

Global Alzheimer's Association Interactive Network



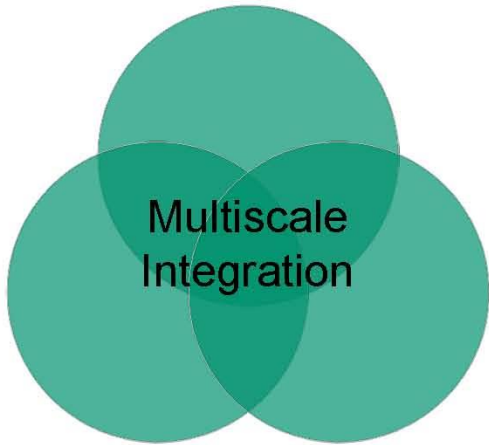
*Transforming the way researchers approach the study of
Alzheimer's disease*

Arthur W. Toga

July 2014



Databases



Tools

Models



Cognition



Whole brain

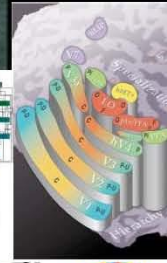
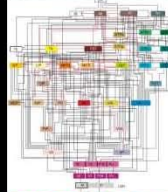
macrocircuits



mesocircuits

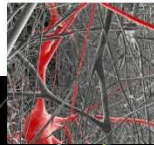


microcircuits

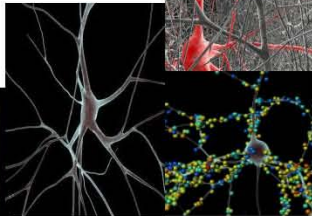


- ✓ Databases
- ✓ Genomics
- ✓ Post-Genomics...
- ✓ Systems Biology...
- ✓ Integrative Biology...
- ✓ Informatics...
- ✓ Neuroscience...
- ✓ Mathematical Modeling...
- ✓ Supercomputer Simulation ...
- ✓ Visualization...
- ✓ Analysis...

synapses



neurons



molecules



Neuroimaging Study Size (Typical)

Year	Size	Equivalent to
1998	54MB	20 copies of War and Peace
2005	67MB	24 copies of War and Peace
2012	531MB	193 copies of War and Peace

Image Data Expansion

Each neuroimaging scan can spawn many derived image leading to exponential growth

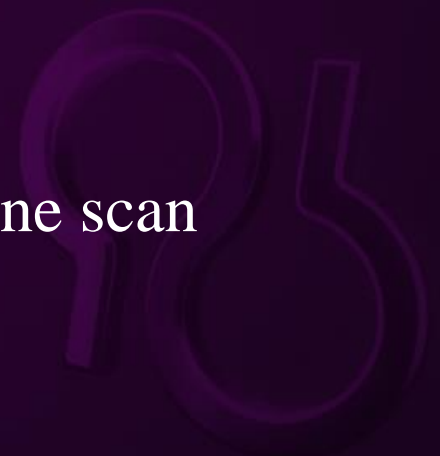
Typical Example:

One 22MB structural scan →

Five preprocessed images (176 MB) →

Eleven postprocessed images (222 MB)

22MB of raw data produces 420MB data for one scan



Genetic Data

- Circa 2010 GWAS Data (per sample)
 - 620,000+ rows of data
 - ~81MB
- 2012: Whole Genome Sequencing (per sample)
 - Standard output from Illumina – multiple files and formats
 - ~250GB per sample
- Example
 - 800 subjects x 250GB = 195TB
 - Time to transfer 195TB:
 - High speed internet (90 Mbit/s): 26 days
 - DSL (45 Mbit/s): 59 days
 - Dial-up (56 kbit/s): 100+ years!



http://www.ppmi-info.org/

Parkinson's Progression Markers Initiative

PARKINSON'S PROGRESSION MARKERS INITIATIVE

Play a Part in Parkinson's Research

About PPMI Access Data & Specimens PPMI News

OUR MISSION

The mission of PPMI is to identify one or more biomarkers of Parkinson's disease progression, a critical step in the development of new and better treatments for PD. This study is being sponsored by **The Michael J. Fox Foundation for Parkinson's Research.**

Subscribe to PPMI e-news. Enter email address.

WELCOME

Welcome to the Parkinson's Progression Markers Initiative (PPMI) website. PPMI is a multi-center, observational clinical study to comprehend PD patients and healthy subjects using advanced neuroimaging and behavioral assessments to identify biomarkers of disease progression. PPMI will be carried out over five years and requires the participation of 400 Parkinson's patients and 400 healthy controls. Data and samples acquired from study participants will be used to create a comprehensive Parkinson's database and scientific community to conduct field-based research. PPMI is made possible by the generous support of the Michael J. Fox Foundation. Learn more about **Who We Are.**

LATEST NEWS FROM PPMI

7:30am ET Saturday and Sunday replay Conversation with Michael J. Fox" on CNN replays a Thursday night special on Gupta in an exclusive interview with Michael J. Fox. Interview in the segment.

MJFF Fall 2010 newsletter focuses on PPMI

The most recent MJFF newsletter highlights study volunteers who are all integral in making PPMI a success.

ADNI | Alzheimer's Disease Neuroimaging Initiative

ADNI Alzheimer's Disease Neuroimaging Initiative

Home About ADNI About Data And Samples Research FAQ

NEWS

The Australian Imaging Biomarkers and Lifestyle Study of Aging (AIBL) Announces its Partnership with ADNI

ADNI announces a new initiative, ADNI "Grand Opportunities" (ADNI GO)

Updated Recall Spreadsheet for MR Images Now Available to Researchers

More

WELCOME

The mission of the Alzheimer's Disease Neuroimaging Initiative (ADNI) is to understand the progression of Alzheimer's Disease in elderly subjects. A major goal of the study is to identify biomarkers of disease progression in the cerebral spinal fluid, and blood biomarkers as potential outcome measures for use in future therapeutic trials.

