Center for

Computational Biology (CCB)

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www.SHAPEOME.org

www.CCB.ucla.edu

Examples of CCB Collaborations

- Bio-computational modeling of brain tissue exposed to radiation
- Shape Optimizing Diffeomorphisms for Computational Biology
- Computational Mining on Large-Scale fMRI Datasets of Cognition
- Brain vascular architecture and hemodynamics modeling
- Modeling of Multivariate Longitudinal Data in Chronobiology
- High Resolution maps of transcription and transcriptional regulation
- Alternative splicing of eukaryotic introns
- Cardiac Atlas
- Compression Algorithms for Volumetric Medical Images
- Mixture linear mixed model for gene-expression in microarrays
- Biomedical Shape Representation And Analysis
- High resolution brain mapping and connections database
- Genomic Imaging in Extended Pedigrees

Examples of CCB DBP-Specific Collabs

- HIV/AIDS Induced Dementia
- Brain Morphology In Vervet Monkey
- Modeling Of HIV Drug Resistance Evolution
- Deformable Registration Methods
- Phenotypic Shape Variation In Drosophila Wings
- Integrating MEG And Cortical Thickness & Dyslexia
- Deep Brain Stimulation Electrode Placement
- Dynamics Of Cortical Networks
- http://www.CCB.ucla.edu

Types of CCB Collaborations

- **SW Tool Collaborations**: Investigators that download software, materials, tools and resources from the CCB web site and do not require direct contact with any CCB researchers (>1,000)
- (Official) **CCB NCBC-Collaborators**, via the bi-annual RFA/Review process, under the RO1 funding mechanism
- **DBP Collaborations**: Investigators who interact with CCB to focus the Center's computational research on challenging biomedical problems
- **Preliminary Collaborations**: Investigators that have active joint projects with CCB researchers that are not formally funded by the DBP or the NCBC Collaborative RO1 process, yet.

CCB Brochure

Computational Brain Atlas

- Computational Atlas

Interactive environment

Integrating:

