

Project on Scientific Transparency

Prof. Brian Wandell*

Director
Stanford Center for Cognitive and
Neurobiological Imaging (CNI)

Deputy Director
Stanford Neurosciences Institute
(SNI)

We thank the Simons Foundation and the
Arnold Foundation for their support

Commercial disclosure*:
We are active participants in a commercial venture related
to the work described here, Flywheel Exchange, LLC.

Michael
Perry*



Renzo
Frigato*



Gunnar
Schaefer*



Bob
Dougherty



Planning for Stanford's Center for Neurobiological Imaging

- The story behind this presentation starts with Bob D. and me, working in our lab, and eager to improve software
- Then, as we were putting together the CNI, we had a chance to think some more but at a larger scale about infrastructure
- This talk is about what we learned from our colleagues about these issues over the last few years, and what we are trying to do



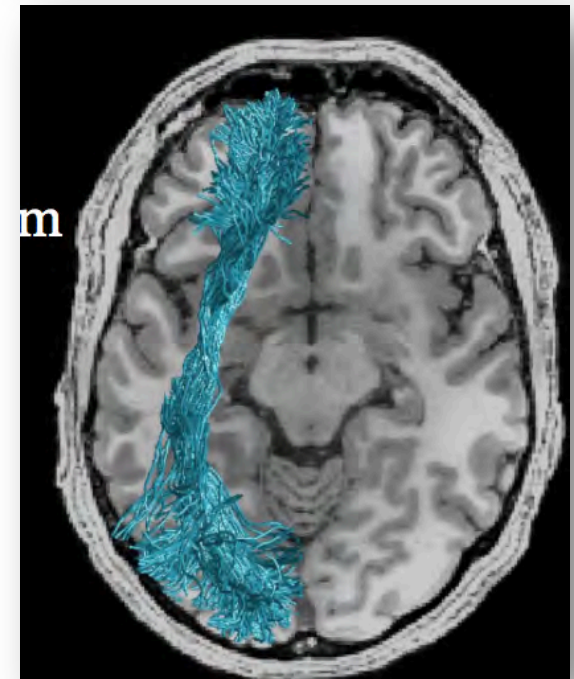
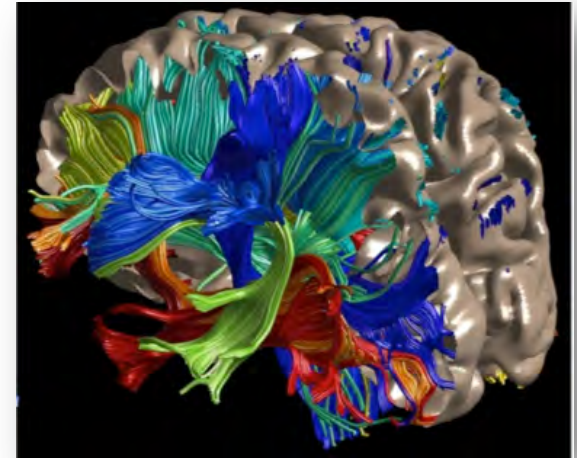
Scientific goals of the project

- Reproducible Research
- Personalized neuroscience
- Software design and technologies
- Where we want to go



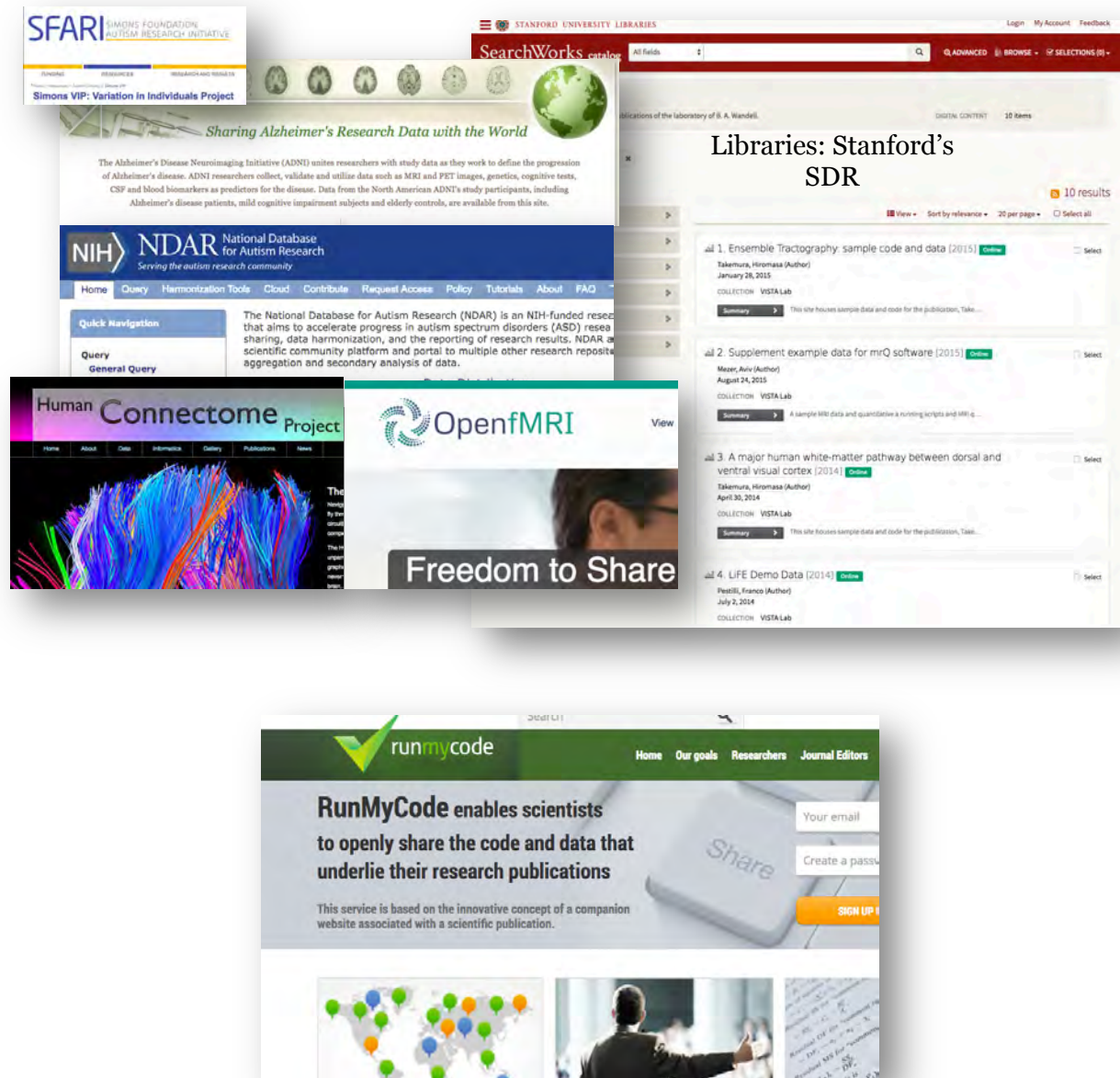
Replication is often impractical

- Neuroscience is transitioning from a cottage industry to larger labs and research organizations
- The complexity of tools and computations puts us into the field of ‘big science’ in which full replication is impractical
 - **Example 1:**
Analyses of 320 subjects with autism, each measured using MRI, at 3 time points over four years
 - **Example 2:**
Structural MRI of 50 illiterate adults flown in from the Amazon rain forest



What tools are on offer?

- Assemble your work and put it in a shared resource (archive)
- Many sites offer archival data storage; I will return to this later
- I particularly admire Amy Hodges and the work at Stanford University Libraries; we use their repository for permanent URL a lot
- A few computational sites that seem important to me. Hurlin, Perignon and Stodden, “runmycode” is very cool for archival code.



Reproducible research is within reach

Replication means obtaining the data again, usually by independent investigators using similar methods, equipment and protocols

Many big science experiments are too expensive and time-consuming to replicate

Reproducible means that starting with the data gathered by the scientists, we can confirm the derived results (e.g., statistics, summary curves and images, numerical relationships)

Proper tools enable scientists to achieve reproducibility much more often

Reproducible Research

An article about computational science in a scientific publication is not the scholarship itself, it is merely advertising of the scholarship. The actual scholarship is the complete software development environment and the complete set of instructions which generated the figures.



Donoho

Reproducible Research

Computational reproducibility is not an afterthought—it is something that must be designed into a project from the beginning. **One does need to develop a whole set of programming and research disciplines** with the end result in mind and stick with them.



Donoho

Scientific data management goals

- Reproducible research requires **scientific data management** tools
- These should be expected as part of science and scientific training
- When we started the **CNI** we had these goals in mind, but no tools; Gunnar and Reno arrived; Simons and Neuroventures helped



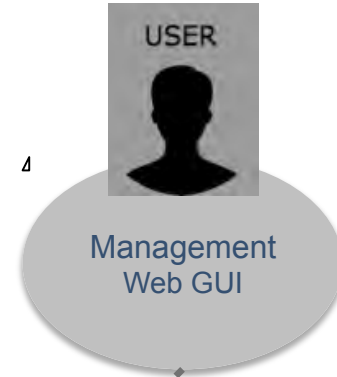
SCITRAN: The scientific transparency foundation

- Use data management tools from the beginning of the project; archival tools at the end
- Simplify data sharing and data discovery
 - User-rights management
 - Search
- Support reproducible research methods
 - Complete software
 - Portable methods
- Be helpful and offer value
 - Data archiving; note taking
 - Automated quality assurance
 - Visualizations
 - Platform independence (browsers, docker)



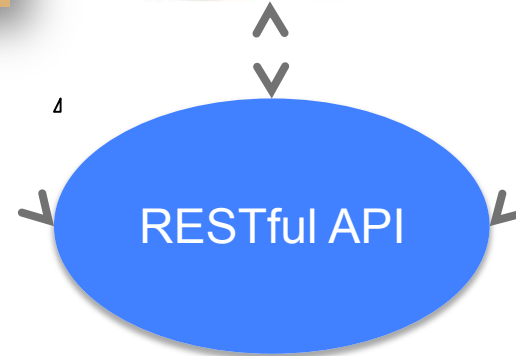
An active experimental system needs more

- Data from the CNI scanner are parsed and stored in a permanent database, no user action required



- The raw data are converted to common formats (e.g., NIfTI, bvec, bval, physiological)

Reaping



Current status at Stanford CNI (04/12/2015)

People

700 scientists

11,469 scan sessions

6232 research subjects

64 research groups

Data

46,229 fMRI

9708 T1 anatomical

5081 diffusion

536 spectroscopy

STANFORD UNIVERSITY | NEUROBIOLOGICAL IMAGE MANAGEMENT SYSTEM (NIMS) | WELCOME, BRIAN WANDELL | STATUS: 1643/0/7

My Data | Search | Manage Experiments | Manage Groups | Logout

My Data

- Move Sessions to other Experiments via drag-and-drop.
- View and update an entry's metadata via double-click.
- Download Sessions or Datasets by dragging them to the Download area.
- Trash entries by dragging them to the Trash area.