ADNI Study

Alzheimer's Disease Neuroimaging Initiative

If you are interested in learning more about this endeavor, click on the links below.

About ADNI | About the Study | Volunteer

RELEASING

ADNI-Info

http://www.loni.ucla.edu

Human Connectome Project

Home About Data Informatics Gallery Publications News

The Human Connectome Project (HCP) is a multi-center, multi-national prospective, observational biomarker study of premanifest and early stage HD with no experimental treatment. The project aims to identify biomarkers of disease progression and to validate these as potential outcome measures for use in future therapeutic trials.

ICBM International Consortium for Brain Mapping

ABOUT ICBM RESEARCH RESOURCES DATABASES DOWNLOADS

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BIRN Biomedical Informatics Research Network

HOME ABOUT BIRN PROJECTS SOFTWARE DATA LONI HOME

Hi Jason Stein | Sign Out

About News & Events References Call To Action

Members Protocols Meta Analysis Mailing List

LONI Laboratory of Neuro Imaging

Home About LONI Research Visualization News & Events Software Data

ABOUT ICBM

International Consortium for Brain Mapping

The International Consortium for Brain Mapping (ICBM) was formed in 1993 with a grant from the NIMH. The primary goal of the ICBM project is the continuing development of a probabilistic reference system for the human brain. **More**

Databases

The ICBM Subject Database is a web-based database infrastructure that simplifies image dataset collection, organization and dissemination. A web interface provides the means to query the data base using a combination of subject demographics and scan-related attributes. **More**

LONI seeks to improve understanding of the brain in health and disease. The laboratory is dedicated to the development of scientific approaches for the comprehensive mapping of brain structure and function.

HCP LONI

ADNI BIRN

ADNI BIRN

PPMI ICBM

PPMI ICBM

ENIGMA CCB

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ENIGMA

Meta-Analysis

TRACK-HD

About TRACK-HD

TRACK-HD is a multi-center, multi-national prospective, observational biomarker study of premanifest and early stage HD with no experimental treatment.

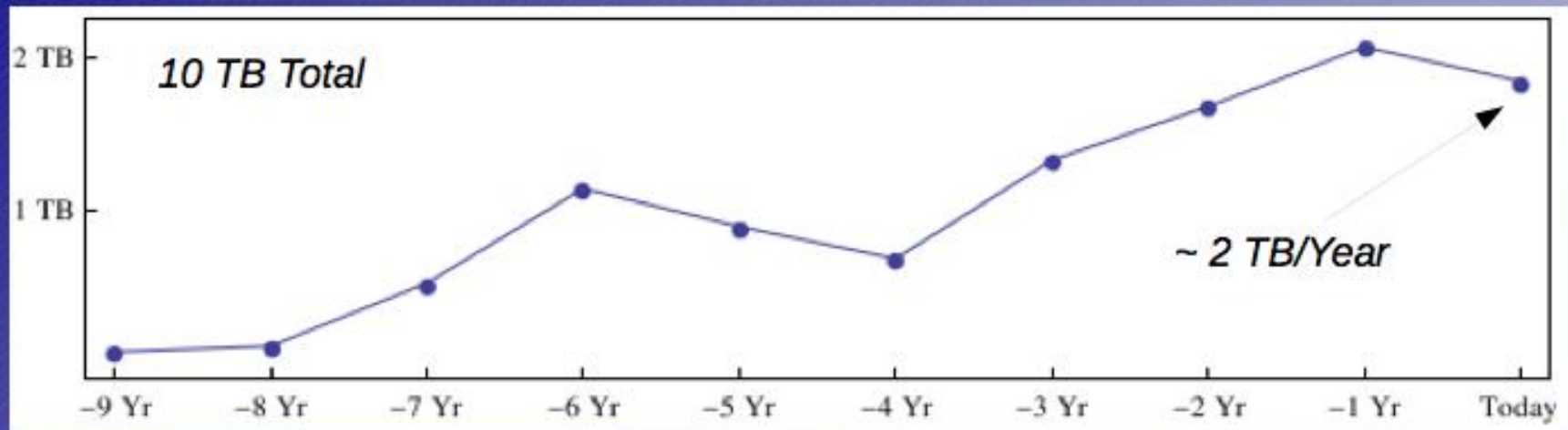
Objectives

- determine what combination of measures is the most sensitive for detecting change over the natural course of premanifest and early HD
- to validate these as potential outcome measures for use in future therapeutic trials