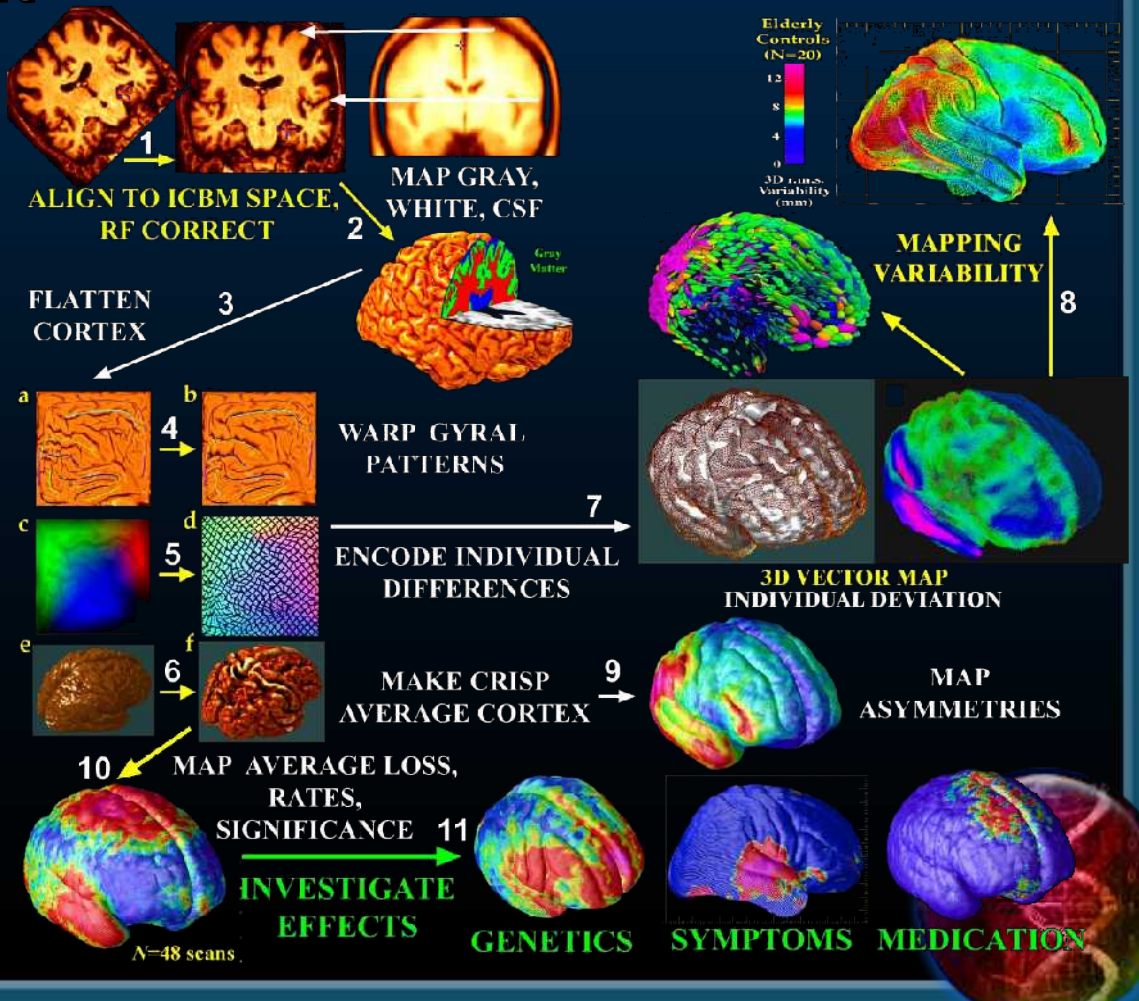
Phenotype

(anatomies, maps, alignments, Demographics)

Genotype,

Shape descriptors &

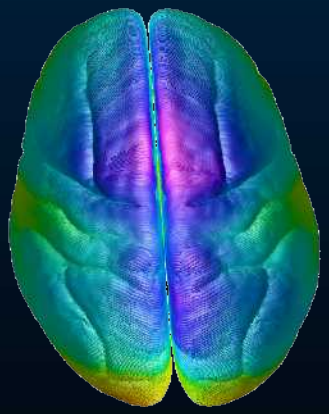
Scientific findings



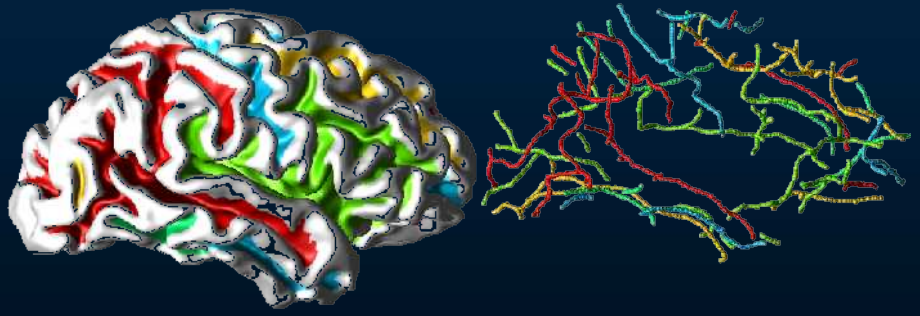
Modeling of Biological Shape

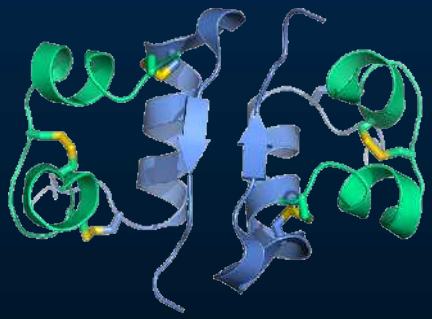
- A unified mathematical framework for modeling & analysis of biological shape, form and size

