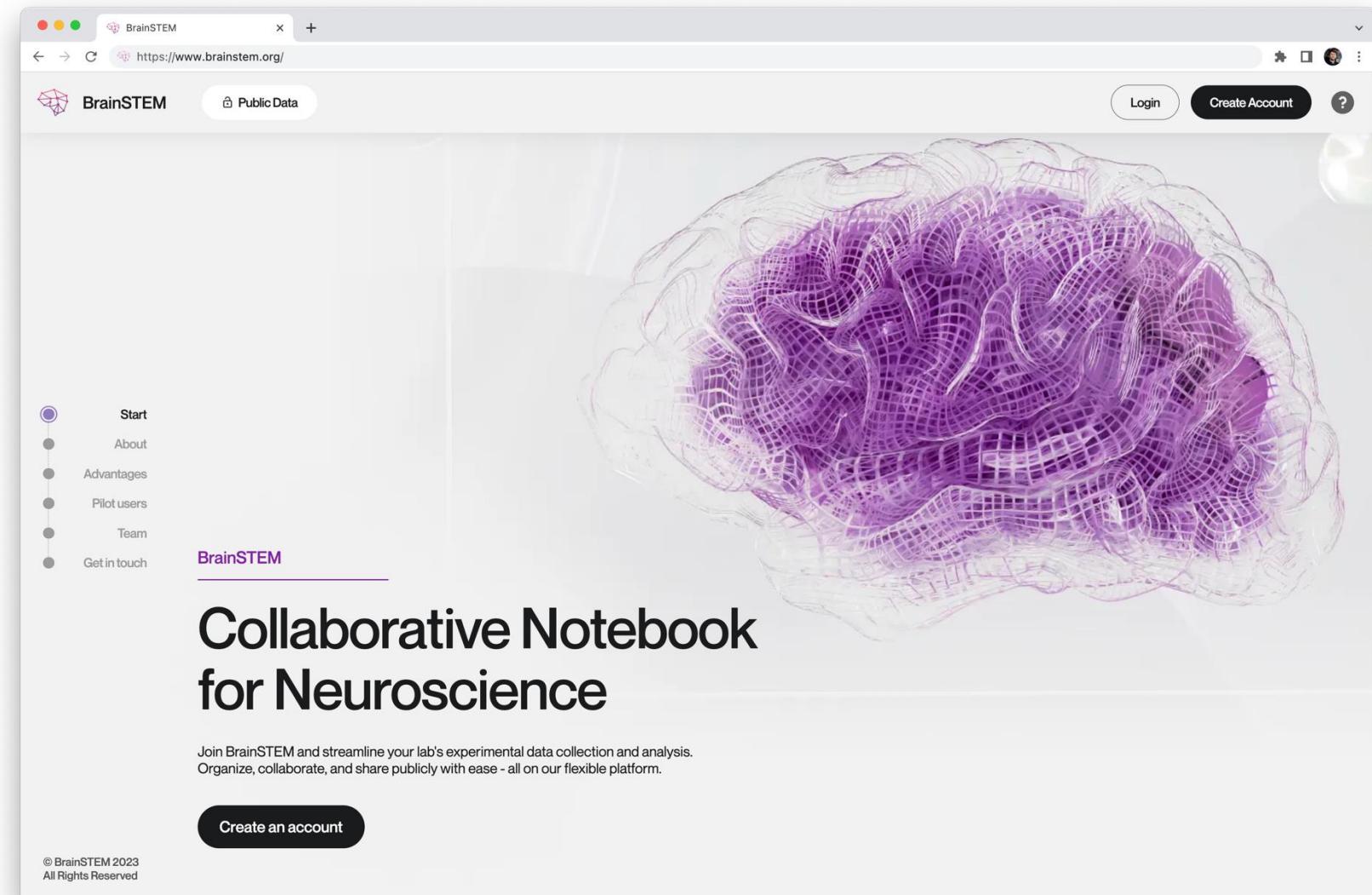


BrainSTEM: An Open Platform for Structured, FAIR Neuroscience Data



The screenshot shows the BrainSTEM website homepage. At the top, there is a navigation bar with a purple brain icon, the text 'BrainSTEM', a 'Public Data' button, and links for 'Login', 'Create Account', and a question mark icon. On the left, a sidebar menu includes 'Start' (which is highlighted with a purple dot), 'About', 'Advantages', 'Pilot users', 'Team', and 'Get in touch'. Below the sidebar, the main content area features a large image of a brain with a purple wireframe overlay. The text 'BrainSTEM' is underlined, followed by the title 'Collaborative Notebook for Neuroscience'. A subtitle reads: 'Join BrainSTEM and streamline your lab's experimental data collection and analysis. Organize, collaborate, and share publicly with ease - all on our flexible platform.' A 'Create an account' button is at the bottom of this section. At the very bottom of the page, there is a copyright notice: '© BrainSTEM 2023 All Rights Reserved'.

Peter C. Petersen, Associate Professor
Department of Neuroscience, UCPH

[BrainSTEM.org](https://www.brainstem.org)
MIT, June 11, 2025

Why BrainSTEM? The Problem with Today's Neuroscience Data

- 1. Metadata is fragmented**
 - Lab notebooks
 - Spreadsheets
 - Embedded with the data
 - Programming scripts
- 2. Lack of standardization and insufficient documentation for reuse**
 - Personal language
 - Lab conventions
 - Implied experimental conditions
- 3. Data sharing has a high entry barrier and is often of limited effectiveness**
 - Sharing your data is very time-consuming
 - Public repositories have limited discovery functionality
 - Sharing has limited impact

What is BrainSTEM?

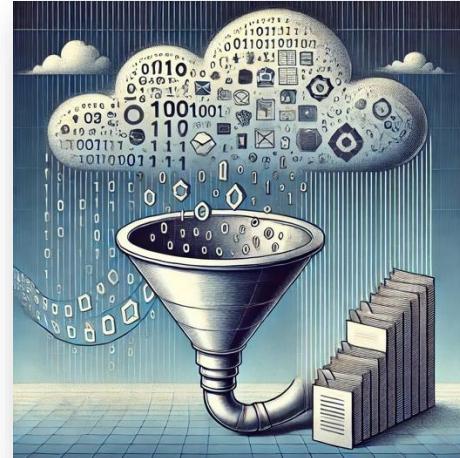
The image displays two screenshots of the BrainSTEM web application interface. The left screenshot shows the 'Dashboard' page, which includes sections for 'Projects' (Recent active projects like 'Theta oscillations in MS'), 'Sessions' (Behaviors, Data acquisition, Manipulations, Epochs), 'Data storage' (Network drive - Petersen lab - SUND, PP harddrive #1, Dimas harddrive 1, NYUshare_Datasets, Peters harddrive, NYUshare_Roman_e15), and 'Inventories' (Recent Inventories). The right screenshot shows a detailed view of a session titled 'Peters session'. It includes fields for 'Session name:' (set to 'Peters session'), 'Project(s):' (listing 'Peter U19 demo project' and 'Peters project'), 'Description' (containing a placeholder text about theta oscillations and a list of projects: 'Peter U19 demo project', 'Julia Project', 'Laughing_Mouse_Project'), and 'Date and time onset' (set to 2024-06-03 at 11:29:00) and 'Tags' (set to 'screening').