Design

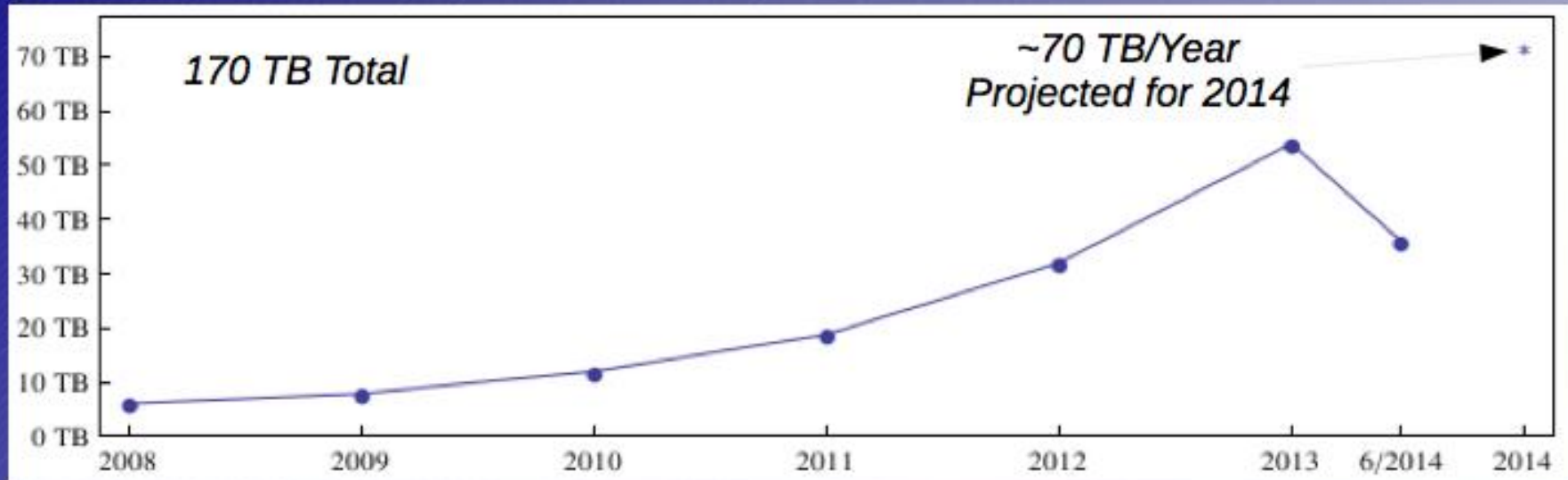
- focused on intensive battery of novel assessments
- extensive annual assessments
- dynamic and fluid protocol
- robust evidence-based measures

Image Data Uploaded



- **17,200 subjects**
- **200,000 scans**
- **121,000 processed scans**
- **64 million image files**

Image Data Downloaded



- **9,087 IDA users**
- **~50 active users / day**
- **46 countries**



The Alzheimer's Disease Neuroimaging Initiative (ADNI) unites researchers with study data as they work to define the progression of Alzheimer's disease. ADNI researchers collect, validate and utilize data such as MRI and PET images, genetics, cognitive tests, CSF and blood biomarkers as predictors for the disease. Data from the North American ADNI's study participants, including Alzheimer's disease patients, mild cognitive impairment subjects and elderly controls, are available from this site.

Welcome

- [About the ADNI Study](#)
- [Overview of ADNI Data](#)
- [Data Use Agreement](#)
- [Request ADNI Specimens from RARC](#)
- [APPLY FOR DATA ACCESS](#)

Returning Users

- [Overview of the ADNI Standardized MRI Data Sets](#)
- [Data Dictionary Search](#)
- [Update Account Information or Add Co-Investigators](#)
- [Submit your ADNI Manuscript for Review](#)

News

MR Study ID Changes

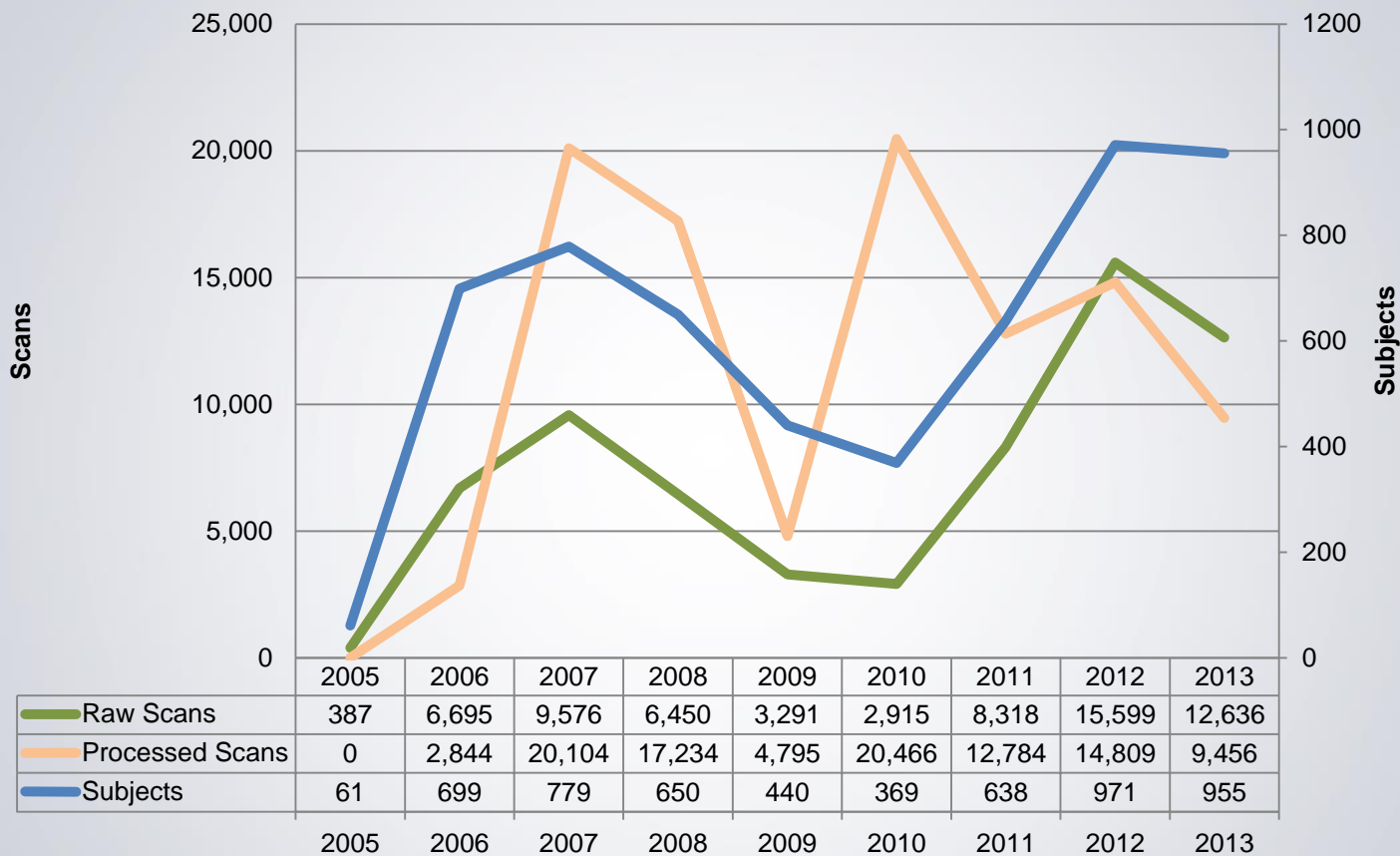
New rules that determine how study ID's are assigned to images archived within the...

