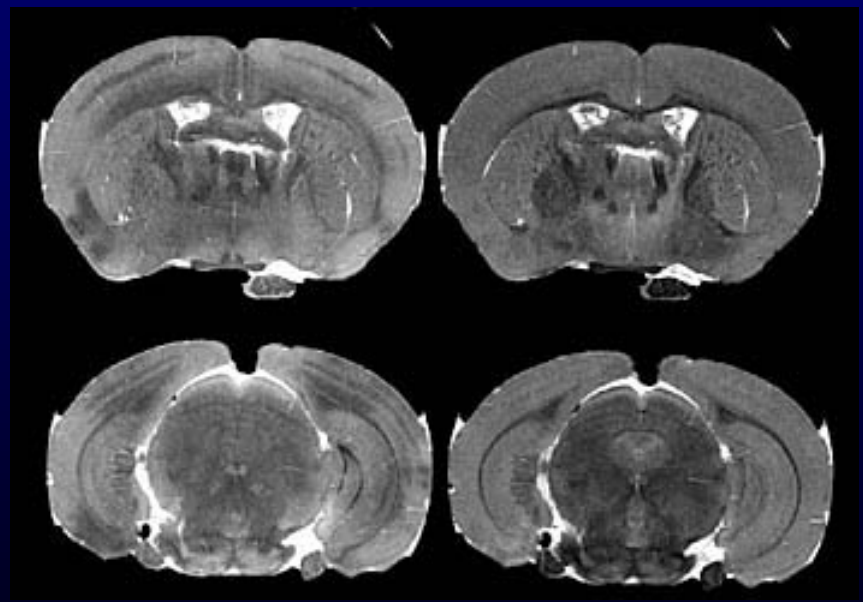
Mouse BIRN

- Looking at disease models within and across individuals
- Looking at different resolutions by combining data from multiple modalities





Duke, UCLA, UC San Diego, Cal Tech

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Mouse BIRN Project

Institutional Participants:

– Center for In Vivo Microscopy, Duke Univ. (Lead Institution)
Allen Johnson, PI

– Laboratory of Neuro Imaging, University of California Los Angeles
Arthur Toga, PI

– MRI Center @ Caltech's Beckman Institute, CalTech
Russell Jacobs, PI

– National Center for Microscopy and Imaging Research, UCSD
Mark Ellisman, PI

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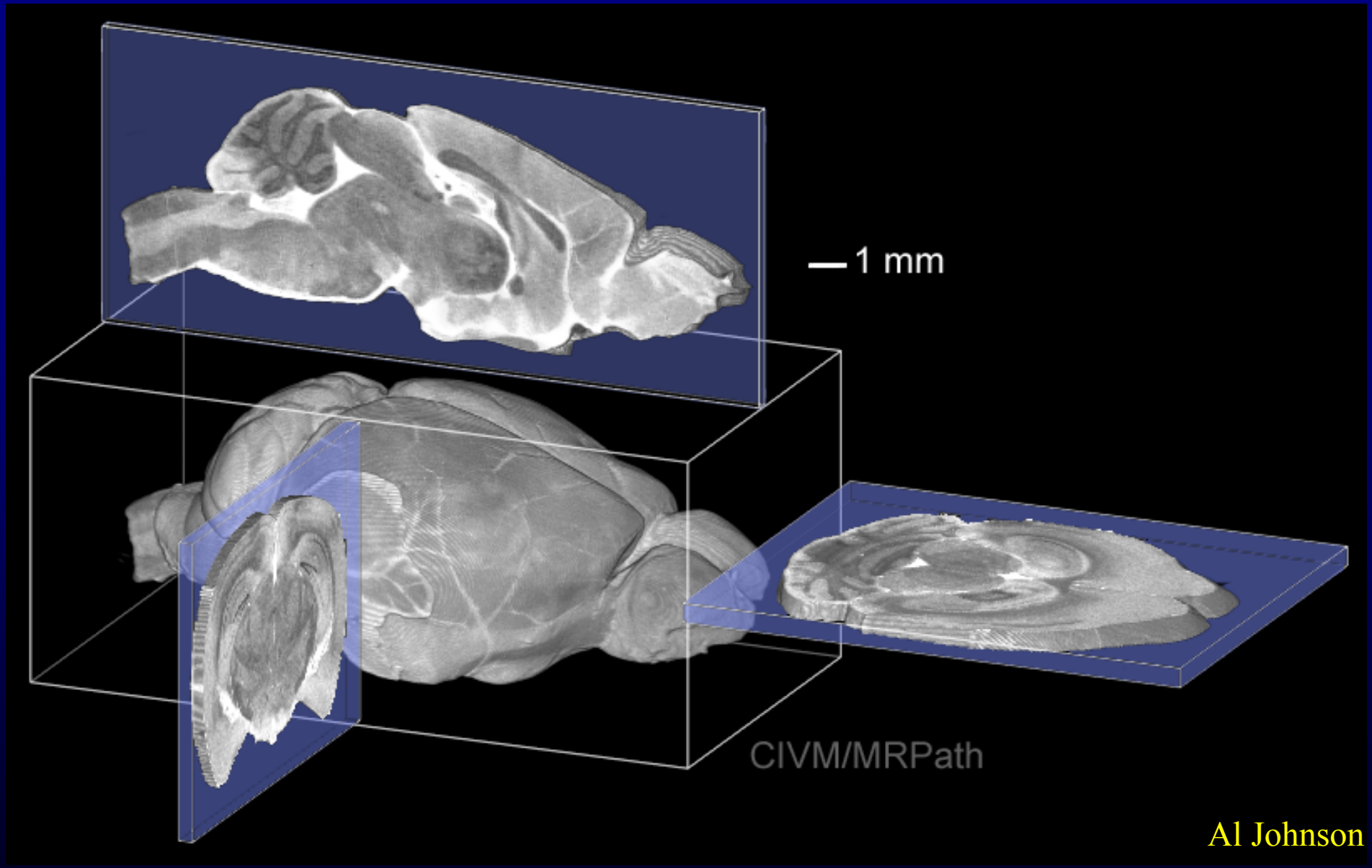