- A user-friendly web-based notebook for describing day-to-day experiments, collaborations, and data sharing
- Focused on experimental neuroscience: from behavior to neurophysiology
- A central resource streamlining data analysis and a portal for reuse of experimental data

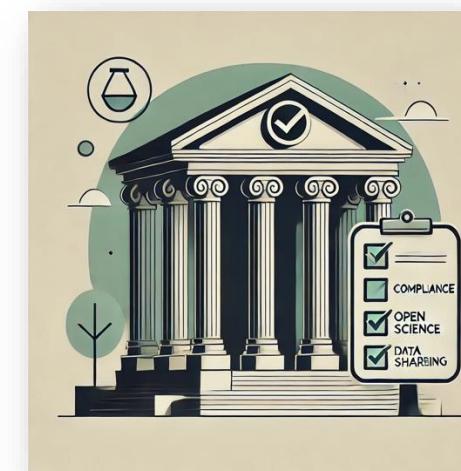
Why are we building BrainSTEM?



Enhance
Reproducibility and
Discoverability



Capture the Incredible
Volume of Rich and
Diverse Data



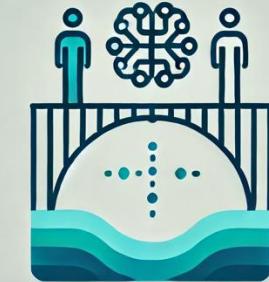
Align with Priorities of
Funding Agencies



Accelerate and
Streamline Discovery



Make data FAIR



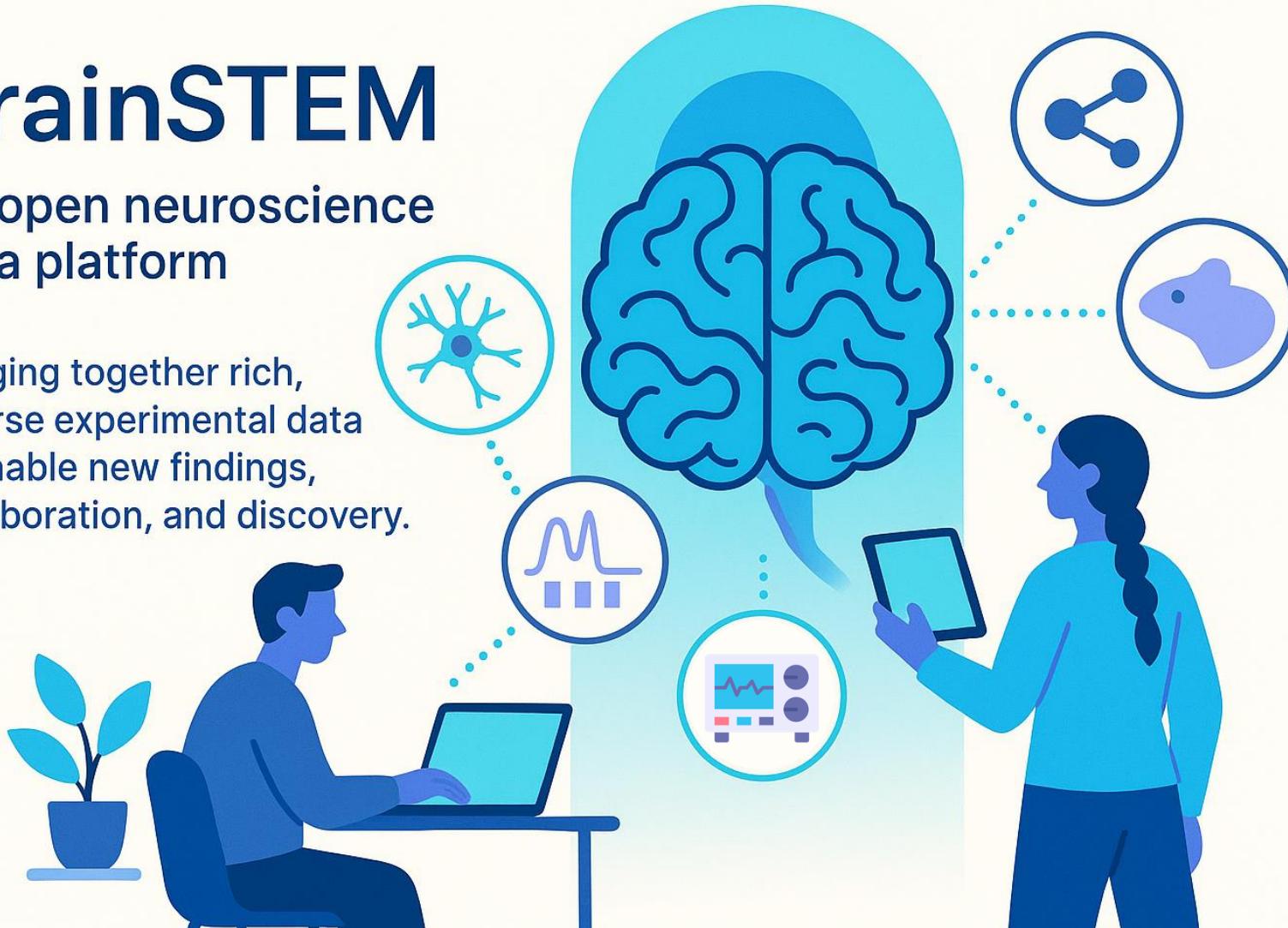
Lower Barriers in
Collaborations

The Bigger Picture

BrainSTEM

An open neuroscience
data platform

Bringing together rich,
diverse experimental data
to enable new findings,
collaboration, and discovery.



The team and funding behind BrainSTEM

The team behind BrainSTEM

BrainSTEM is developed and funded by the [Oxytocin U19 Brain Initiative Grant 5U19NS107616](#), led by György Buzsáki, Moses V. Chao, Robert C. Froemke, Dayu Lin, Adam Mar, Alisa R. Surkis, Richard Tsien.



Peter Petersen | PhD

Project leader

Assistant Professor at University of Copenhagen.



Alisa Surkis | PhD

Director of the Data Core

Deputy Director at NYU Health Sciences Library.



Rodrigo Amaducci | PhD

Lead developer (2021-2023)

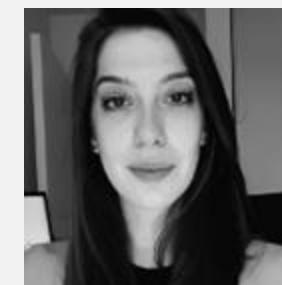
Now: Software Developer, Majorel, Spain.



Mingze Dou

Documentation

Master's student at University of Copenhagen



Lorena Carballo

Front-End & Graphics Designer



Eli Taft

Senior Software Engineer



Jack Miszencin

Project Leader

Main features of BrainSTEM

Advantages

Discover what BrainSTEM can do for your lab

BrainSTEM can accelerate your science, promote collaboration, extend the lifetime of your data, and make FAIR data sharing easy.



User-friendly

Designed for ease of adoption and use. No technical know-how is needed.



Standardized

A standardized yet, flexible, and extendable data model.



Customizable

The interface can be customized to suit your needs.



Collaborative

Granular access control enables collaboration within or across labs.