Updated BSI measures dataset is now available

Updated BSI measures dataset is now available from the Download section of the ADNI...

[MORE NEWS >](#)





Scans Archived 2005 - 2013

Total: 190,903

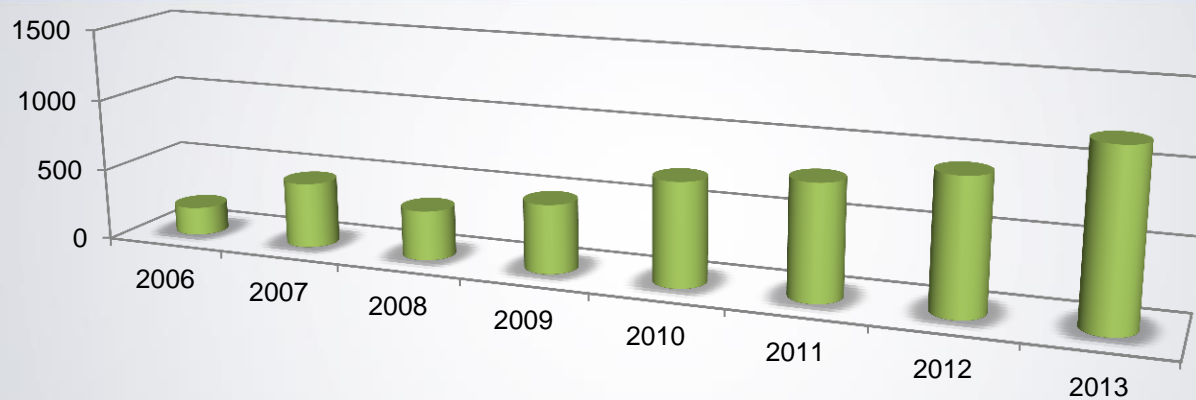
Subject: 168,359

Phantom: 22,554

Number of subjects is consistent, but fewer raw MR scans were archived in 2013 due to a reduced frequency in collecting phantom scans.