Download

- Include raw
- Legacy format

Trash

- Hide Trash
- Show Trash
- Trash Only

Experiments					Sessions			Epochs		Datasets
Group	Experiment	Date & Time	Exam	Subj.	Time	Description	Data Type			
wandell	achiasma	2016-05-16 09:35	12506	s004	09:35:46	3Plane_Loc_tgre	Bitmap			
wandell	anatomicals	2016-04-28 09:29	12370	s004	09:36:27	ASSET_calibration	Dicom Data*			
wandell	anatomy	2016-04-26 09:11	12350	s010	09:37:13	BOLD_EPI_Ax_RL				
nordahl	app	2016-04-18 10:32	12276	s004	09:45:43	Ax_EPI_fMRI_ENC_Accel2_15mm				
cni	audio	2016-04-07 09:22	12178	s004	23:59:59	Screen_Save				
cni	audiotest	2016-03-29 09:18	12077	s004	23:59:59	Screen_Save				
wandell	aviv	2016-03-24 09:13	12049	s004	23:59:59	Screen_Save				
yjliao	axonal transport	2016-03-17 09:13	12002	s004						
cni	bobd	2016-03-17 09:10	12001	s004						
cni	brainpaint	2016-03-14 12:00	11972	s004						
cni	brainprint	2016-03-14 08:36	11970	s004						
cni	cpoetter	2016-03-07 09:05	11914	s004						
cni	day	2016-03-03 09:12	11892	s004						
cni	demo	2016-02-22 09:07	11815	s004						
cni	dsi	2016-02-18 09:11	11784	s004						
cni	dti demo	2016-02-16 08:28	11764	s004						
cni	ditest	2016-02-09 10:13	11718	s004						
cni	dv24	2016-02-08 09:25	11711	s004						
cni	dv24_test	2016-02-04 09:33	11684	s004						
wandell	dwi	2016-02-01 09:13	11660	s004						
cni	dwttest	2016-01-25 09:21	11621	s004						
wandell	ecog	2016-01-21 09:06	11593	s004						
wandell	fastrest	2016-01-19 16:01	11580	s004						
wandell	fmri	2016-01-19 09:36	11577	s004						
cni	fmri demo	2016-01-11 09:26	11524	s004						
cni	fmri_demo	2016-01-08 17:32	11516	s004						
cni	fmridemo	2016-01-08 08:48	11511	s004						
wandell	frk	2016-01-07 09:25	11506	s004						
cni	gaba	2016-01-04 09:31	11493	s004						
cni	geometry_test	2015-12-17 09:49	11469	s004						
cni	geotest	2015-12-14 09:35	11454	s004						

Project and user rights management

- Create projects
- Assign access to people (RA, Collaborators, Students)
- Levels of access from admin, read-only, read-write.



The screenshot shows the Flywheel Admin interface for Project Management. The top left features the Flywheel logo and the Stanford University name. The user is identified as Brian Wandell. The main navigation menu on the left includes Dashboard, Admin, and Site. The Admin section is expanded, showing Projects, Collections, and Site. The main content area displays a list of projects, each with a 'Project Information' and 'Permissions' section. The projects listed are: ALDIT: JHU , ALDIT; ALDIT: Stanford CNI , ALDIT; ALDIT: Palo Alto VA , ALDIT; and ADNI: T1 , ADNI. A 'Create New Project' button and a 'Select Group' dropdown are visible in the top right corner.

Value: Monitor acquisition and keep data organized

It took us a long time to realize this simple organization
Project -> Session -> Acquisition -> File

The screenshot displays the Flywheel Stanford web interface. On the left is a navigation sidebar with 'Dashboard', 'Sessions', 'Collections', 'Upload', 'Admin', 'Projects', 'Collections', and 'Site'. The main content area is titled 'Dashboard' and shows a list of sessions with columns for Session Label, Project, and Subject. A table lists sessions such as '20150803_1518' (ALDIT: Stanford CNI, ex10306) and '20160111_1629' (ALDIT: Stanford CNI, ex11528). The right panel shows a detailed view for session '20150803_1518', listing acquisitions with columns for Time, Measurement, Description, Type, and Tasks. Acquisitions include 'High Order Shim' (3_1_HO_Shim, 3_2_HO_Shim) and 'Diffusion' (DTI pe1 b1k mux3 2.4mm, DTI pe1 b7k mux3 2.4mm).

Session Label	Project	Subject
20150803_1518	ALDIT: Stanford CNI	ex10306
20160111_1629	ALDIT: Stanford CNI	ex11528
20150804_1623	ALDIT: Stanford CNI	ex10316
20160201_1629	ALDIT: Stanford CNI	ex11666
20160202_1030	ALDIT: Stanford CNI	ex11671
20160202_1116	ALDIT: Stanford CNI	ex11673
20160202_1041	ALDIT: Stanford CNI	ex11672
2016-02-26 13:25:20	ALDIT: JHU	SNR Test 2
2016-01-14 08:42:09	ALDIT: JHU	DSI Raw Test 2
20160203_1308	ALDIT: Stanford CNI	ex11677
2016-02-24195911	ALDIT: Palo Alto VA	15058_phanto...
20151117_1313	ALDIT: Stanford CNI	ex11264

Time	Measurement	Description	Type	Tasks
	High Order Shim	3_1_HO_Shim Bootstrapper	pfile	Info, Download
	High Order Shim	3_2_HO_Shim Bootstrapper	pfile	Info, Download
	Diffusion	DTI pe1 b1k mux3 2.4mm Bootstrapper	bval	Info, Download
		Bootstrapper	bvec	Info, Download
		Bootstrapper	P11264.7_vrgf.dat	Info, Download
		Bootstrapper	P11264.7_tensor.dat	Info, Download
		Bootstrapper	P11264.7_noise.dat	Info, Download
		Bootstrapper	P11264.7_ref.dat	Info, Download
		Bootstrapper	nifti	Info, Download
		Bootstrapper	pfile	Info, Download
		Bootstrapper	P11264.7_param.dat	Info, Download
		Bootstrapper	dicom	Info, Download
		dc_m_convert	bval	Info, Download
		dc_m_convert	bvec	Info, Download
		dc_m_convert	nifti	Info, Download
		dc_m_convert	montage	Info, Download
		qa-report-fmri	qa	Info, Download
	Diffusion	DTI pe1 b7k mux3 2.4mm Bootstrapper	P14336.7_param.dat	Info, Download
		Bootstrapper	P14336.7_ref.dat	Info, Download
		Bootstrapper	P14336.7_tensor.dat	Info, Download
		Bootstrapper	P14336.7_vrgf.dat	Info, Download
		Bootstrapper	pfile	Info, Download
		Bootstrapper	P14336.7_noise.dat	Info, Download
		Bootstrapper	bvec	Info, Download
		Bootstrapper	bval	Info, Download

- We check which data have been collected and processed from any web-browser (desktop, mobile)
- We can visualize data to check quality and monitor experimental progress

Value: Provide information about the project

The screenshot shows a web application interface with a sidebar on the left and a main content area. The sidebar contains the following navigation items:

- Dashboard
- Sessions
- Collections
- Upload
- Admin
 - Projects
 - Collections
 - Site

The main content area displays a PDF viewer for the file 'ADNI_GeneralProceduresManual.pdf'. The viewer shows page 1 of 120. The PDF content is a 'Table of Contents' page with the following sections and page numbers:

Section	Page Numbers
CONTACT INFORMATION	
Protocol Staff	1
Study Supplies and Help Desks	2
ADNI PROTOCOL	
Protocol Synopsis	3-5
Schedule of Assessments	6-8
Personnel Requirements	9-10
Use of Multiple Locations at a Single Center	10
START-UP CERTIFICATION	
ADCS Start-up Requirements	11-12
MRI Certification	13
PET Certification	14
SCREENING PROCESS	
Summary and Data Flow	15-17
Scan Category Assignment	18-19
Notifying Private MD of Study Participation	19
Inclusion / Exclusion Criteria	20-21
Excluded Medications	22-25
PRN Recommendations	25
STUDY VISIT PROCEDURES	
Screening Visit Procedures	26
Baseline Through Final Visit Procedures	27
Rules for Scheduling Subject Visits	28
Early Discontinuation From Study	29-30

Value: Notes, attachments, viewers

- Create notes about a project, or a session, or a file
- Add attachments describing the project, or session (e.g., something special happened during the session)
- Viewers for attachments

The screenshot displays the Flywheel Stanford web application interface. On the left is a navigation sidebar with the Stanford logo and user profile for Brian Wandell. The main content area is titled "Dashboard | Sessions" and shows a table of 39 sessions. The table has columns for "Session Label", "ENGAGE", and "Subject". The first row is highlighted. To the right, a detailed view of a session is shown, including tabs for "Data", "Annotation", "Project", "Subject", "Session Analyses", and "Project Analyses". The "Attachments" section lists files like "cortex.obj", "Fibers.gif", and "SampleCSVFile_11kb.csv" with icons for viewing, downloading, and deleting. Below this is a "Notes" section with a text input field and a "SAVE" button. A note from wandell@stanford.edu dated 5/17/16 9:52 PM is visible, stating: "These files are here only for demonstration purposes. They are not derived from this session!". At the bottom, there is a "Tags" section with an "Add a tag" input field.