Programmable access

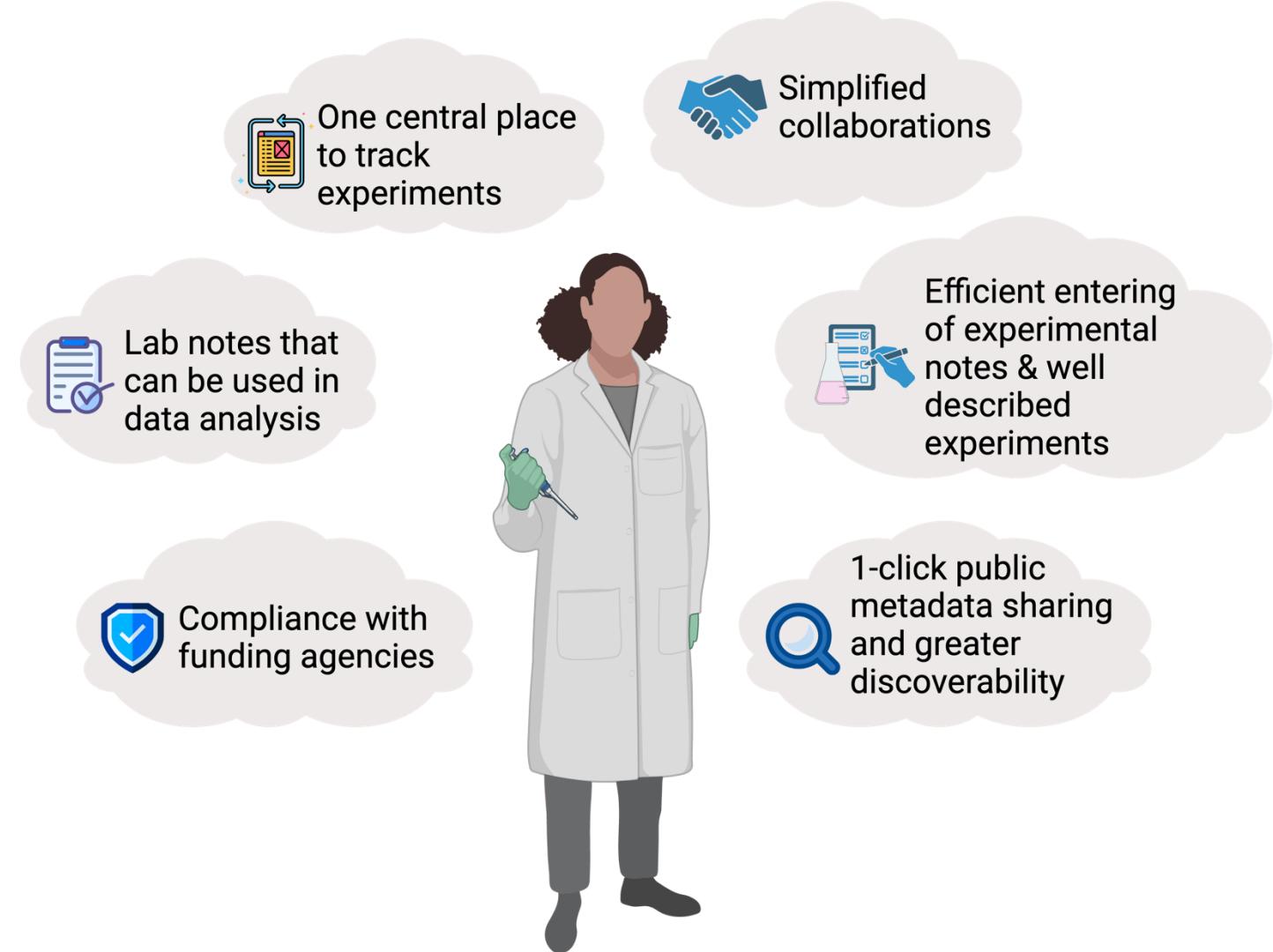
An API provides coordination with Python, Matlab, and other analysis tools.



Relational

Organized data model for accuracy and easy access.

Benefits to researchers



One central place
to track
experiments

Simplified
collaborations

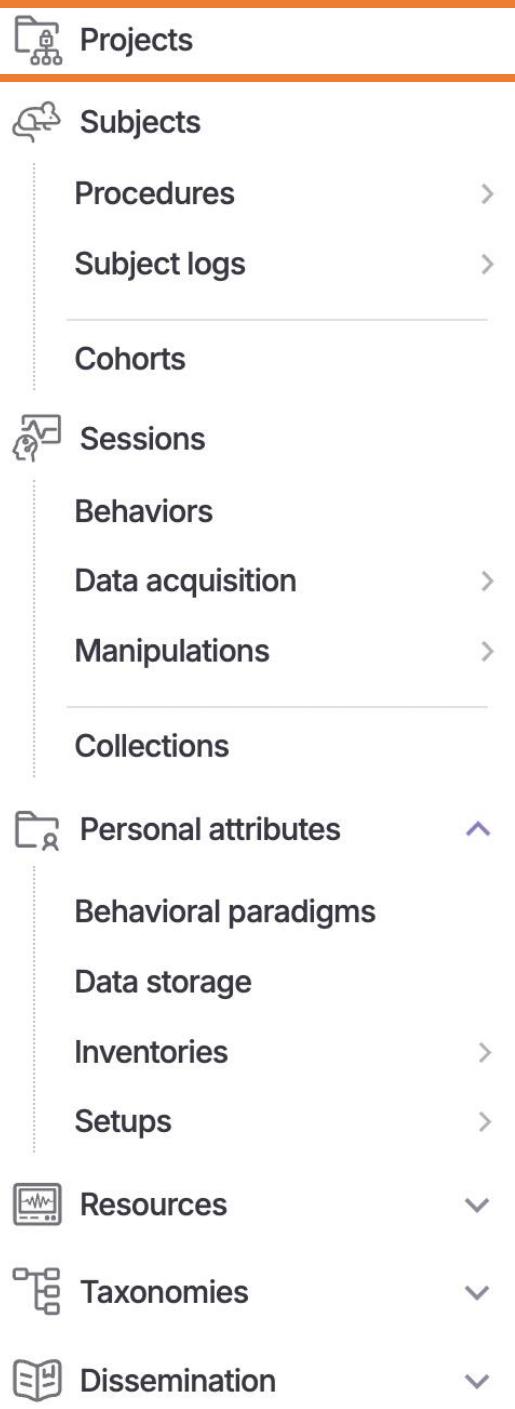
Lab notes that
can be used in
data analysis

Efficient entering
of experimental
notes & well
described
experiments

Compliance with
funding agencies

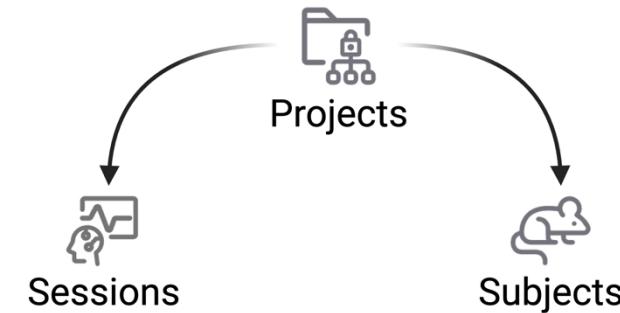
1-click public
metadata sharing
and greater
discoverability

Basic elements of BrainSTEM



Projects

Organizational units representing research initiatives encompassing related subjects and sessions.



Basic elements of BrainSTEM

Projects

- Subjects
- Procedures
- Subject logs
- Cohorts

Subjects

Genetic line

DNA helix icons: purple, blue, green.