Data Use Applications



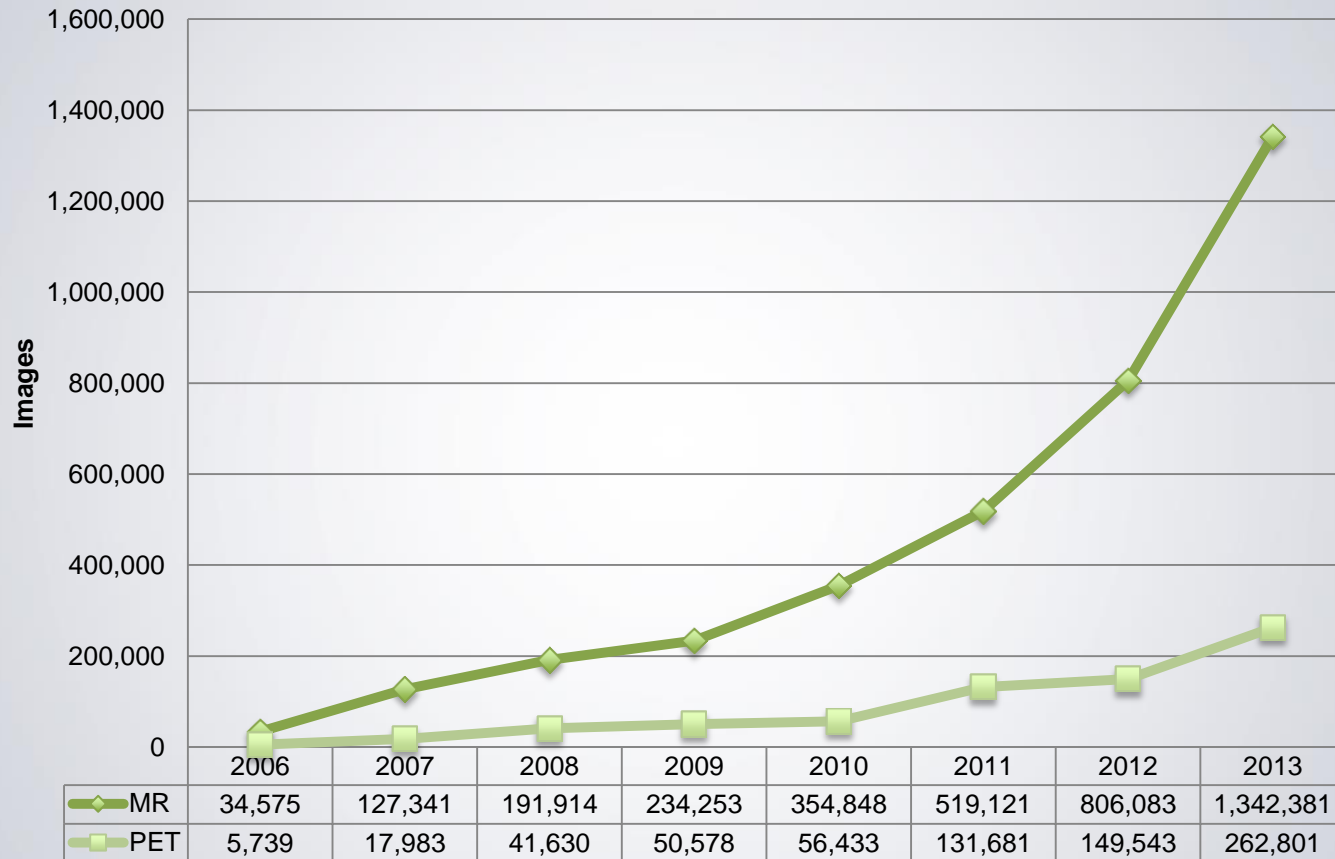
Applications received to date: 5,614

Applications received in 2013: 1,191

(29% increase from 2012)



Images Downloaded 2006 - 2013



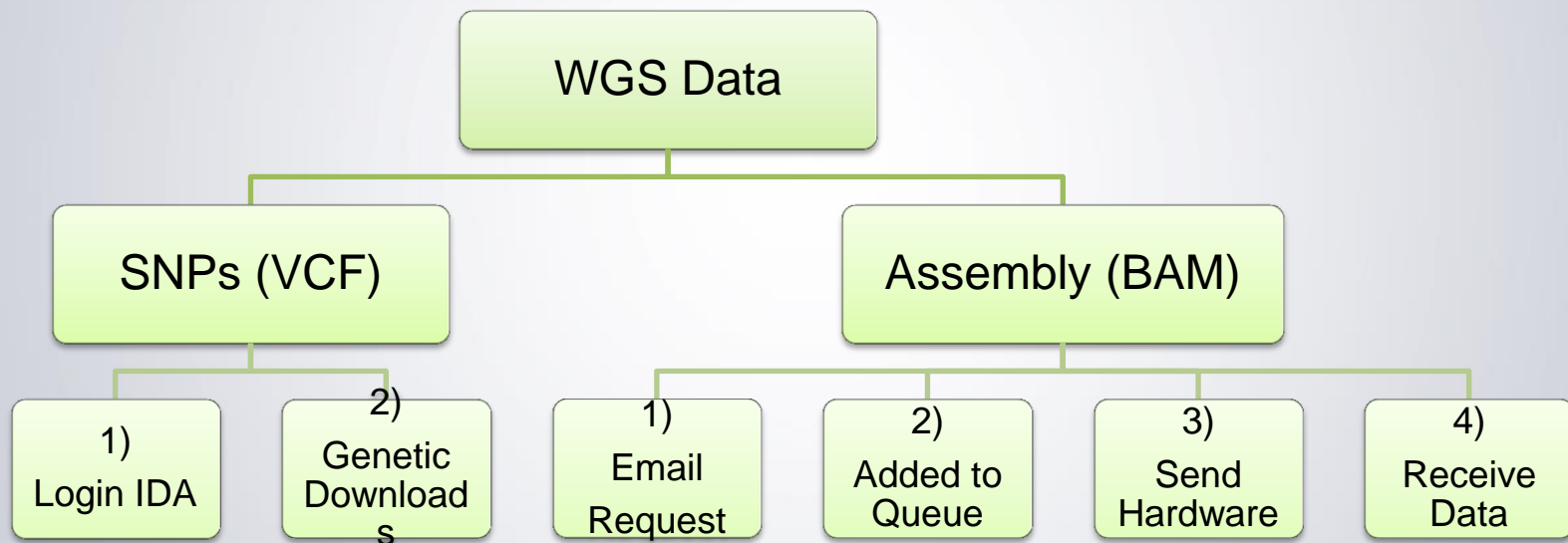
MRI: 3,610,516

PET: 716,388

Total Downloads: 4,326,904



Processes for obtaining WGS data





The process of obtaining genetic data follow two paths.

Smaller datasets such as SNPs are available from within the IDA and are available to all active ADNI investigators.

Large datasets, the WGS BAM assembly files require investigators to send hardware on which LONI can place of copy of the files.



WGS SNPs (PLINK & VCF formats)



ADNI @LONI PROJECTS SEARCH ARCHIVE DOWNLOAD EXPLORE MANAGE LONI Home

Study Data | Image Collections | Genetic Data

Download Genetic Data

Reminder: The ADNI Data Use agreement prohibits unauthorized sharing of these data, posting to public databases and any attempt data to identify individuals using these data. By downloading these data you acknowledge our [Terms and Conditions](#).