Session Label	ENGAGE	Subject
20160212_1145	ENGAGE	PA30563
20160315_1513	ENGAGE	PA29685
20160418_1125	ENGAGE	PA30104
20160323_1713	ENGAGE	PA30071
20160331_1726	ENGAGE	PA284642MO
20160407_1002	ENGAGE	PA27541
20160415_0903	ENGAGE	PA274342MO
20160407_0642	ENGAGE	PA270402MO
20160317_1707	ENGAGE	PA26994
20160419_0909	ENGAGE	PA269042MO
20160316_1740	ENGAGE	PA26039
20160324_1736	ENGAGE	PA25642
20160330_0847	ENGAGE	PA201472MO
20160325_1310	ENGAGE	MV09434
20160318_1355	ENGAGE	MV08866
20160416_1216	ENGAGE	MV08645
20160322_0757	ENGAGE	MV06904
20160411_1608	ENGAGE	MV059532MO

Value: Edit and search for subject information

- Subject information
- Basic fields included (age, sex)
- Additional fields can be created and values stored

The screenshot displays the Flywheel Stanford web application interface. On the left is a navigation sidebar with 'Dashboard' and 'Admin' sections. The main content area is titled 'Dashboard | Sessions' and shows a table of session records. The table has columns for 'Session Label', 'ADNI: T1', and 'Subject'. The first row is highlighted, showing a session from 2012-02-09 with subject ID 4526. To the right, a detailed view for 'Subject | 4526' is shown, featuring tabs for 'Data', 'Annotation', 'Project', 'Subject', 'Session Analyses', and 'Project Analyses'. The 'Subject' tab is active, displaying personal information such as 'First Name: Unknown', 'Last Name: Unknown', 'Sex: Male', and 'Age: 79 years, 4 months, 26 days'. Below this, a table lists 'Information' fields with their corresponding values: EDU (16), APGEN2 (4), bDX (3), APGEN1 (4), and bAGE (79.4).

Session Label	ADNI: T1	Subject
2012-02-09 09:35:28	ADNI: T1	4526
2012-02-20 20:40:52	ADNI: T1	4521
2012-02-03 14:23:53	ADNI: T1	4496
2012-02-01 10:01:41	ADNI: T1	4491
2012-02-01 12:40:39	ADNI: T1	4485
2012-01-25 12:57:58	ADNI: T1	4483
2012-01-26 08:52:51	ADNI: T1	4477
2012-01-27 16:12:01	ADNI: T1	4476
2012-02-01 11:46:34	ADNI: T1	4475
2012-01-24 15:16:10	ADNI: T1	4474
2012-02-10 14:05:02	ADNI: T1	4473
2012-02-02 12:21:46	ADNI: T1	4468
2012-01-30 11:31:26	ADNI: T1	4466
2012-02-14 13:14:32	ADNI: T1	4465
2012-01-26 16:20:48	ADNI: T1	4464
2012-02-02 07:35:51	ADNI: T1	4463

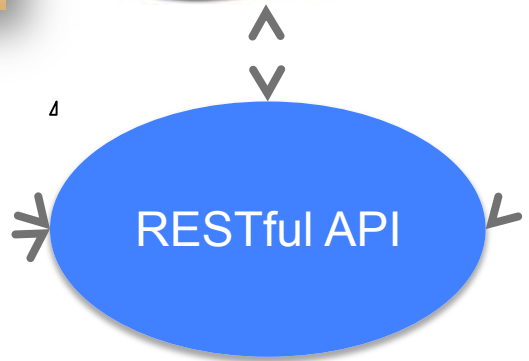
Field	Value
First Name	Unknown
Last Name	Unknown
Sex	Male
Age	79 years, 4 months, 26 days
Information	EDU: 16
	APGEN2: 4
	bDX: 3
	APGEN1: 4
	bAGE: 79.4

Value: Time machine for data organization

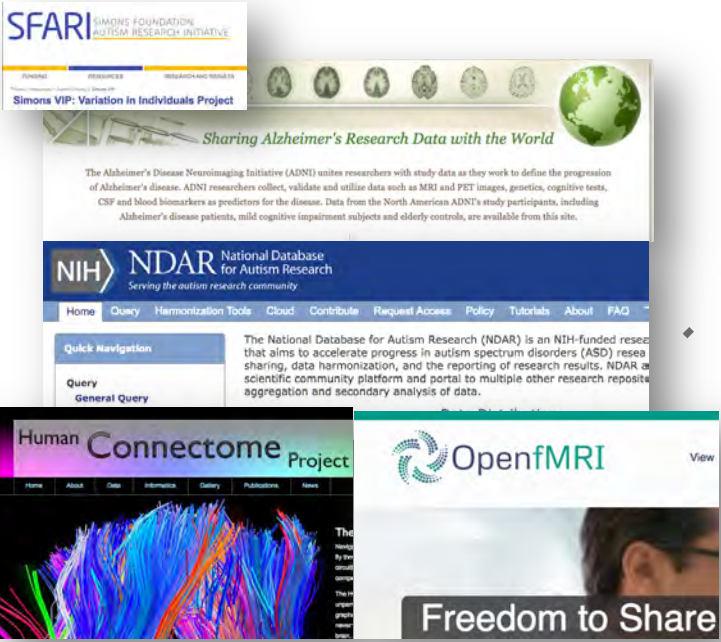
- Data from colleagues, legacy, or public repositories can be added (openFMRI, HCP, ADNI)
- BIDS, organizers, multisite integration