Cohorts

Breeding

x	x
xx	xx
y	xy
xy	xy

Sex

Species & Strains

Sessions

- Behaviors
- Data acquisition
- Manipulations

Collections

Personal attributes

- Behavioral paradigms
- Data storage
- Inventories
- Setups

Resources

Taxonomies

Dissemination

Virus injections

Probe implantations

Optic fibers

Cranial windows

Surgical procedures

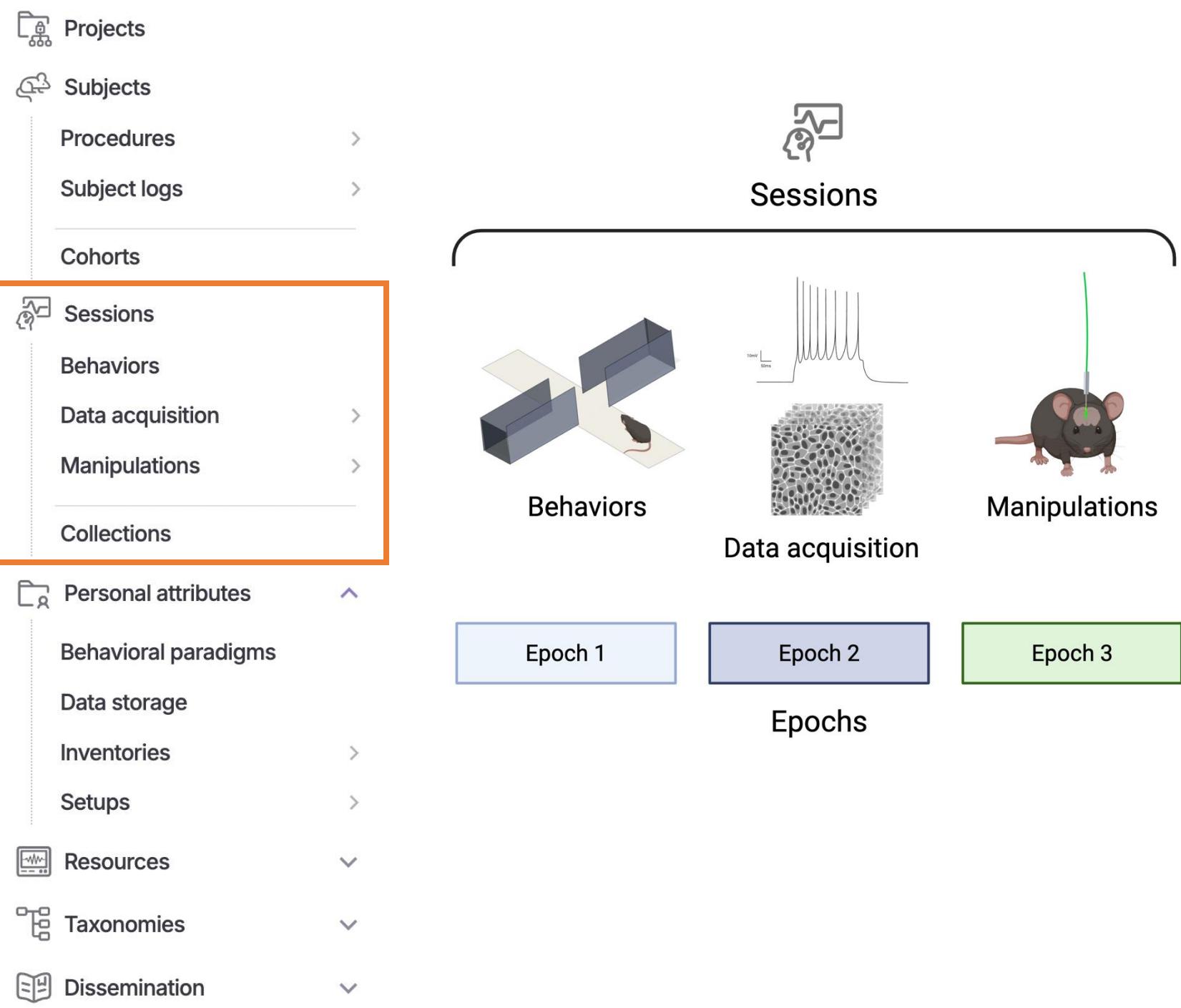
Weighing

Food & Water

Housing

Subject logs

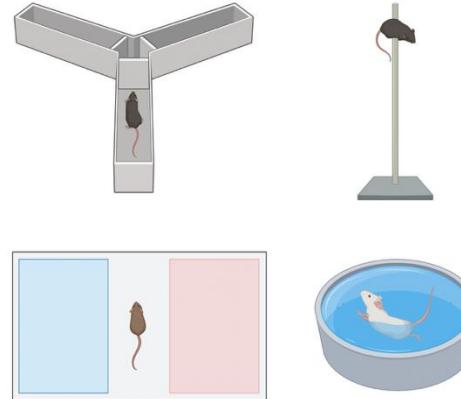
Basic elements of BrainSTEM



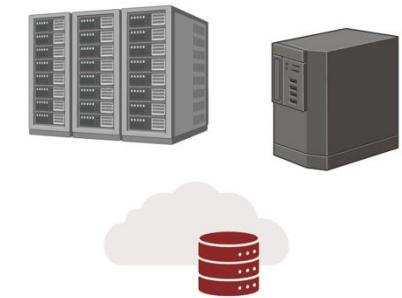
Basic elements of BrainSTEM

- [Projects](#)
- [Subjects](#)
- [Procedures >](#)
- [Subject logs >](#)
- [Cohorts](#)
- [Sessions](#)
- [Behaviors](#)
- [Data acquisition >](#)
- [Manipulations >](#)
- [Collections](#)
- [Personal attributes](#)
- [Behavioral paradigms](#)
- [Data storage](#)
- [Inventories + Consumable stocks](#)
- [Setups + Equipment](#)
- [Resources](#)
- [Taxonomies](#)
- [Dissemination](#)