Al Johnson

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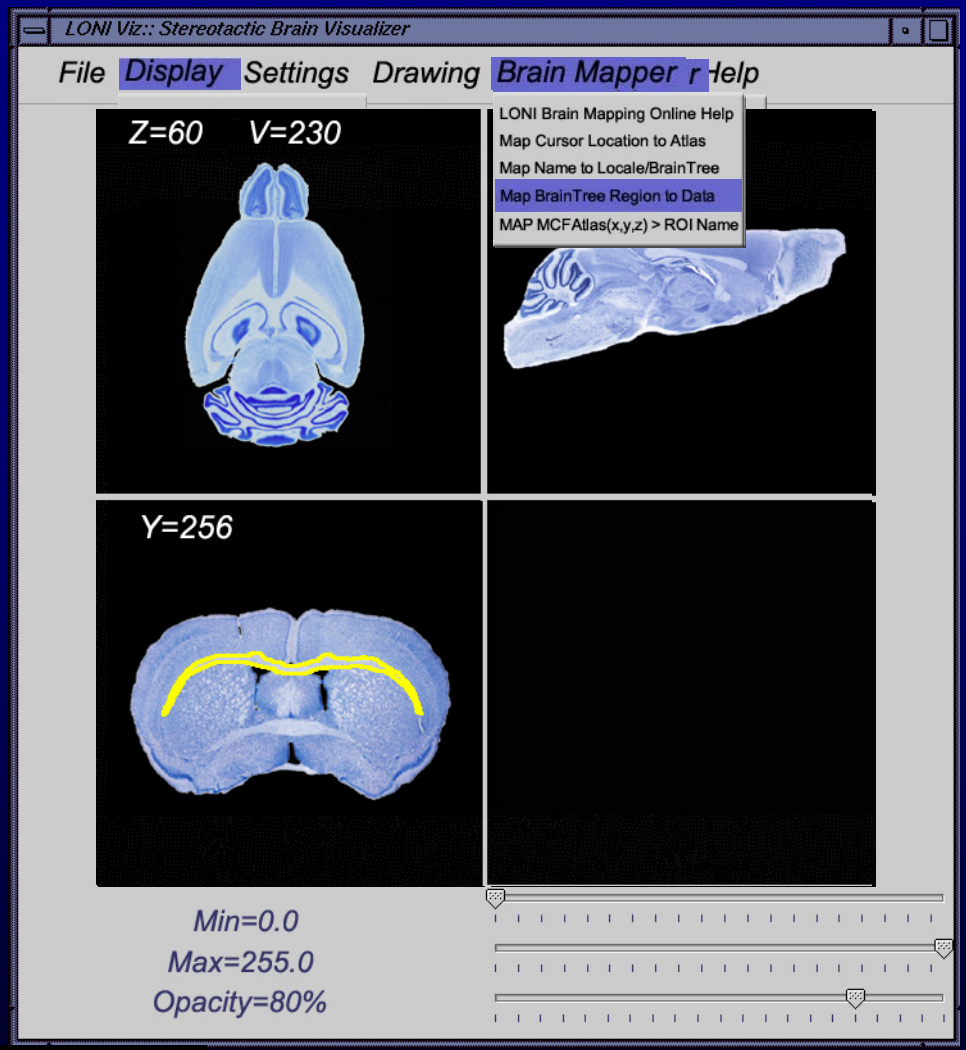
LONI Viz:: Stereotactic Brain Visualizer
File
Display
Settings
Drawing
Brain Mapper
Help
LONI Brain Mapping Online Help
Map Cursor Location to Atlas
Map Name to Locale/BrainTree
Map BrainTree Region to Data
MAP MCFAtlas(x,y,z) > ROI Name
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Y=256
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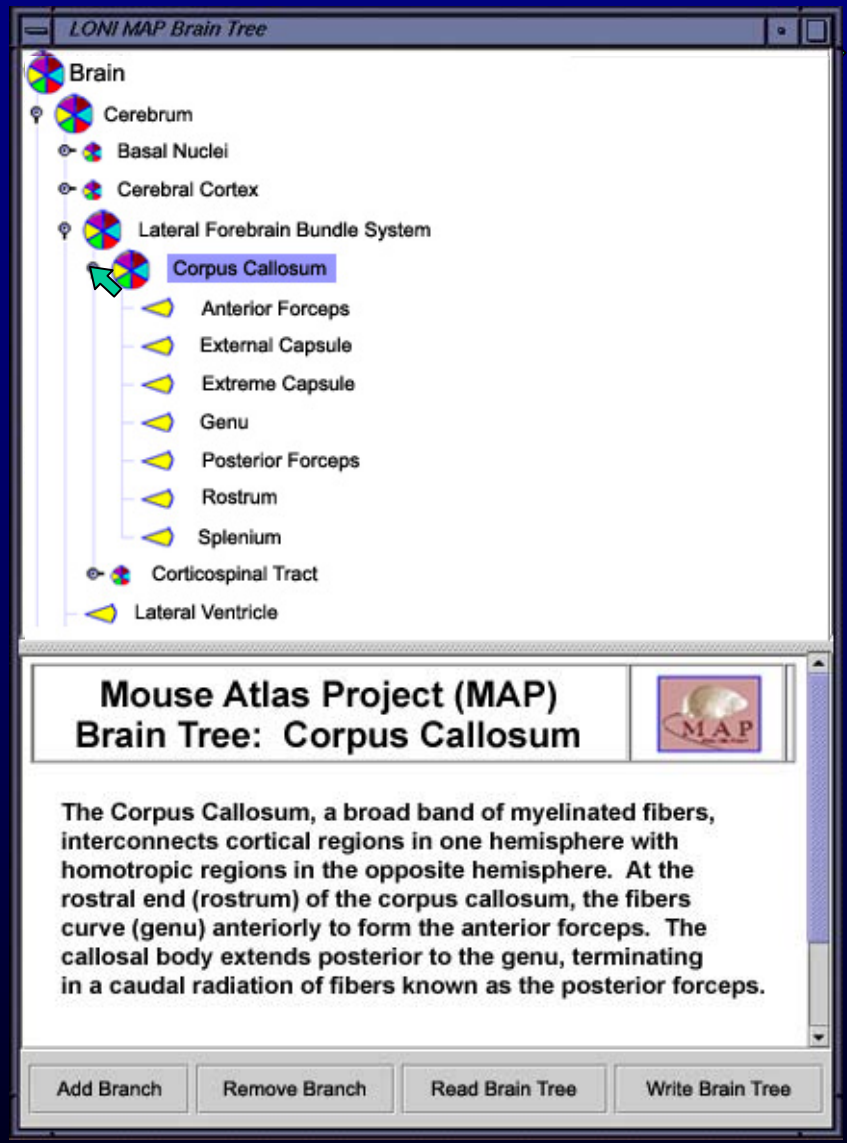
Opacity=80%


LONI MAP Brain Tree
Brain
Cerebrum
Basal Nuclei
Cerebral Cortex
Lateral Forebrain Bundle System
Corpus Callosum
Anterior Forceps
External Capsule
Extreme Capsule
Genu
Posterior Forceps
Rostrum
Splenium
Corticospinal Tract
Lateral Ventricle
Mouse Atlas Project (MAP)
Brain Tree: Corpus Callosum
MAP
The Corpus Callosum, a broad band of myelinated fibers, interconnects cortical regions in one hemisphere with homotropic regions in the opposite hemisphere. At the rostral end (rostrum) of the corpus callosum, the fibers curve (genu) anteriorly to form the anterior forceps. The callosal body extends posterior to the genu, terminating in a caudal radiation of fibers known as the posterior forceps.
Add Branch
Remove Branch
Read Brain Tree
Write Brain Tree