Canonical Representation of the Cortex

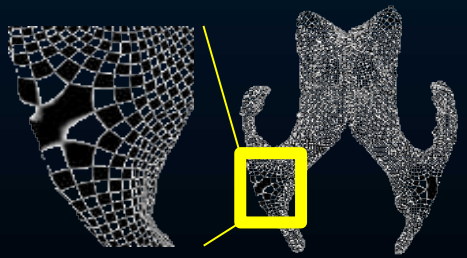


Global and Local Shape Descriptors

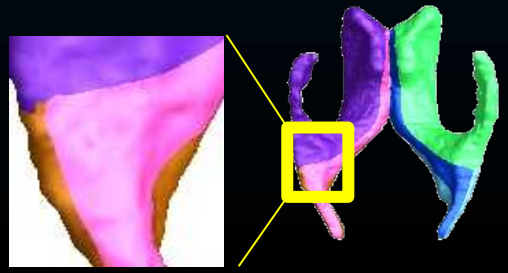


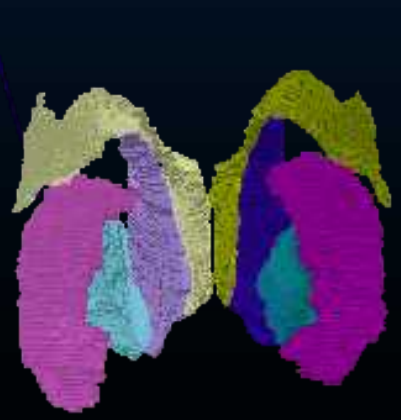


Shape of Insulin: primarily α-helical



Conformal surface representation using intrinsic geometric features

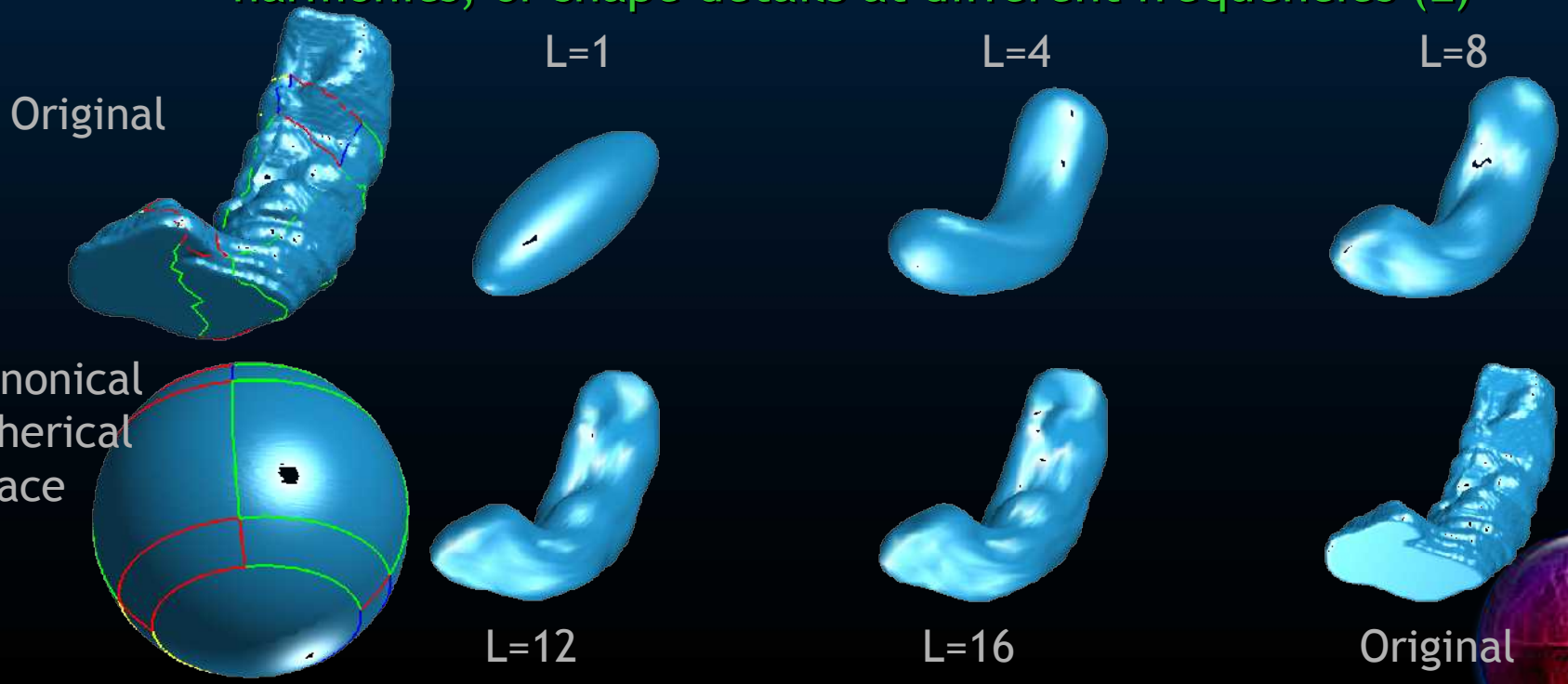




Characteristics of Shapes:
Statistics Features
Geometry
Appearance
Topology
etc.

CCB Shape Modeling

- Multi-resolution representation of biological shape
  - Wavelet-based Representation
  - Fourier Spherical Harmonics
    - Reconstructing Hippocampus from Different spherical harmonics, or shape details at different frequencies (L)



CCB Computational Science

- Direct Surface Mapping
  - Cortex (using manual or semi-automated sulcal boundaries)
  - Subcortical (hippo – automated intrinsic boundaries)
- Automatic mapping of one cortex onto another

CCB, NCBC and Interactions

- NAMIC, http://www.na-mic.org
  - *SLIPIE* (Slicer-LONI Pipeline Integration Environment)
  - Java ← JNI mediation → C/C++ tools
  - Level-set segmentation techniques
- I2B2, http://www.i2b2.org
  - HIVE cells → Neuroscience Pipelines
  - Pipeline modules → HIVE Objects
  - Neurogenetics (e.g., Huntington's), DB & biosequence analysis
- SimBios, http://simbios.stanford.edu
  - Structure Modeling Tools → Pipeline Modules
  - CCB Compute/Viz Libs → SimTK
  - Simulating Temporal Brain Changes
  - Simulating Kinetics using Random Distribution Sampling
- NCBO, http://bioontology.org
  - DBPs, Anatomy and Imaging ontologies
- NCIBI, http://www.ncibi.org
  - Databasing → CCB IDA
- C2B2, http://magnet.c2b2.columbia.edu
  - Molecular data integration → ASAP (annotation)
- NCBC WG's: Resourceome, Sci Ontologies, Systems Biology