Behavioral paradigms



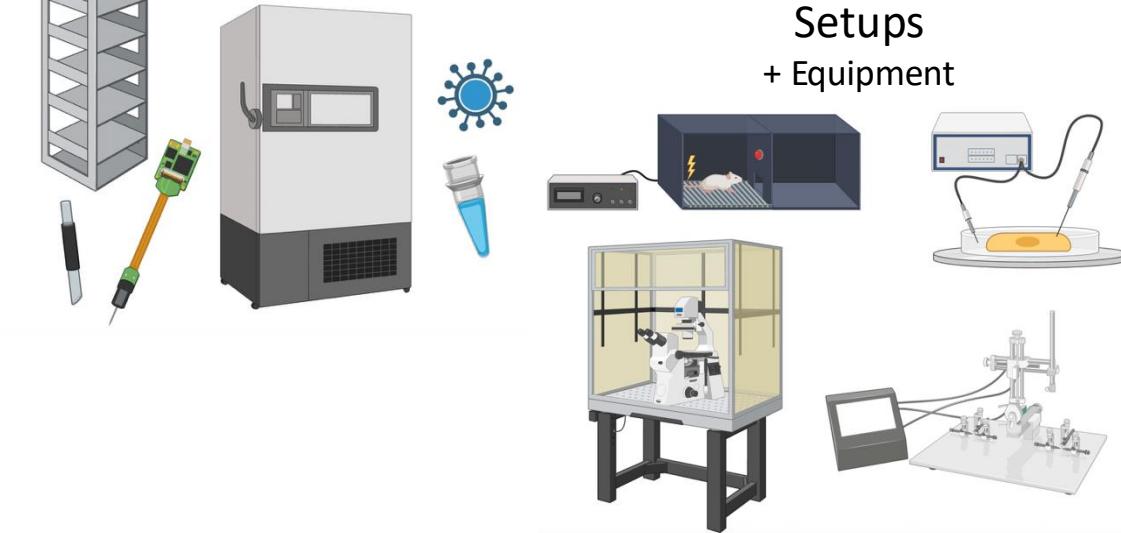
Data storage



Inventories + Consumable stocks



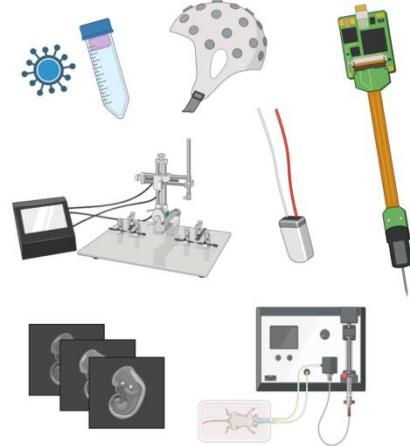
Setups + Equipment



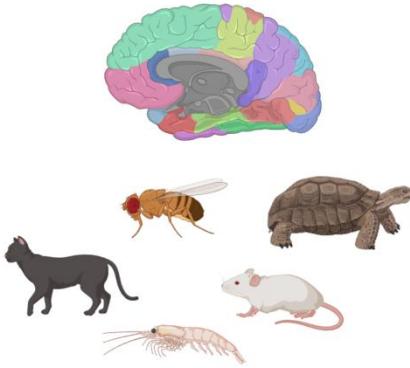
Basic elements of BrainSTEM

- [!\[\]\(a4e6c12a7460acb99e3ecd7781b3aea3_img.jpg\) Projects](#)
- [!\[\]\(72f3bfe51b477f2c2b004c0a9c331962_img.jpg\) Subjects](#)
- [!\[\]\(8fd176124ea7303c38d05a8b3acff154_img.jpg\) Procedures >](#)
- [!\[\]\(58b939658e30b77fcda4f0badcc2af08_img.jpg\) Subject logs >](#)
-
- [!\[\]\(7a826f8dea09f13e2fee55c90bb7dad2_img.jpg\) Cohorts](#)
- [!\[\]\(d38c95b2e81bbda5ba3da8e61d9cd145_img.jpg\) Sessions](#)
- [!\[\]\(0faa8774582ac47ef5fbd6bafa9436bd_img.jpg\) Behaviors >](#)
- [!\[\]\(75329fe282cfabfa3caefd3cdaff4799_img.jpg\) Data acquisition >](#)
- [!\[\]\(cbebdabbc2eec52a2a8acbcee2795d22_img.jpg\) Manipulations >](#)
-
- [!\[\]\(be2641930427ea73e62c7a54fe6eff87_img.jpg\) Collections](#)
- [!\[\]\(236eda499298f92988ed75f0ff1de1d8_img.jpg\) Personal attributes !\[\]\(39ea4dcf49a30f6efe6fb11108e6ca48_img.jpg\)](#)
- [!\[\]\(20cbaa5fcf7b2c2d50cb68140e49dd06_img.jpg\) Behavioral paradigms](#)
- [!\[\]\(cea8138519145a2ff34ce1a635e7e98a_img.jpg\) Data storage](#)
- [!\[\]\(dc191998b885e5b886f4079b7c9f93d9_img.jpg\) Inventories >](#)
- [!\[\]\(86aadee6af24e9451f12cc83eacea81d_img.jpg\) Setups >](#)
-
- [!\[\]\(b767a79aeeafbe983e1adbcf2359ca7f_img.jpg\) Resources !\[\]\(56c314eaea4aeac6913b08f7d5d226fb_img.jpg\)](#)
- [!\[\]\(a86afd324fcd44d58533a09b0a390d49_img.jpg\) Taxonomies !\[\]\(28f0a087bc756324e458c00eceb21990_img.jpg\)](#)
- [!\[\]\(c7667f77aafc23414f3e77c5898cbaa0_img.jpg\) Dissemination !\[\]\(561befbf649664ff4f6d62d27eff8ba7_img.jpg\)](#)

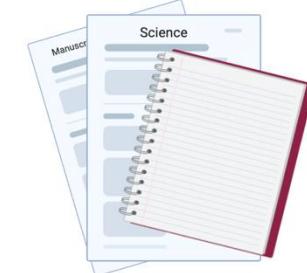
Resources



Taxonomies



Dissemination



Shared standards and controlled vocabulary



Resources

- Consumables
- Hardware devices
- Suppliers



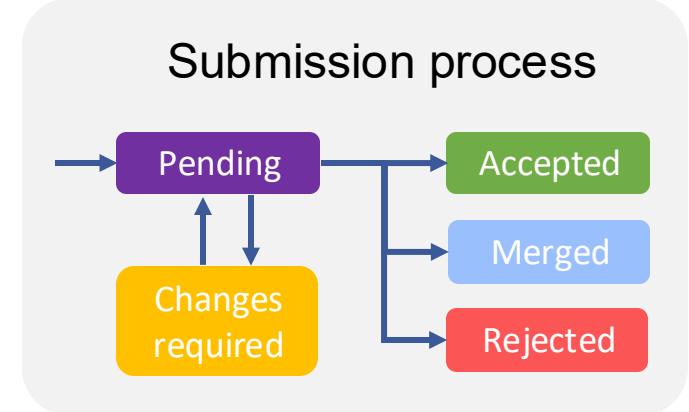
Taxonomies

- Species and strains
- Setup types



Dissemination

- Journals
- Publications



1. New entries and changes are submitted through forms.
2. *Submitting authors can use entries right away.*
3. Submissions must be approved by us (admin team).
4. Pending approvals can be monitored on the approval pages.
5. An email alert is sent on status changes.
6. Once approved, entries will appear for everyone.

How about extension of the data model?

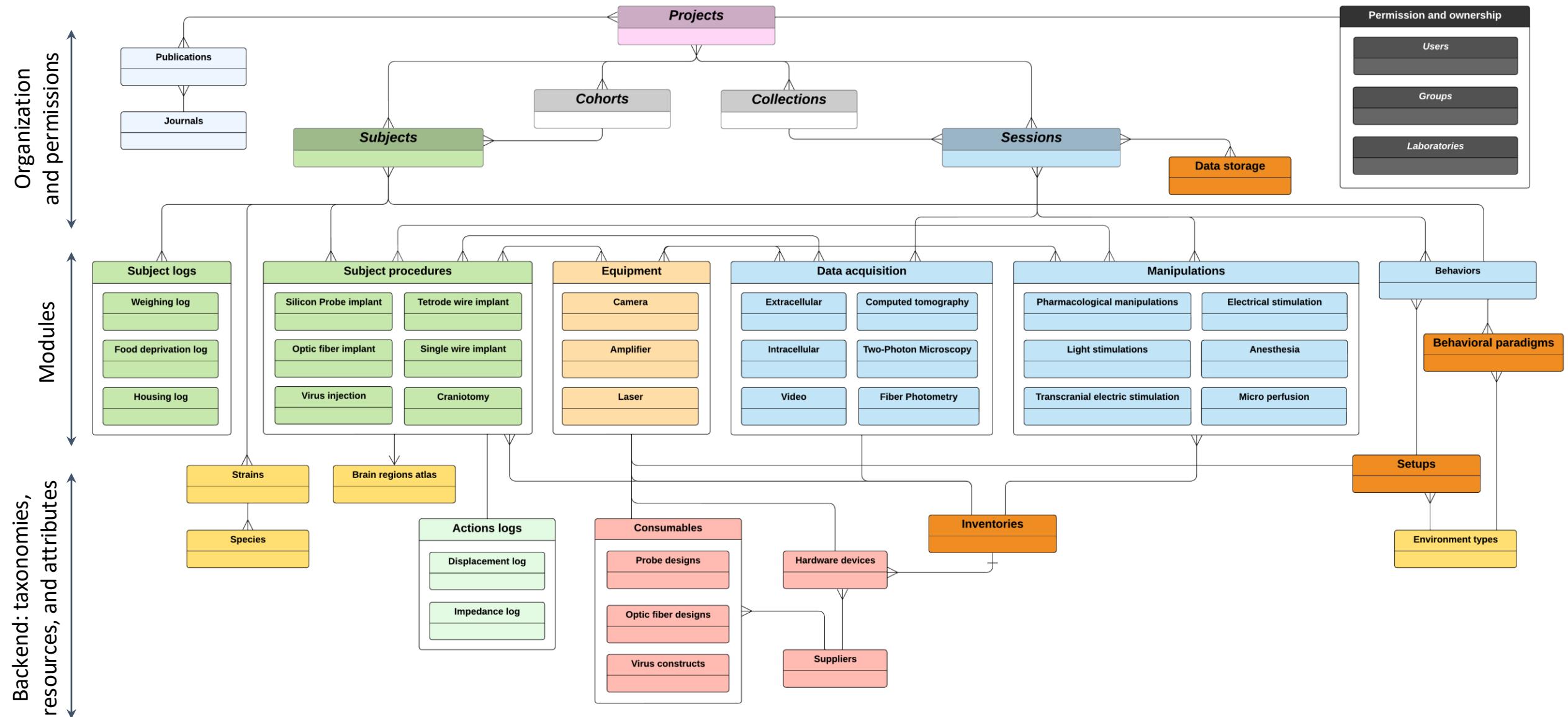
We implement changes to the actual database and codebase