ADNI WGS

- Data
- Documentation
- ALL

ADNI1 GWAS

ADNIGO/2 GWAS

ALL

ADNI WGS:

ADNI1/GO/2 Whole Genome Sequencing (WGS) samples were genotyped using the Illumina Omni 2.5M BeadChip and assembly performed using CASAVA-1.9.0a1_110909.90

WGS Data

ADNI WGS SNP Data - Complete PLINK	Version:2014-02-20	.PLINK format
ADNI WGS SNP Data Set 01 of 29	Version:2013-08-21	.VCF format
ADNI WGS SNP Data Set 02 of 29	Version:2013-08-21	.VCF format
ADNI WGS SNP Data Set 03 of 29	Version:2013-08-21	.VCF format
ADNI WGS SNP Data Set 04 of 29	Version:2013-08-21	.VCF format
ADNI WGS SNP Data Set 05 of 29	Version:2013-08-21	.VCF format
ADNI WGS SNP Data Set 06 of 29	Version:2013-08-21	.VCF format
ADNI WGS SNP Data Set 07 of 29	Version:2013-08-21	.VCF format
ADNI WGS SNP Data Set 08 of 29	Version:2013-08-21	.VCF format
ADNI WGS SNP Data Set 09 of 29	Version:2013-08-21	.VCF format
ADNI WGS SNP Data Set 10 of 29	Version:2013-08-21	.VCF format
ADNI WGS SNP Data Set 11 of 29	Version:2013-08-21	.VCF format
ADNI WGS SNP Data Set 12 of 29	Version:2013-08-21	.VCF format
ADNI WGS SNP Data Set 13 of 29	Version:2013-08-21	.VCF format



Gaain.org | Homepage



[DESIGN](#) [FAQ/SUPPORT](#) [ABOUT](#) [DATA & TOOLS](#) [NEWS](#)

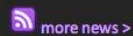
THE FUTURE OF ALZHEIMER'S RESEARCH

The Global Alzheimer's Association Interactive Network (GAAIN) is a collaborative project that will provide researchers around the globe with access to a vast repository of Alzheimer's disease research data and the sophisticated analytical tools and computational power needed to work with that data. Our goal is to transform the way scientists work together to answer key questions related to understanding the causes, diagnosis, treatment and prevention of Alzheimer's and other neurodegenerative diseases.

[APPLY FOR DATA >](#)

[ACCESS DATA >](#)

LATEST



- 11-03-13 Genetic mutation linked to Alzheimer's disease doubles rate of brain tissue loss, USC study shows
- 05-24-12 The Developments of the Project neuGRID: New digital platforms enhance the fight against Alzheimer's
- 03-14-12 Research & Standardization in Alzheimer's Disease Conference (RASAD 2012)

PARTNERS

[BECOME A PARTNER](#)



Partners in GAAIN are of a global initiative linking investigators, data, tools and infrastructure for the study of Alzheimer's disease. [Find out more >](#)

SEARCH

The Global Alzheimer's Association Interactive Network

Why GAAIN?

Imagine Venice without bridges

- Isolated islets
- Inaccessible to pedestrians
- Requires a boat
- Requires special navigation skills



Why GAAIN?



Create an infrastructure that provides bridges between islets of data to form an accessible global information network easily traversed.

Example: Tripit.com

The screenshot shows the Tripit.com user interface. At the top, there's a navigation bar with the Tripit logo, a search bar for "Who's in or out?", and user information for David Murphy. Below the navigation bar are tabs for Home, Trips, Network, Point Tracker, and Tript Pro. The main content area is divided into several sections:

- Welcome back, David:** A personalized greeting with a profile picture and summary statistics: "You're in CA. You've traveled 15,719 mi to 14 locations. Your network: 1 connection. Join your company group."
- Upcoming Trips:** A section titled "YOUR TRIPS" featuring a trip card for "FIESTA BOWL (4 days)" from Dec 31, 2011, to Jan 3, 2012. It includes buttons for "View all upcoming", "Add a trip", and "iCal feed".
- Network Updates:** A section titled "YOUR NETWORK" showing "1 Connection". It lists updates for "VISITING MOUNTAIN VIEW, CA" and "CLOSE WHEN YOU'RE TRAVELING".
- Travel Stats:** A section titled "1ST PLACE FOR DISTANCE TRAVELED" and "FULL STATS". It lists top travelers: David Murphy (15,719 mi) and Magali Ferare (14,577 mi). A table shows travel statistics for 2011 and Total.
- Latest Tripit News:** A list of recent news items, including "Itineraries on Fire: Download Tripit in the Amazon Appstore" and "4 Easy Ways to Put Your Itinerary Data to Work".
- Advertisements:** Two advertisements are visible: one for Lufthansa's FlyNet service and another for "FLIGHTS."

1ST PLACE FOR DISTANCE TRAVELED		FULL STATS		
		2011	Total	
	1. David Murphy	15,719 mi		
	2. Magali Ferare	14,577 mi		
		Trips	7	7
		Days	32	32
		Distance	15,719 mi	15,719 mi
		Cities	14	14
		Countries	1	1

Tripit.com aggregates a user's travel and booking information (ie: airline tickets, vacation rentals).

Problems for Investigators



Discovering data needed for investigation



Obtaining data from study investigators



Combining & interpreting data across studies

Problems for Data Holders



Protecting subject privacy

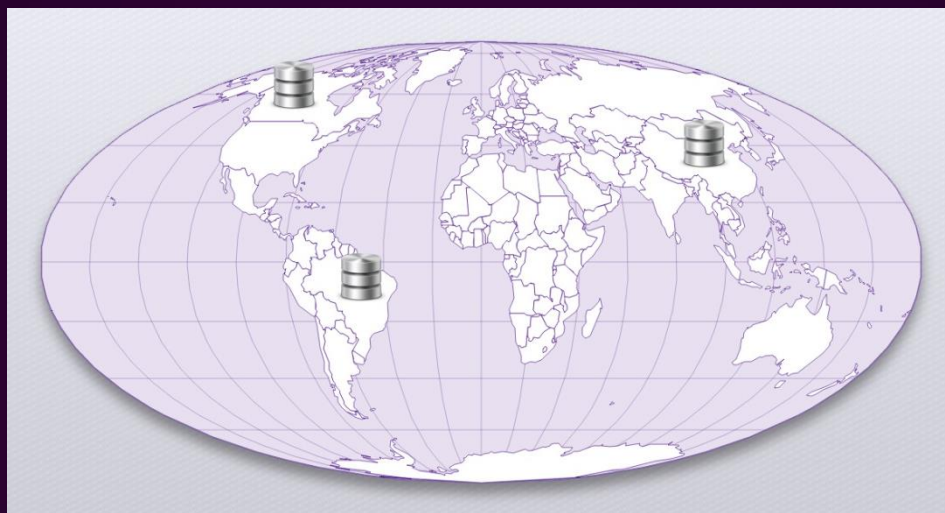


Maintaining data control



Receiving credit

Research efforts in Alzheimer's disease



Research efforts could be vastly expanded in scope and capabilities if data were linked to a global infrastructure that would enable scientists to access and utilize vast, interlinked repositories of data on thousands of subjects at risk for or already suffering from the ravages of Alzheimer's disease.