Reaping

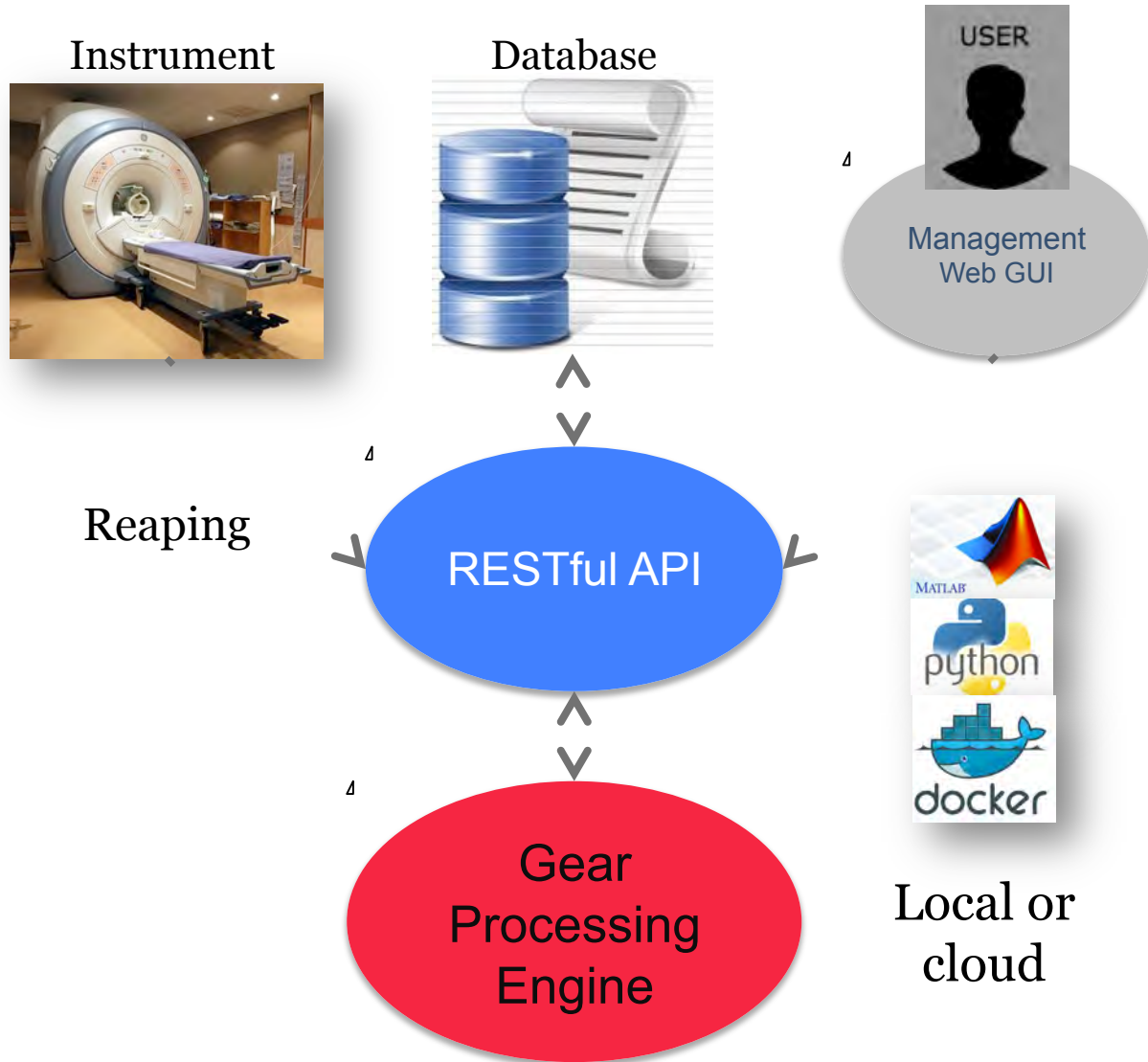


Web and application data uploading



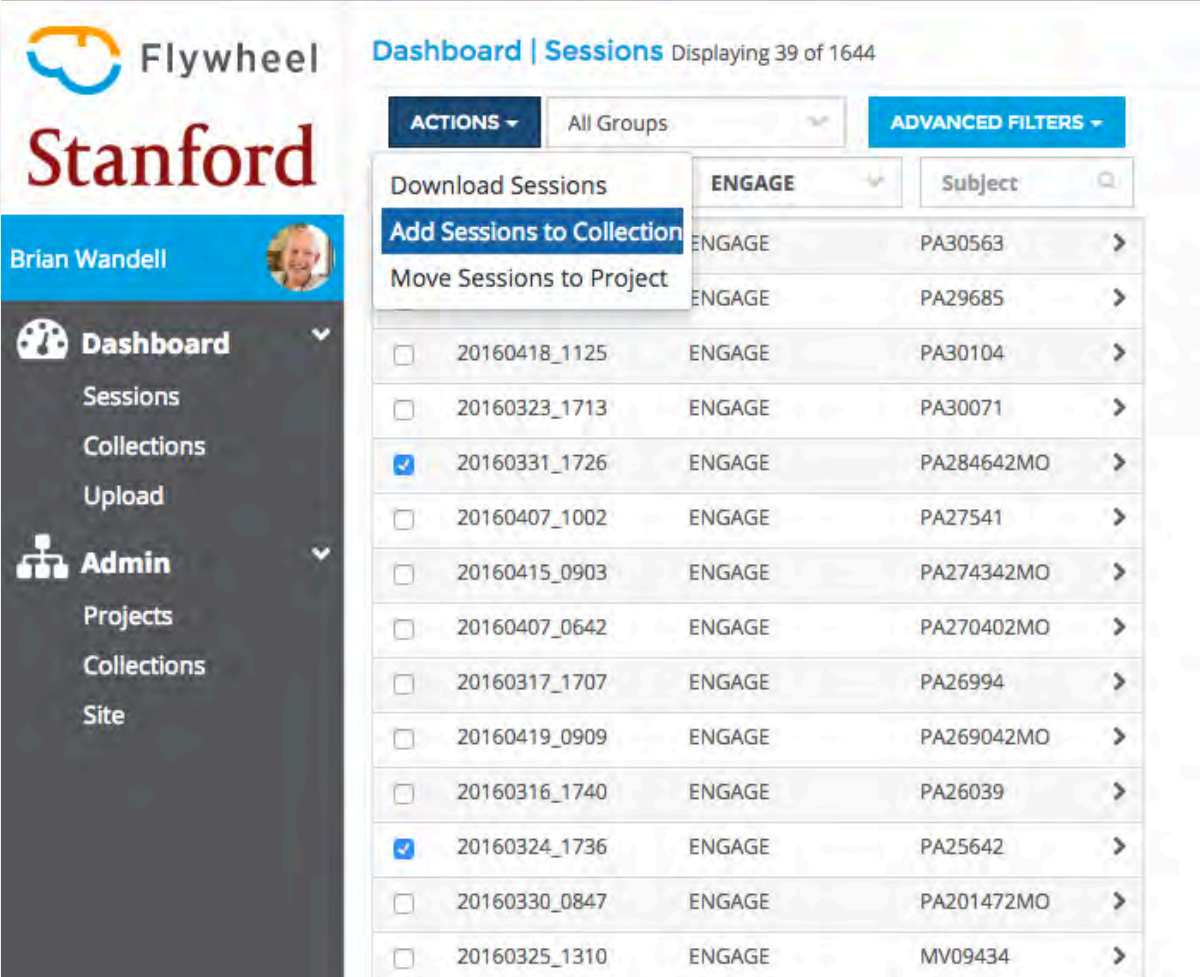
Analysis methods

- Given permission, data can be collected into a virtual experiment for further analysis
- There is a developing format for creating a defined container (**Gear**) to analyze data
- Processing will be managed by an engine
- The Gear analyses – including results and software – are described in the database for reproducibility
- Gears are based on docker containers for completeness and platform independence – Matlab and Python interface are being developed



Analysis example: Create a collection from the database

- Select sessions or acquisitions to group into a collection
- We expect people will do their analyses on collections
- Ask me about file duplication afterward – the answer is cool



The screenshot shows the Flywheel Stanford Sessions dashboard. The header includes the Flywheel logo and the text "Stanford". The user profile for Brian Wandell is visible. The dashboard title is "Dashboard | Sessions" with a sub-header "Displaying 39 of 1644". A navigation sidebar on the left lists "Dashboard", "Sessions", "Collections", "Upload", "Admin", "Projects", "Collections", and "Site". The main content area features a table of sessions with columns for checkboxes, session IDs, "ENGAGE" status, subject names, and expand arrows. A context menu is open over the row with ID "20160331_1726", showing options: "Download Sessions", "Add Sessions to Collection" (highlighted), and "Move Sessions to Project".

		ENGAGE	Subject	
<input type="checkbox"/>	20160418_1125	ENGAGE	PA30563	>
<input type="checkbox"/>	20160323_1713	ENGAGE	PA29685	>
<input checked="" type="checkbox"/>	20160331_1726	ENGAGE	PA30104	>
<input type="checkbox"/>	20160407_1002	ENGAGE	PA30071	>
<input type="checkbox"/>	20160415_0903	ENGAGE	PA284642MO	>
<input type="checkbox"/>	20160407_0642	ENGAGE	PA27541	>
<input type="checkbox"/>	20160317_1707	ENGAGE	PA274342MO	>
<input type="checkbox"/>	20160419_0909	ENGAGE	PA270402MO	>
<input type="checkbox"/>	20160316_1740	ENGAGE	PA26994	>
<input checked="" type="checkbox"/>	20160324_1736	ENGAGE	PA269042MO	>
<input type="checkbox"/>	20160330_0847	ENGAGE	PA26039	>
<input type="checkbox"/>	20160325_1310	ENGAGE	PA25642	>
<input type="checkbox"/>			PA201472MO	>
<input type="checkbox"/>			MV09434	>

Analyze collection data using Gears

Gears can be executed on a file from the UI or
Using an API with both Matlab and Python interfaces
The analyses posted to scitran

The screenshot displays the Flywheel Stanford web interface. On the left is a dark sidebar with the user's name 'Brian Wandell' and a profile picture. Below the name are two main sections: 'Dashboard' with sub-items 'Sessions', 'Collections', and 'Upload'; and 'Admin' with sub-items 'Projects', 'Collections', and 'Site'. The main content area is titled 'Dashboard | Collections' and shows 'Displaying 2 of 2' items. It features a table with columns for 'Session Label', 'All Projects', and 'Subject'. Two rows are visible, both with checkboxes and right-pointing arrows. The first row has '20160212_1145', 'ENGAGE', and 'PA30563'. The second row has '20160221_1207', 'ENGAGE', and 'PA30104'. Above the table are buttons for 'ACTIONS', a dropdown menu set to 'GearTest', and 'ADVANCED FILTERS'. To the right of the table is a detailed view of a session analysis for 'Label | FSL bet2 analysis'. This view includes tabs for 'Data', 'Annotation', 'Collection', 'Subject', 'Session Analyses', and 'Collection Analyses'. It shows the user 'wandell@stanford.edu' and a timestamp of '2016-05-17 18:02'. There are sections for 'Inputs' and 'Outputs', each with a file name and a 'Tasks' button. The 'Inputs' section shows '16_1_T1w_1mm_dicom_nifti.nii.gz' and the 'Outputs' section shows '16_1_T1w_1mm_dicom_nifti_bet.nii.gz'. A 'Notes' section at the bottom has a text area with the placeholder 'Add a note to this session' and a 'SAVE' button.

Session Label	All Projects	Subject
<input type="checkbox"/> 20160212_1145	ENGAGE	PA30563
<input type="checkbox"/> 20160221_1207	ENGAGE	PA30104