1. General changes to fields and options available in forms.
2. New types of modules or changes to existing ones:
 - Procedures
 - Data acquisition
 - Manipulations
 - Equipment
 - Subject logs
 - Procedure logs

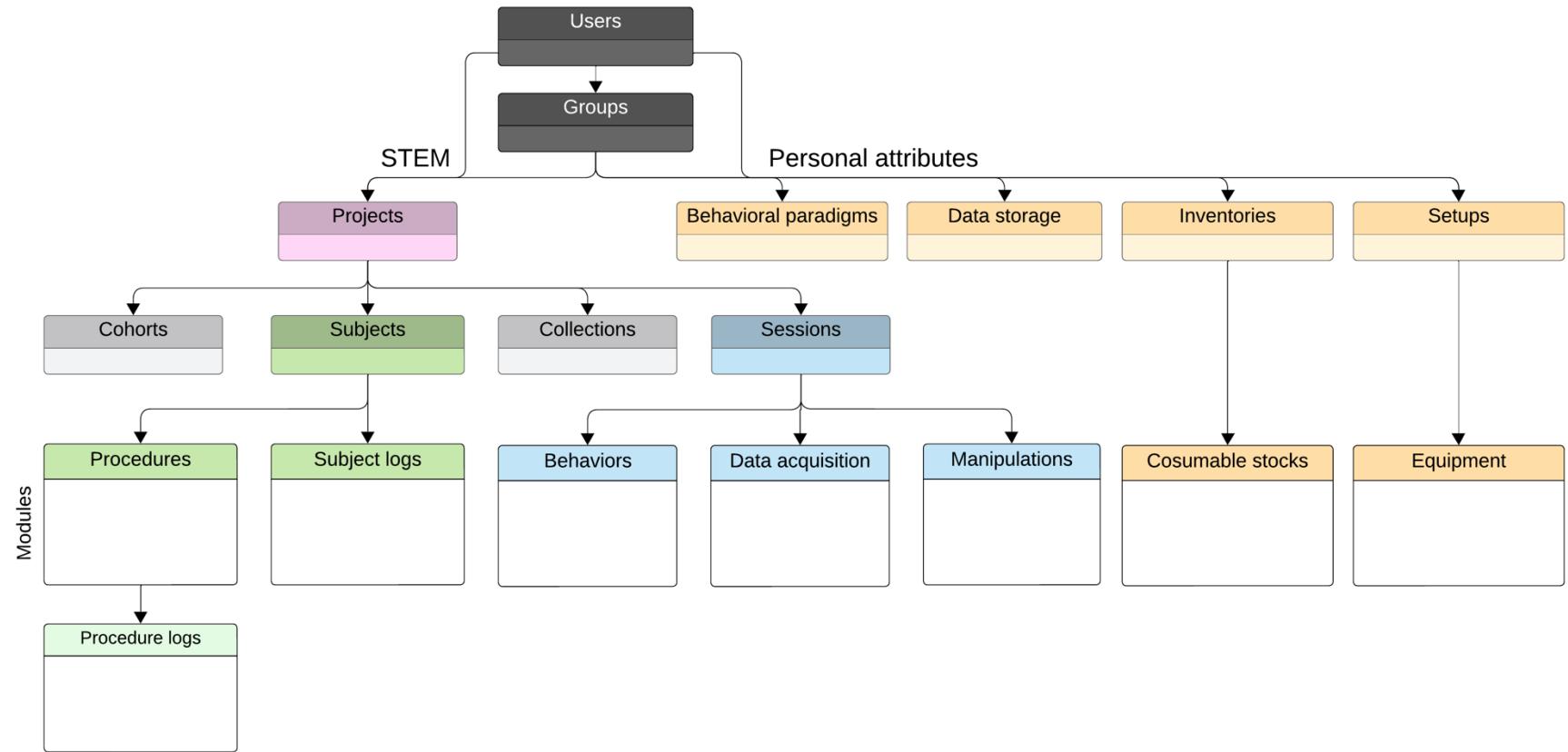
Also, new types of consumables, brain region atlases, and coordinate systems.

1. Request for changes must be done in a dialog with us.
2. Use our [GitHub Discussions](#) to suggest features, and our [GitHub Issues](#) to report issues and bugs.
3. This feedback is critical!