GAAIN Aggregator and Personal Dashboard

GAAIN recognizes a user's existing accounts for partnering data sources and allows him/her to analyze the data with our tools and/or apply for additional consortiums

The dashboard indicates which data sources are unavailable to the user (ie: the user must apply for access, data source is currently offline)

The dashboard interface features a dark purple header with the GAAIN logo (Alzheimer's Association) on the left and user navigation links (Welcome Jane, Sign Out, DASHBOARD, QUERY, EXPLORE) on the right. A purple banner below the header says "Welcome".

The main content area is divided into several sections:

- User Profile:** Jane Smith, PhD, last login: Nov. 20, 2013, Update account.
- DATA SOURCES:** A list of data sources with status indicators. 'aibl' (Australian Imaging, Biomarker & Lifestyle Flagship Study of Ageing) is green. 'ADNI' (Alzheimer's Disease Neuroimaging Initiative) is green. 'neuGRID for you' is blue. 'AD' (AD Consortium X) is greyed out. 'AD' (AD Consortium Y) is greyed out.
- CONNECT TO MORE DATA SOURCES >** A purple button.
- DATA DEMOGRAPHICS - 20,712 participants available:** Includes a bell curve chart for AGE (ranging from -30 to 30) and a pie chart for DIAGNOSIS. The AGE chart shows percentages for age groups: 67.5 - 71.8 (34.1%), 71.9 - 76.3 (34.1%), and 76.4 - 87.1 (13.6%). The DIAGNOSIS chart shows percentages for AD, EMCI, LMI, and Control.
- HISTORY:** A list of recent data access events with timestamps and details like "female, MMSE scores, AD" or "male, MMSE scores <12".
- GAAIN NEWS:** A list of news items with dates and titles, such as "Genetic mutation linked to Alzheimer's disease doubles rate of brain tissue loss, USC study shows."

The footer contains a search bar, a search icon, and links for Terms of Use, Privacy Policy, and Contact the webmaster. On the right, it says "The Global Alzheimer's Association Interactive Network" and "Funded by the Alzheimer's Association" with the GAAIN logo.

Data Heterogeneity

AD Data Consortium X

XADC	XID	SEX	BIRTHYR	MMSE
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ADNI

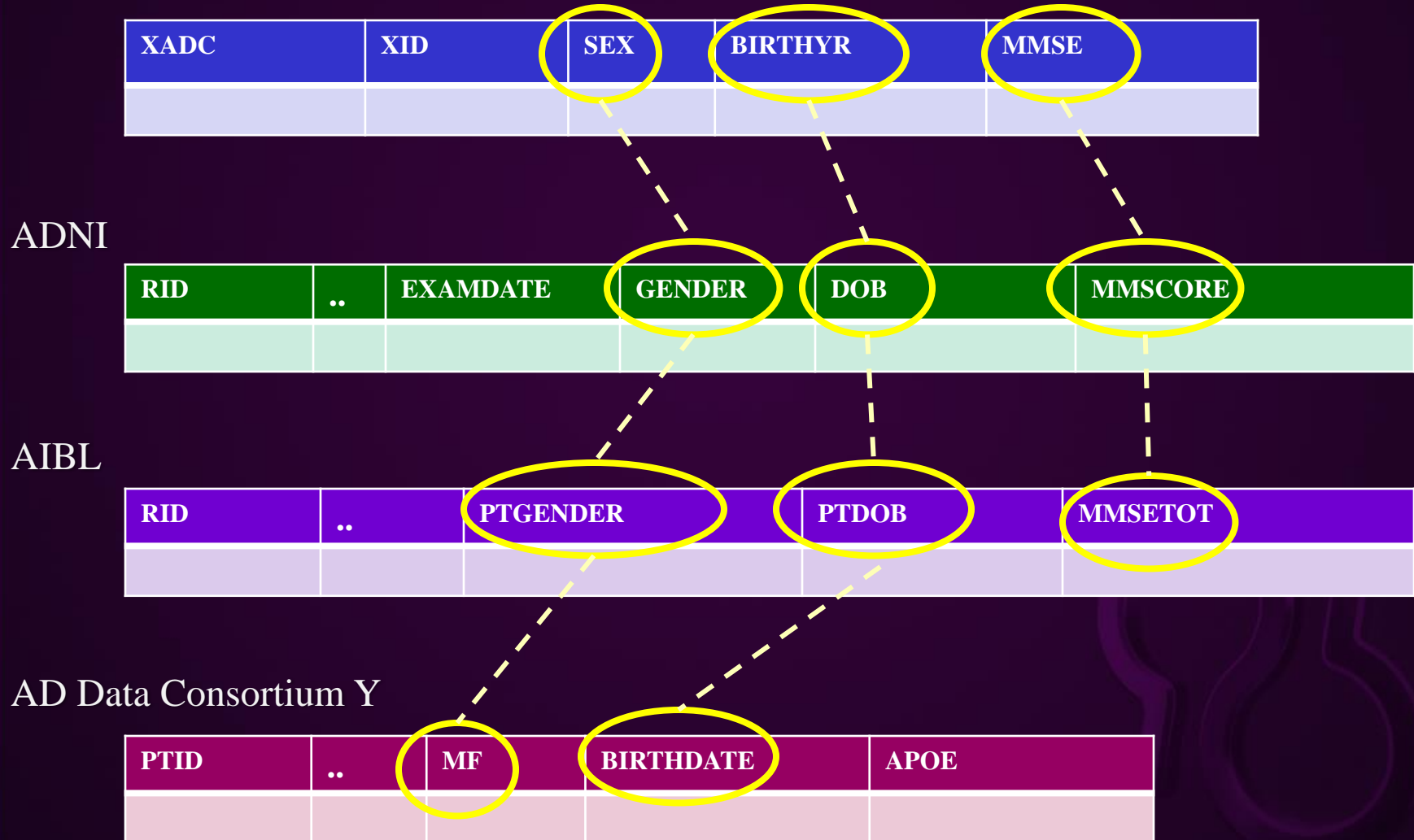
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AIBL