Label | FSL bet2 analysis

User: wandell@stanford.edu

Timestamp: 2016-05-17 18:02

Inputs Tasks

16_1_T1w_1mm_dicom_nifti.nii.gz

Outputs Tasks

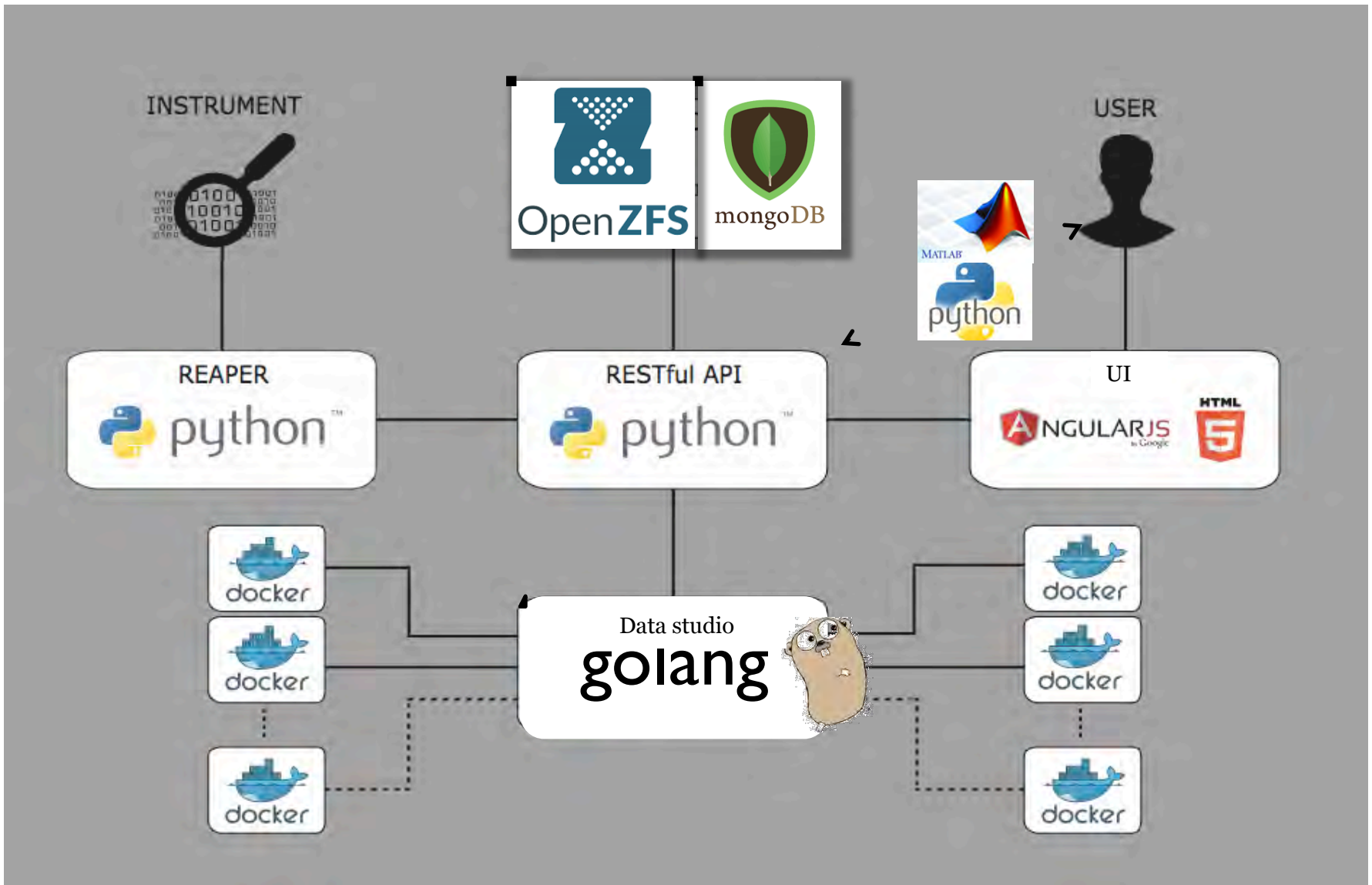
16_1_T1w_1mm_dicom_nifti_bet.nii.gz

Notes

Add a note to this session

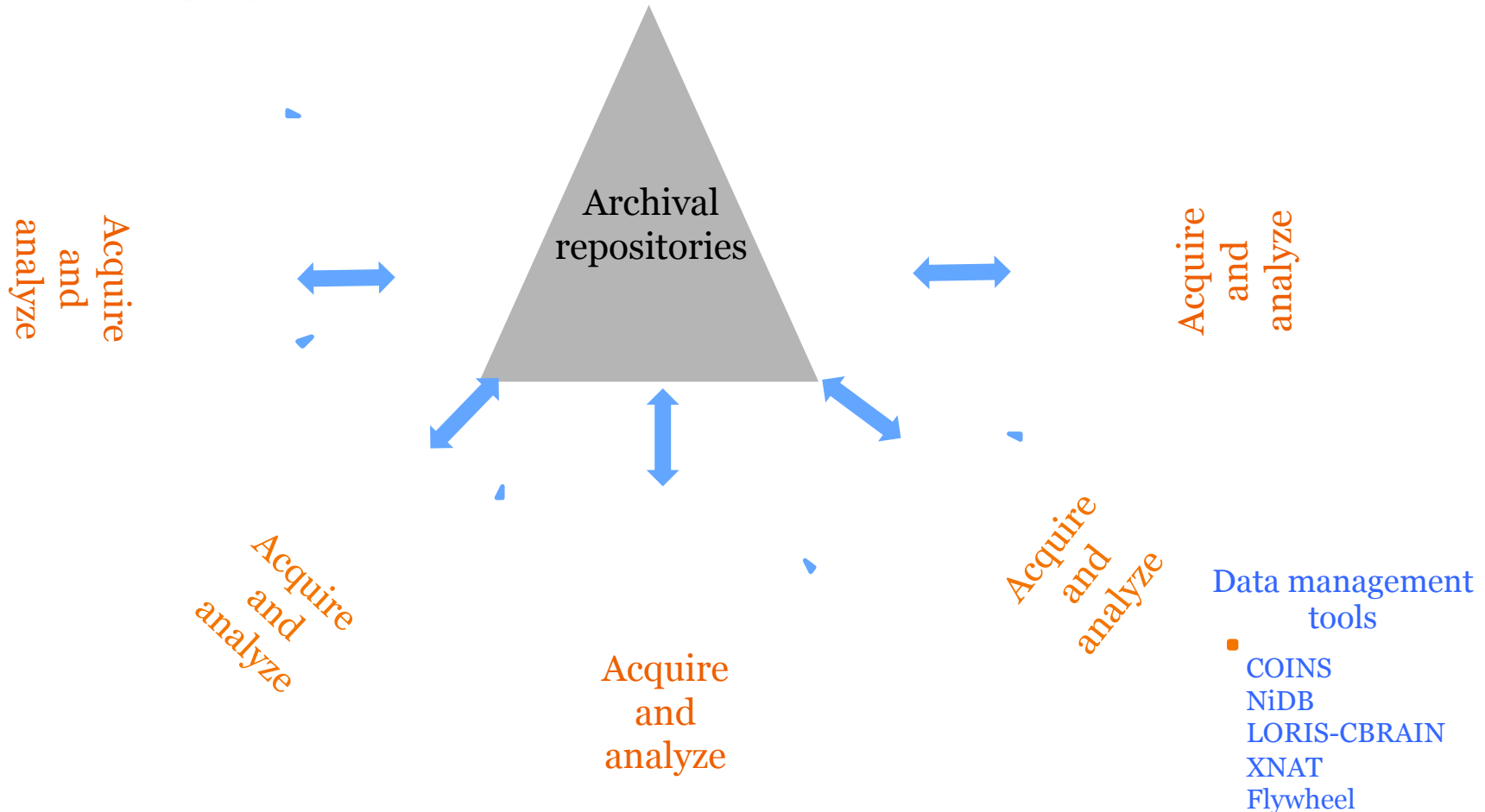
SAVE

Web technologies



Archives and data management tools

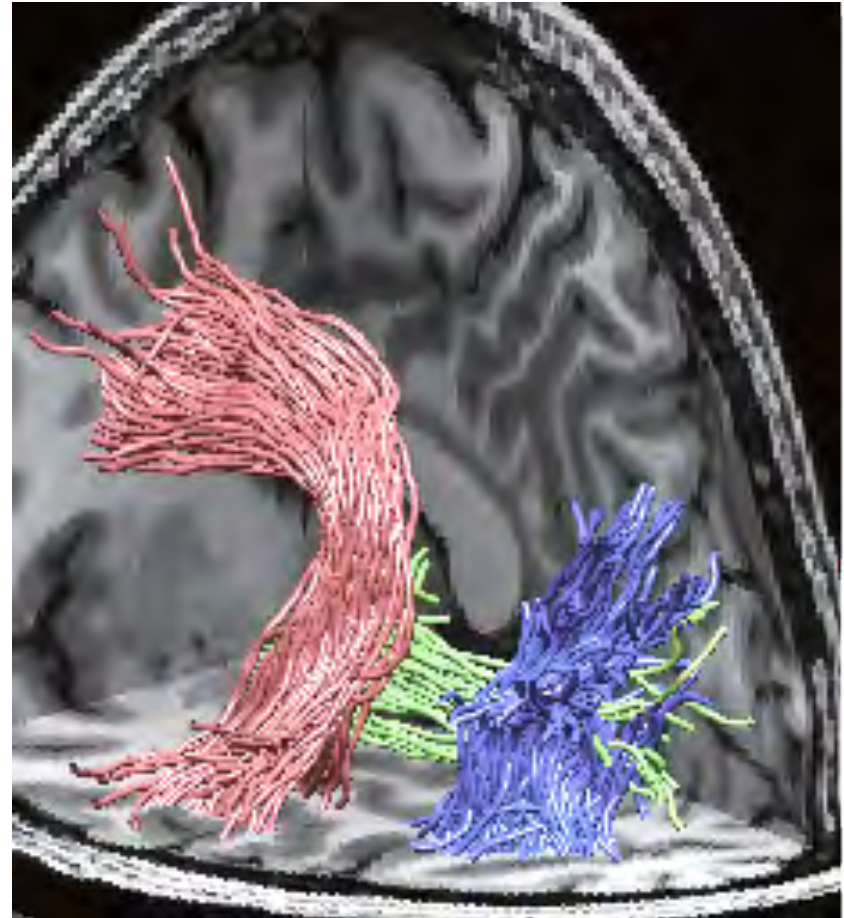
LONI IDA UMCD iEEG.org MR Innovations Anima OMEGA	CBFBIRN Open Science CBS PAIN PDBP (Parkinsons) GAAIN Age-ility (nitrc)	Cimbi PedsDTI ConnectomeDB (xnat) SchizNet (xnat) NDAR	FITBIR openfMRI (scitran) Neurovault FBIRN ADNI NUNDA (xnat)	NITRC PING PNC PLORAS VUIIS (xnat) XNAT Central (xnat)	Simons VIP (scitran)
------------------------------------------------------------------	----------------------------------------------------------------------------------------	-----------------------------------------------------------------------	-----------------------------------------------------------------------------	-----------------------------------------------------------------------	-------------------------