The relational data model of BrainSTEM



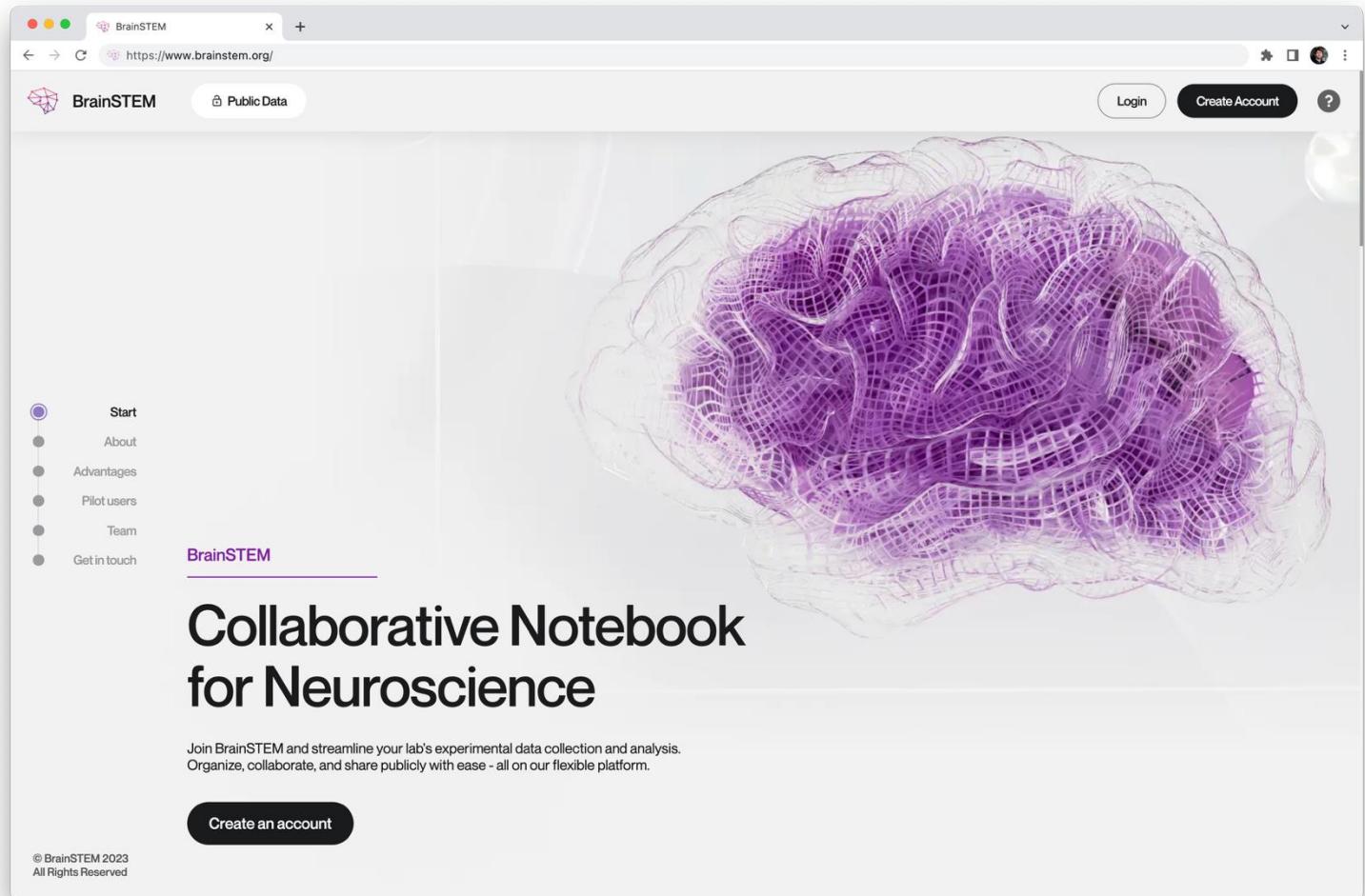
Object-level permissions



Object-level permissions with inheritance from users and groups through projects and personal attributes.

Permission levels	Groups 3 levels / users	Projects 4 levels / groups and users	Personal Attributes 4 levels / groups and users
Members	Inherit project-permissions assigned to the group	Read access to project-related subjects, sessions, collections, and modules	Read access to personal attributes, equipment and consumable stocks
Contributors	-	Create, edit, and delete related models	Create, edit, and delete related models
Managers	Add and remove members	Add and remove members and groups	Add and remove members and groups
Owners	Manage group details and add and remove managers	Edit project details and add and remove managers	Edit personal attribute details and add and remove managers

Demo

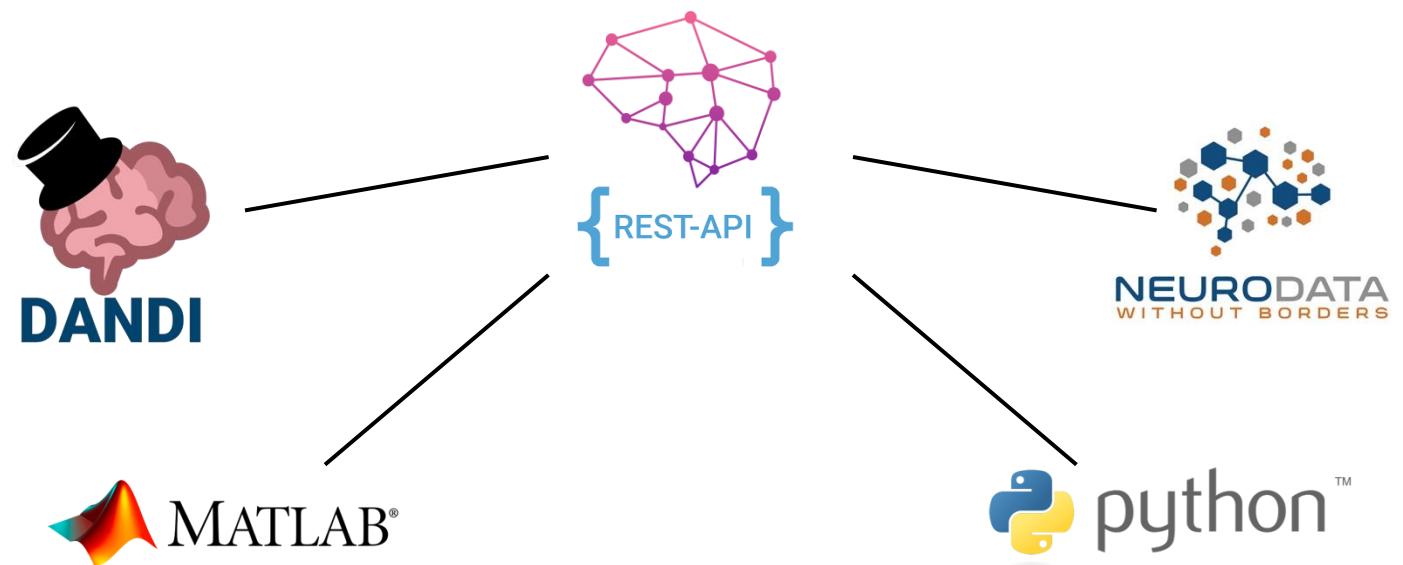


The screenshot shows the homepage of the BrainSTEM website. At the top, there is a navigation bar with a logo, a "Public Data" button, and "Login" and "Create Account" buttons. Below the navigation bar is a large image of a brain with a purple wireframe overlay. To the left of the brain, there is a sidebar with a vertical menu and a "BrainSTEM" button. The main content area features the text "Collaborative Notebook for Neuroscience" and a brief description: "Join BrainSTEM and streamline your lab's experimental data collection and analysis. Organize, collaborate, and share publicly with ease - all on our flexible platform." At the bottom of the page is a "Create an account" button and a copyright notice: "© BrainSTEM 2023 All Rights Reserved".

[BrainSTEM.org](https://www.brainstem.org)



API



API

Allows for both reading and writing content



API endpoints:

`https://www.brainstem.org/api/*portal*/app/*model/*id*/`

Session endpoint:

`https://www.brainstem.org/api/private/stem/session/`

Procedure endpoint:

`https://www.brainstem.org/api/private/modules/procedure/`

Private and public portals have separate authentication systems:

Public sessions:

`https://www.brainstem.org/api/public/stem/session/`

Filters:

`/?filter{name}=project1`

`/?filter{description.icontains}=hippo`

Sorting:

`/?sort[]=-name`

`/?sort[]=description`

Include relationships:

`/?include[]=behaviors`

`/?include[]=dataacquisition`

Combine query parameters:

`/?filter{name}=project1 &sort[]=-name &include[]=behaviors`

API tools for Python and Matlab

```
% 0. Setup credentials:  
% Email and password will be requested  
get_token
```



```
% 1. Loading sessions  
output1 = load_model('model', 'session');
```

```
% 2. Updating a session  
session = output1.sessions(1);  
session.description = 'new description';  
output2 = save_model('data', session, 'model', 'session');
```

```
% 3. Creating a new session  
session = {};  
session.name = 'New session85';  
session.description = 'new session description';  
session.projects = {'0c894095-2d16-4bde-ad50-c33b7680417d'};  
  
output3 = save_model('data', session, 'model', session');
```

```
% 4. Load public projects  
output4 = load_model('model', 'project', 'portal', 'public');
```

```
# 0. Setup credentials:  
# Email and password will be requested  
settings = StemSettings()
```



```
# 1. Loading sessions  
output1 = load_model(settings, session)
```

```
# 2. Updating a session  
session = output1["sessions"][0]  
session["description"] = 'new description'  
output2 = save_model(settings, "session", data=session)
```