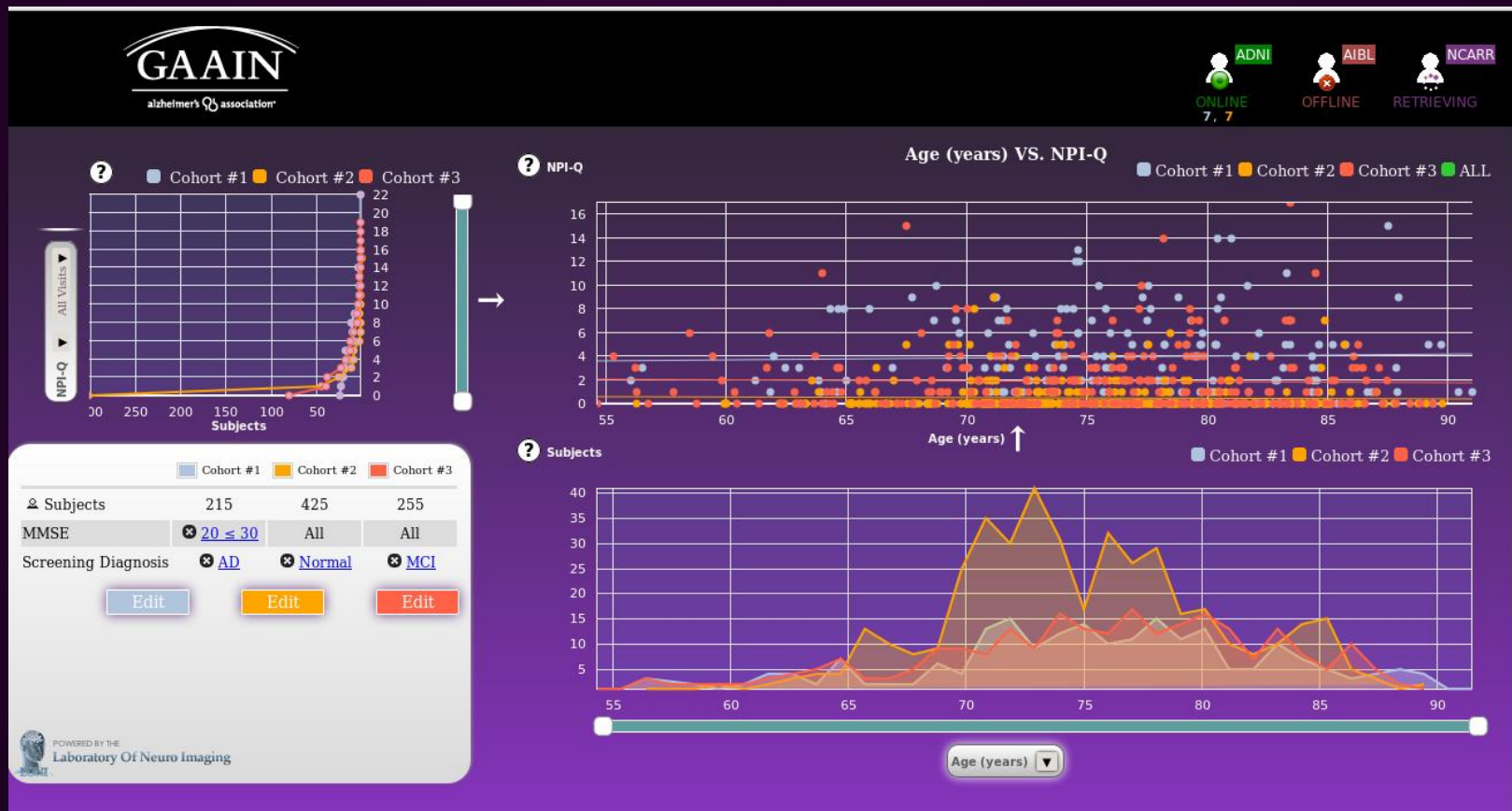
RID	..	PTGENDER	PTDOB	MMSETOT
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AD Data Consortium Y

PTID	..	MF	BIRTHDATE	APOE
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“Google with graphs” Search



A big solution for big data

- GAAIN serves as a benchmark for large data research efforts
- Provides seamless connections of a users' existing Alzheimer's disease consortium data accounts
- Allows researchers to narrow down a study population that relates to their work across multiple partner consortiums
- Provides tools capable of analyzing clinical, imaging and genetic data types via the LONI Pipeline