LONI

3/7/02

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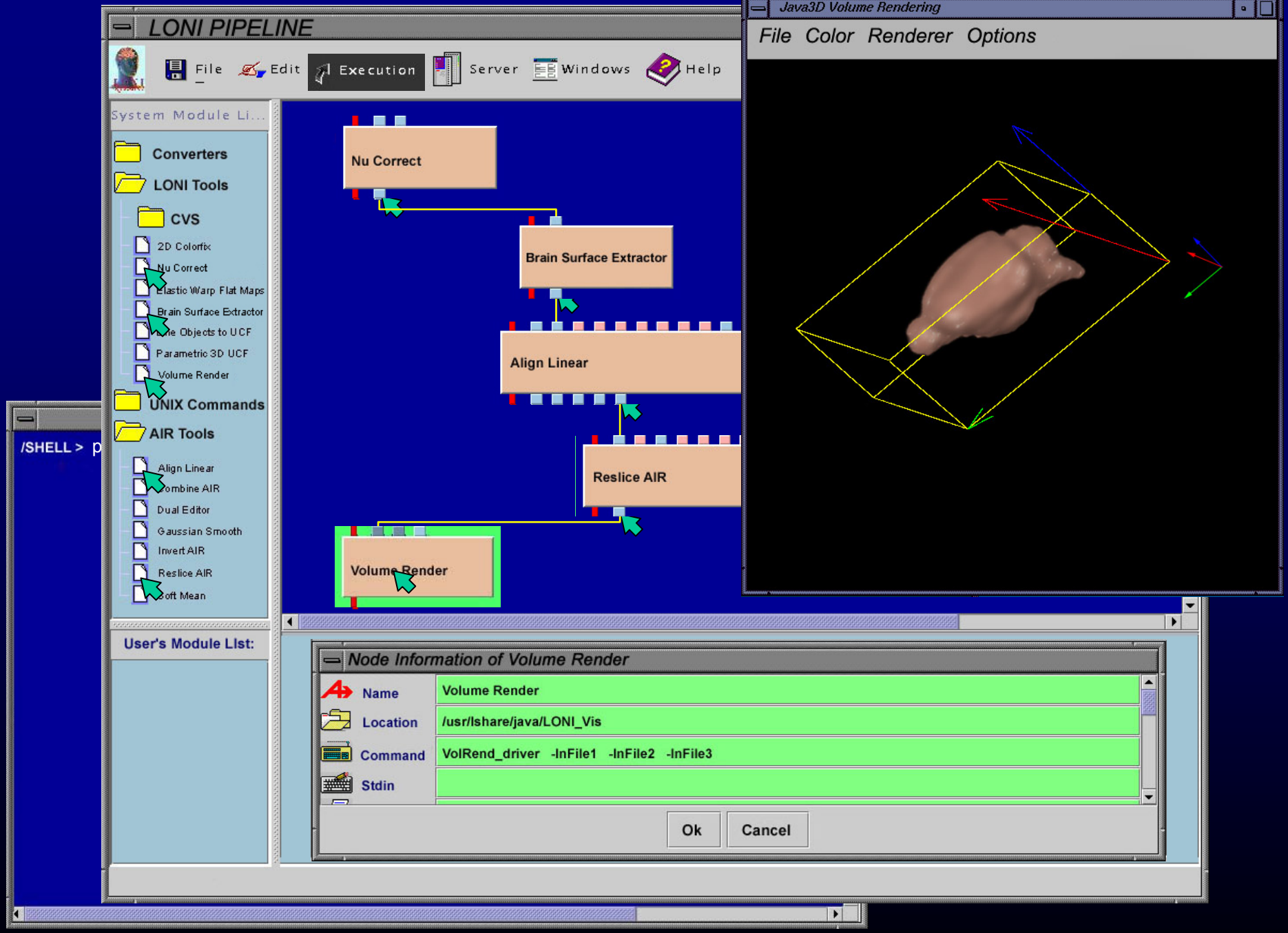
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Converters
LONI Tools
CVS
2D Colorfix
Nu Correct
Elastic Warp Flat Maps
Brain Surface Extractor
Parametric 3D UCF
Volume Render
UNIX Commands
AIR Tools
Align Linear
Dual Editor
Gaussian Smooth
Invert AIR
Reslice AIR
User's Module List:
Nu Correct
Brain Surface Extractor
Align Linear
Reslice AIR
Volume Render
Java3D Volume Rendering
File Color Renderer Options
/SHELL > p
Node Information of Volume Render
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Volume Render
Location
/usr/lshare/java/LONI_Vis
Command
VolRend_driver -InFile1 -InFile2 -InFile3
Stdin
Ok
Cancel

BIRN Future

- Addition of new sites in a rapid, well-defined fashion
- Cross-species integration of data
- Characterization of treatment at multiple levels
- Expand model to other areas of biomedical research