Scientific goals of the project

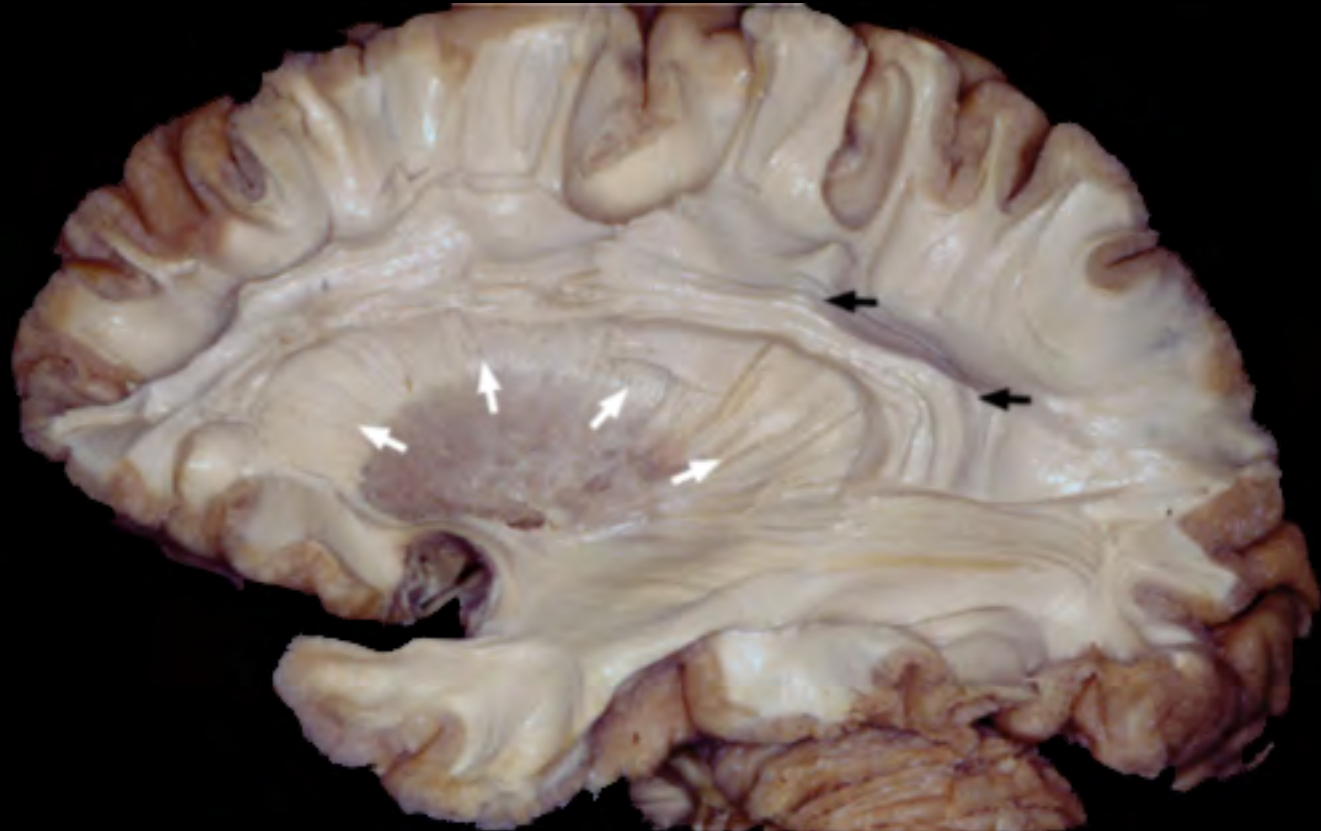
Personalized neuroscience

An opportunity that derives from a combination of big science and the quest for reproducible research



Human fascicles (tracts)

- There are many long-range connections
- These connections are not passive – they change their properties in response to use
- A system with active wires



(c) Wandell, 2016

Courtesy Professor Ugur Ture

Figure 25

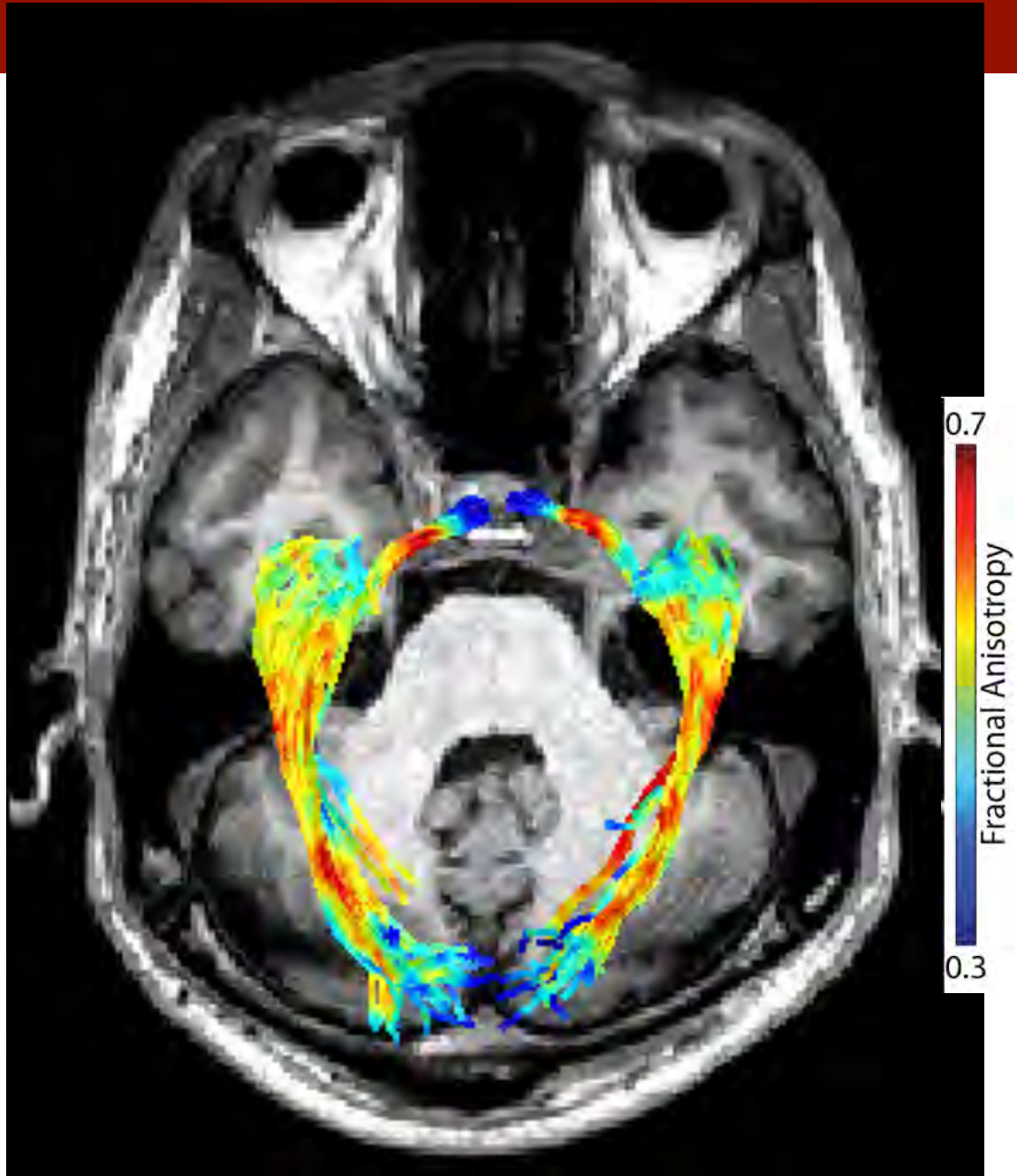
A motivating example

- A subject or patient with a retinal eye disease comes to the lab
- We want to know the consequences of retinal degeneration on cortical structures

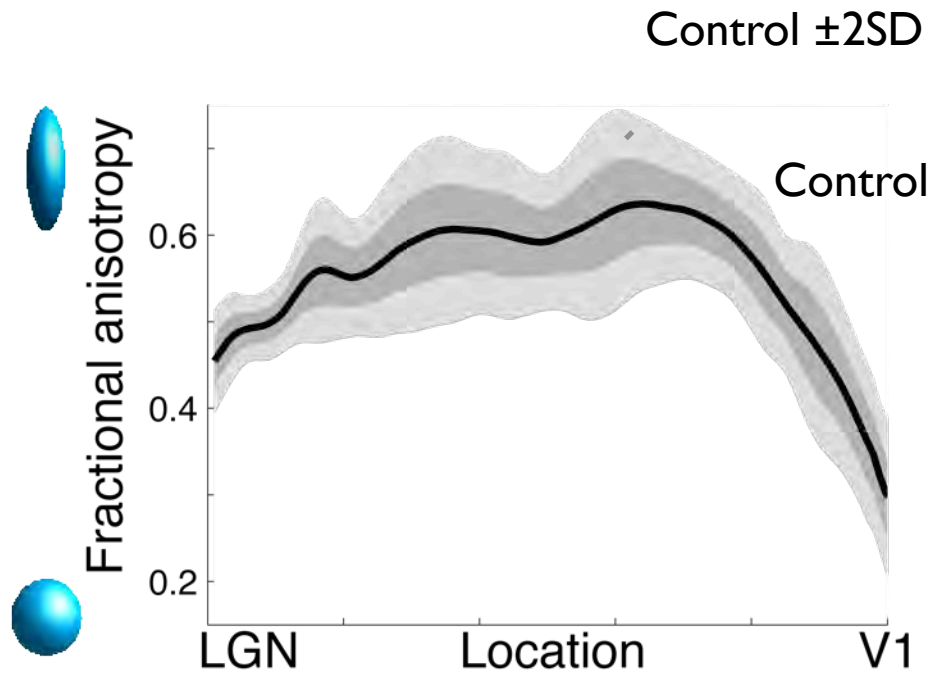


A motivating example

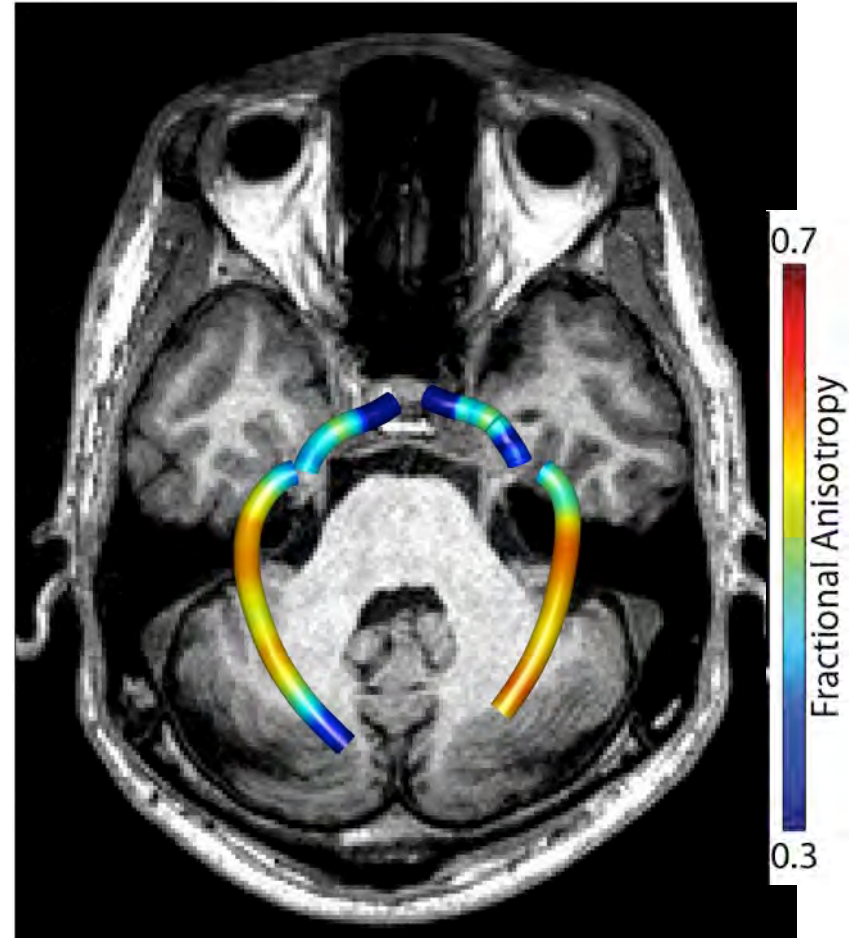
- Measure the subject's visual white matter and secure the data!
- Use validated computational tools for quality assurance
- Use open-source software for tract identification, tissue estimation and comparison with other populations



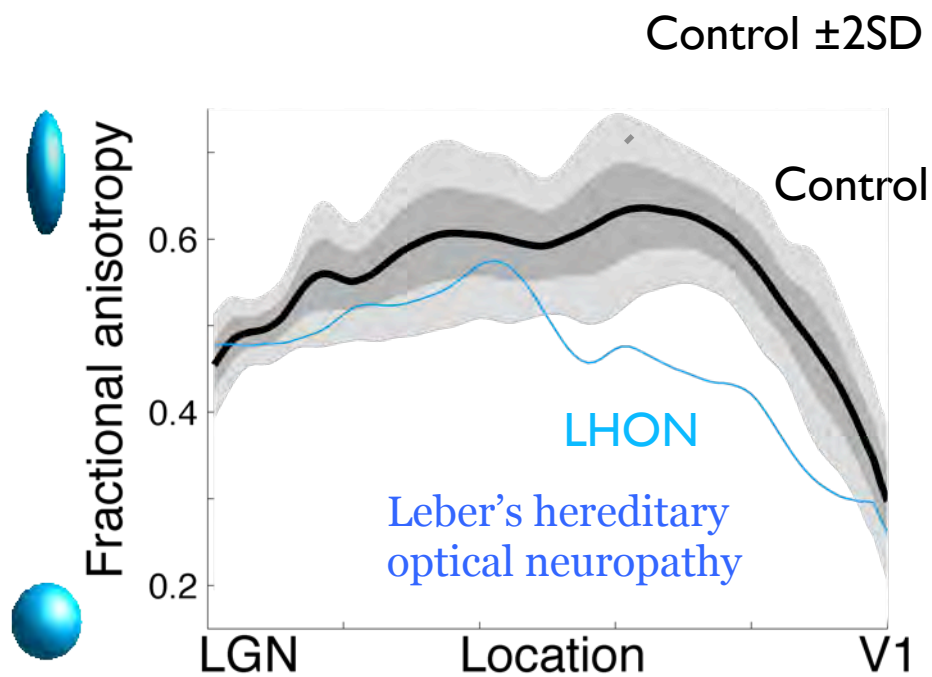
Use databases to find control data



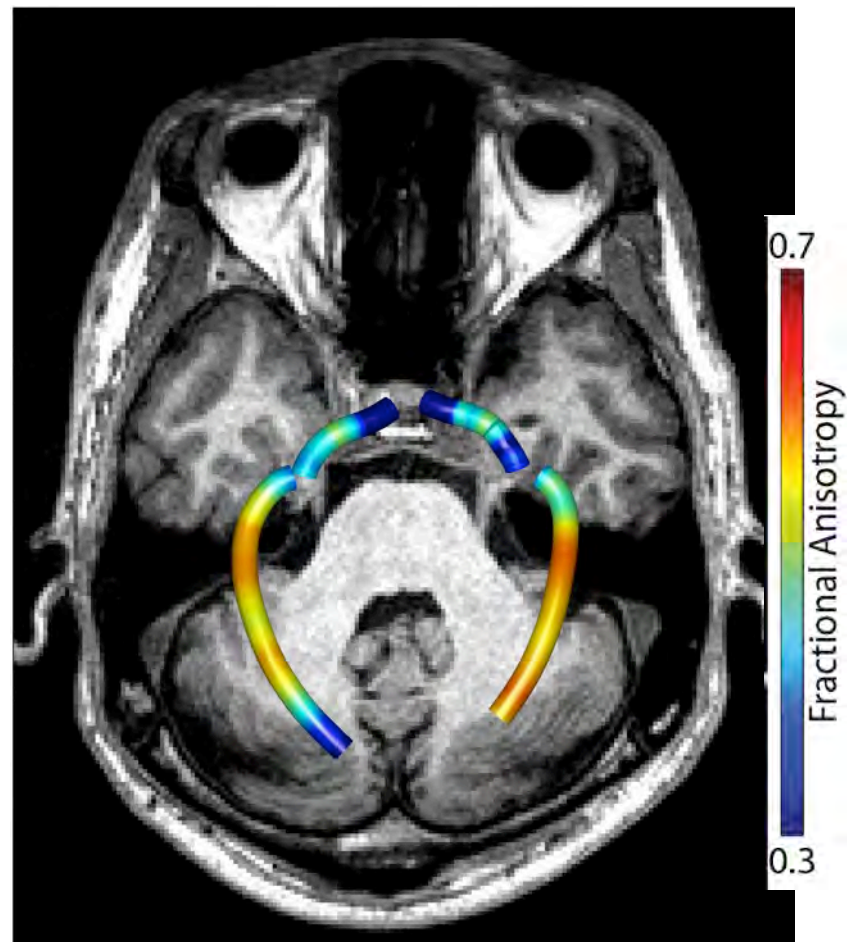
The expectation based on data acquired and stored in the SDM



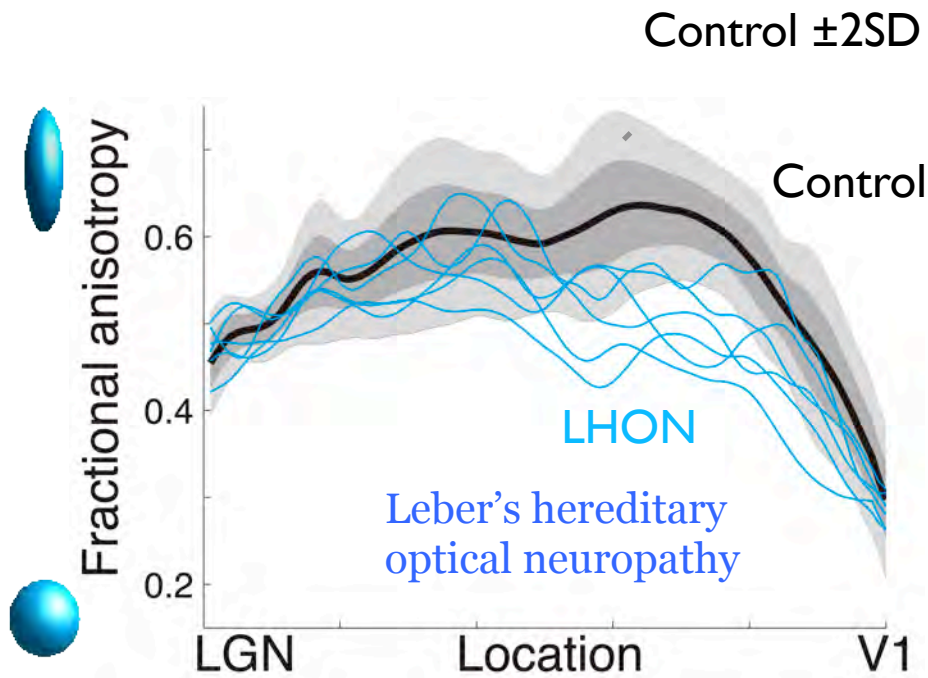
Compare your subject with the distribution and think



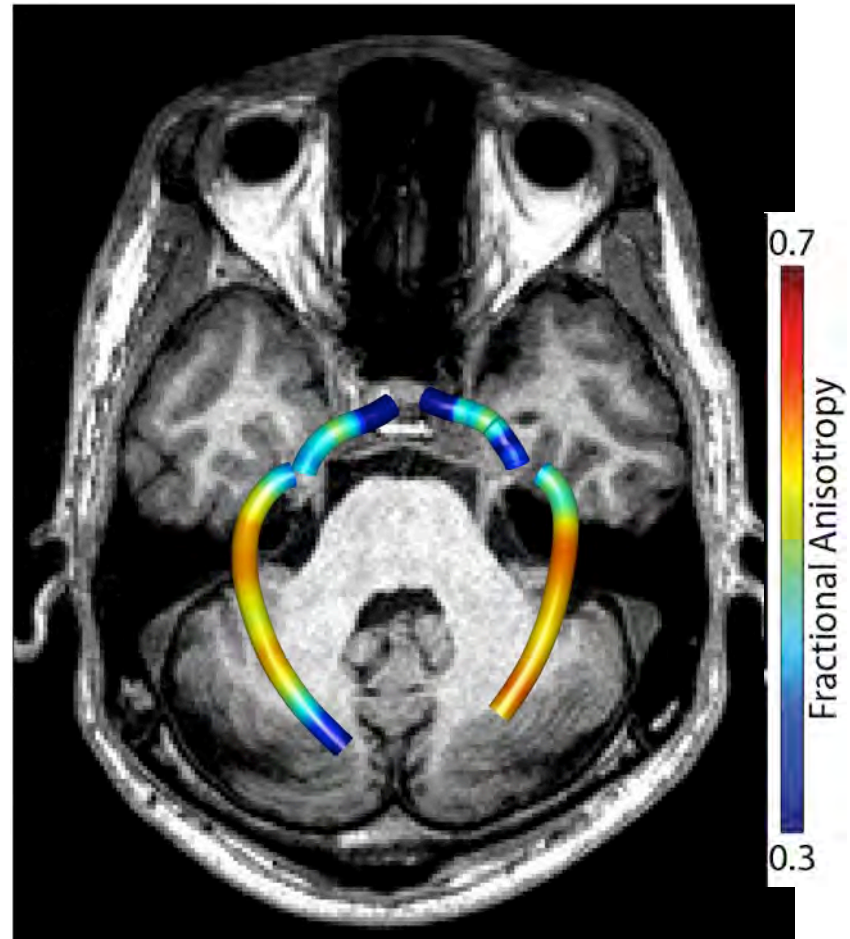
This subject compared to the expectation



Data science and statistics issues



Each subject with the disease has some variation and we would like to know, and track each one over time

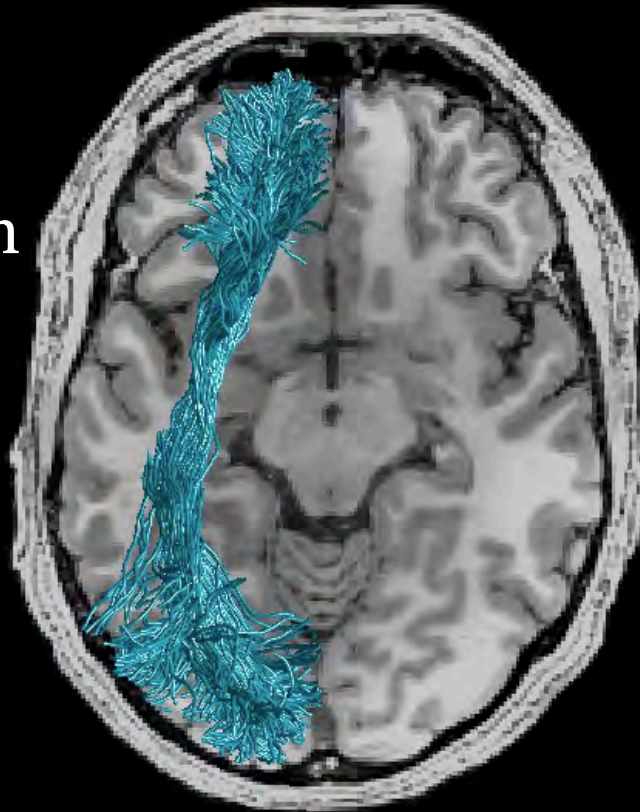


An example application

(image from F. Pestilli)

Inferior fronto-
occipital fasciculum

Left
IFOF



150 Directions, 2 mm³, B=2000 projected on a 1 mm³ T1 anatomical image
(c) Wandell, 2016

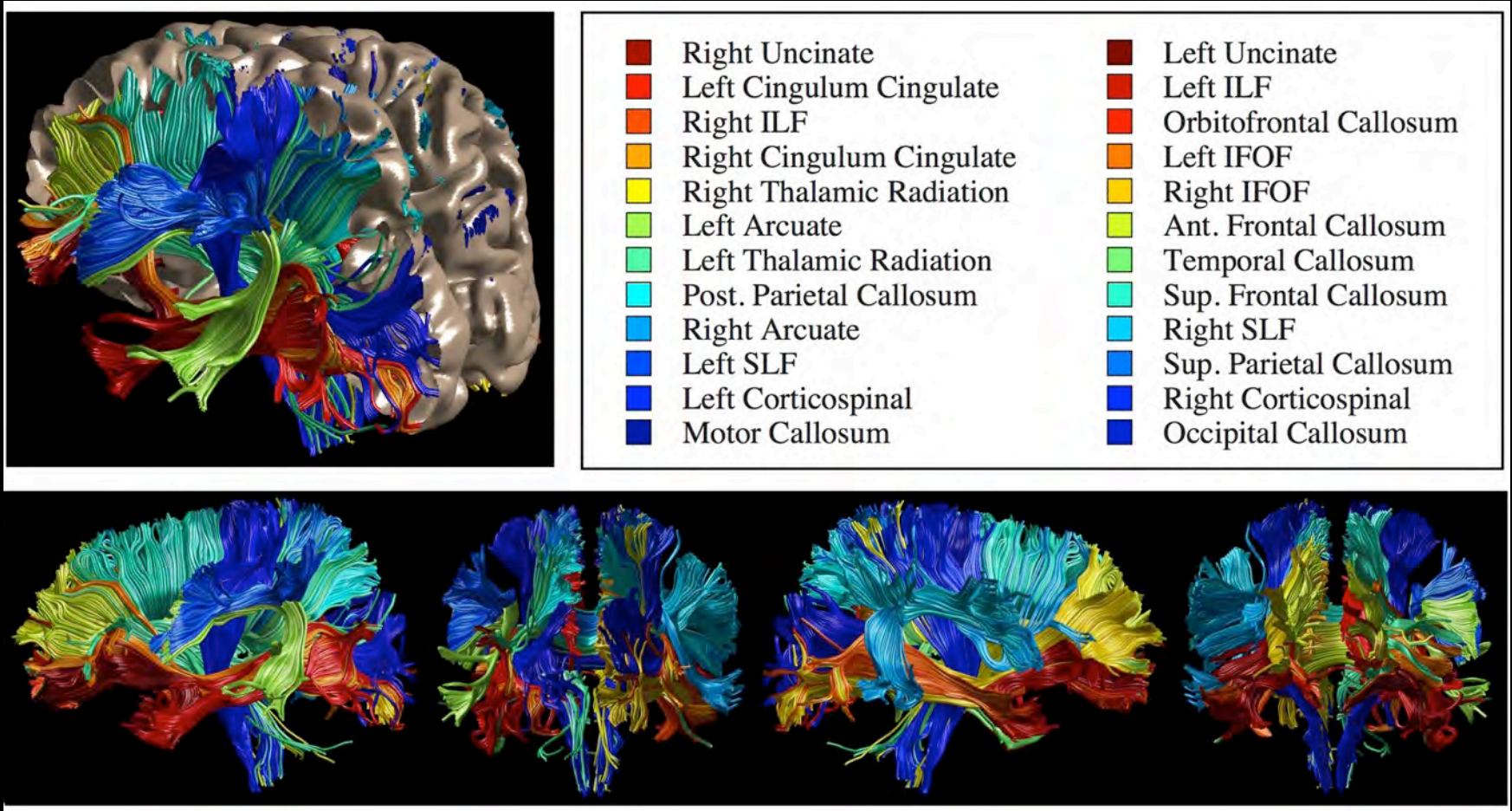
Building databases of healthy controls

Tissue development from 7-85 years

(Yeatman, Wandell, Mezer, 2014, *Nature Communications*)

- Diffusion-weighted and quantitative imaging identify the major tracts and tissue properties in individual subjects

Color indicates age of maturity. See paper for details. (N=120)



Scitran extension to methods

- “Who did skull-stripping on a T1 data set with the same MRI parameters as mine? What parameters did they choose that worked well?”
- “How did Noah find the positions of V1/V2/V3 from an anatomical MRI in an adult? Will it work on a child’s brain?”
- “I would like to run a machine-learning algorithm 1000 times on a variety of data sets and store the learned parameters and keep a searchable record”
- “What analyses did I run on these data last year? Where did I store the results?”
- “How did Joyce find the arcuate fasciculus from her diffusion data? Can I use the same methods on my diffusion data?”
- “What process was used to create Figure 3 in the paper by Jones? If I change this parameter, will the results be similar?”

Scitran extension for Stanford community data sharing

- Interactions with archival databases (e.g., NDAR, ADNI)
 - We downloaded much of ADNI by hand
 - We have Simons VIP
 - We might download NDAR
 - We have part of the HCP
- Integration with publishers and libraries (e.g., SDR)
- Many SoM colleagues have been working with us to incorporate their special data sets.

Thanks from the Project on Scientific Transparency

- Our fears
 - Sustainability
 - Hiring and keeping an excellent team
- Our plan
 - Open-source
 - Commercial venture



Join us at OHBM Annual Meeting
in Geneva, Switzerland, June 26-30, 2016.

[SCHEDULE A MEETING >](#)

Flywheel is the researcher's data platform
CAPTURE • ANALYZE • COLLABORATE • CAPITALIZE
on your data and algorithms

How much value is
hiding in your work?

 Flywheel

DASHBOARD COLLECTIONS PROJECTS ORGS SEARCH



Stanford | Project on Scientific Transparency

ABOUT NIMS INTERACTIVE COMPUTING THE POST TEAM CONTACT

SCITRAN

Scientific data management

NIMS is a scientific data management system, specifically designed for neuroimaging data.
[Click to learn more about NIMS!](#)

Summary

- Scientific data management tools are needed to support reproducible research in the era of complex science
- We have made a start for neuroimaging with the open-source scitran and corporate partner, Flywheel Exchange
- Technology exists and needs development; social barriers and risks remain significant

We thank the Simons Foundation and the Arnold Foundation for their support

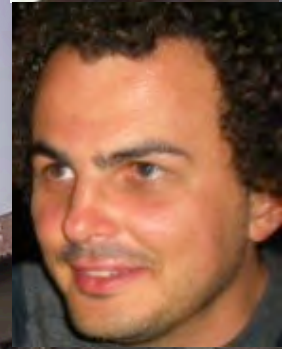
Commercial disclosure*:

We are active participants in a commercial venture related to the work described here, Flywheel Exchange, LLC.

Michael Perry*



Renzo Frigato*



Gunnar Schaefer*



Bob Dougherty