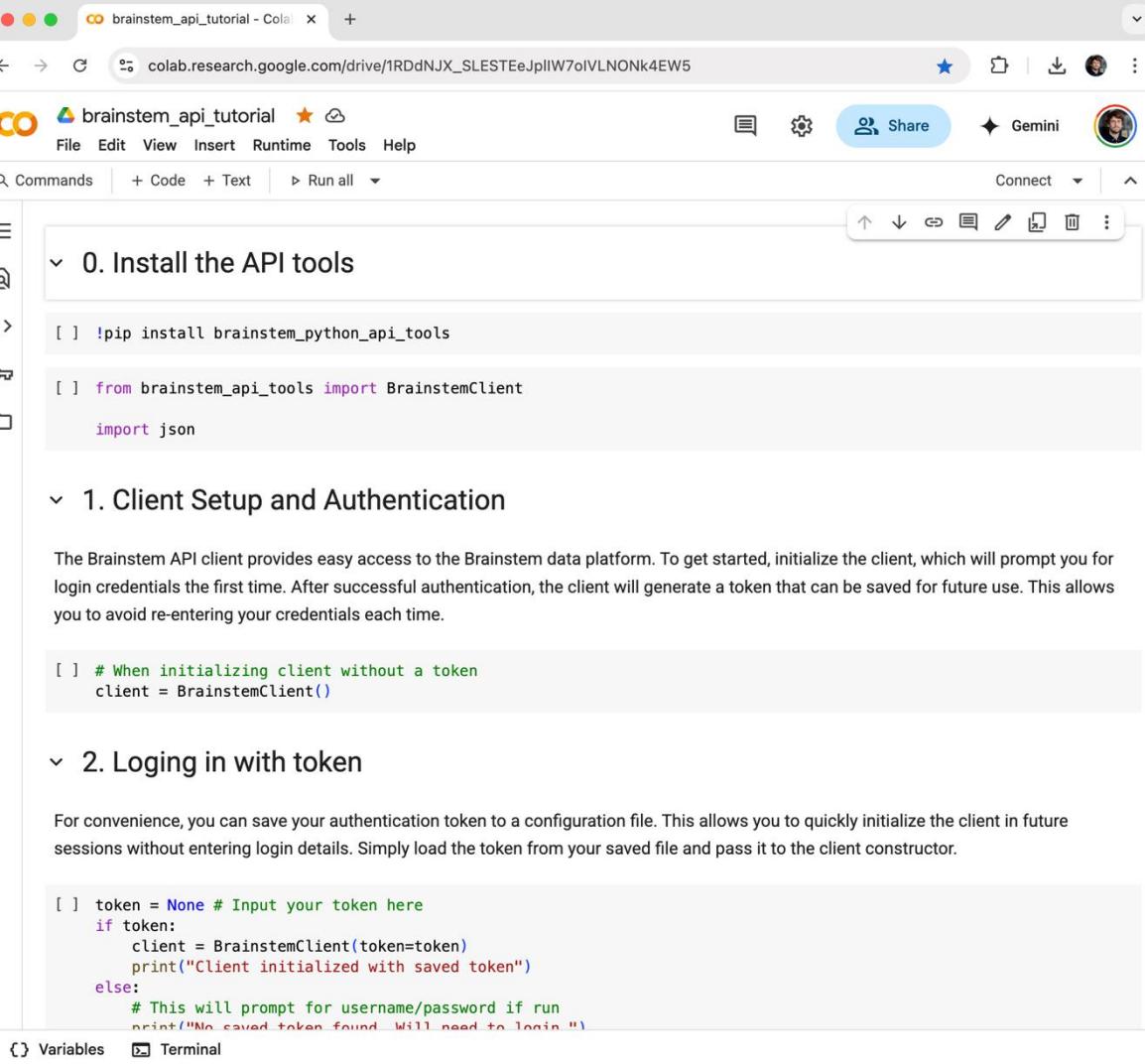
```
# 3. Creating a new session  
session = {}  
session["name"] = 'New session88'  
session["description"] = 'new session description'  
session["projects"] = ['e7475834-7733-48cf-9e3b-f4f2d2d0305a']  
  
output3 = save_model(settings, "session", data=session)
```

```
# 4. Load public projects  
output4 = load_model(settings, "project", portal="public")
```

Jupyter notebook & pip Installation



The Python pip Installation logo features the word "python" in a lowercase, sans-serif font above a stylized yellow and blue cube icon. Below the cube, the word "pip" is written in a smaller, lowercase, sans-serif font, followed by the word "Installation".

A screenshot of a Google Colab notebook titled "brainstem_api_tutorial". The notebook is organized into sections: "0. Install the API tools", "1. Client Setup and Authentication", and "2. Logging in with token". In the "0. Install the API tools" section, code snippets show the installation of the Brainstem API tools via pip and importing the BrainstemClient module. The "1. Client Setup and Authentication" section explains the client's role and provides code for initializing it without a token. The "2. Logging in with token" section discusses saving tokens to configuration files and includes code for initializing the client with a saved token or prompting for login details if none are provided.

API tools available at GitHub: <https://github.com/brainstem-org/>



Support and documentation

BrainSTEM Documentation

Search BrainSTEM documentation

BrainSTEM.org Matlab API tools Python API tools

Home

Data model

Web interface

API

API tools

Tutorials

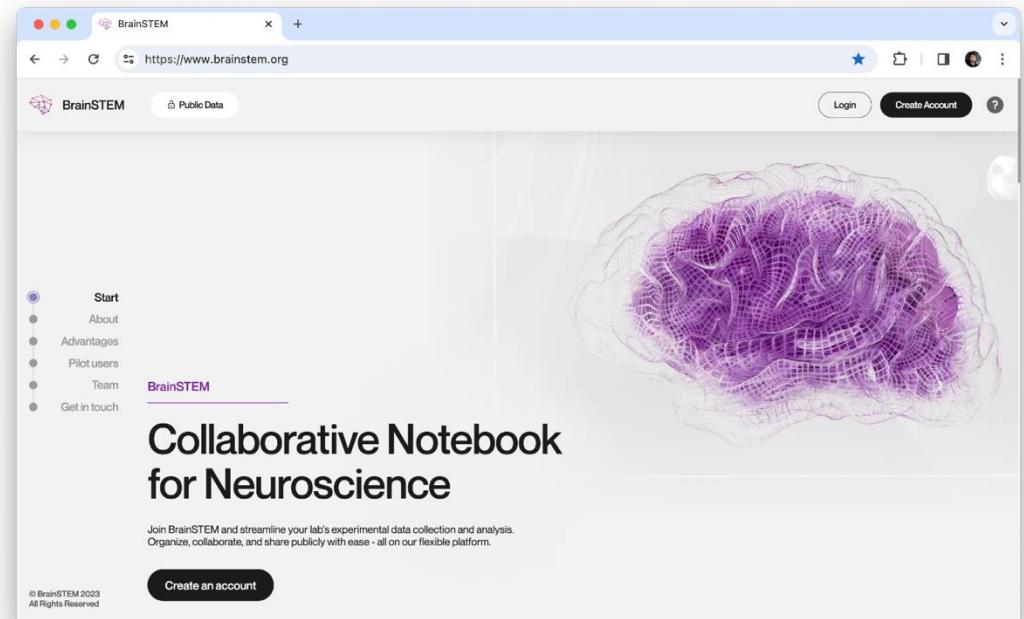
Public data

Get started now Visit www.BrainSTEM.org

Collaborative Notebook for Neuroscience

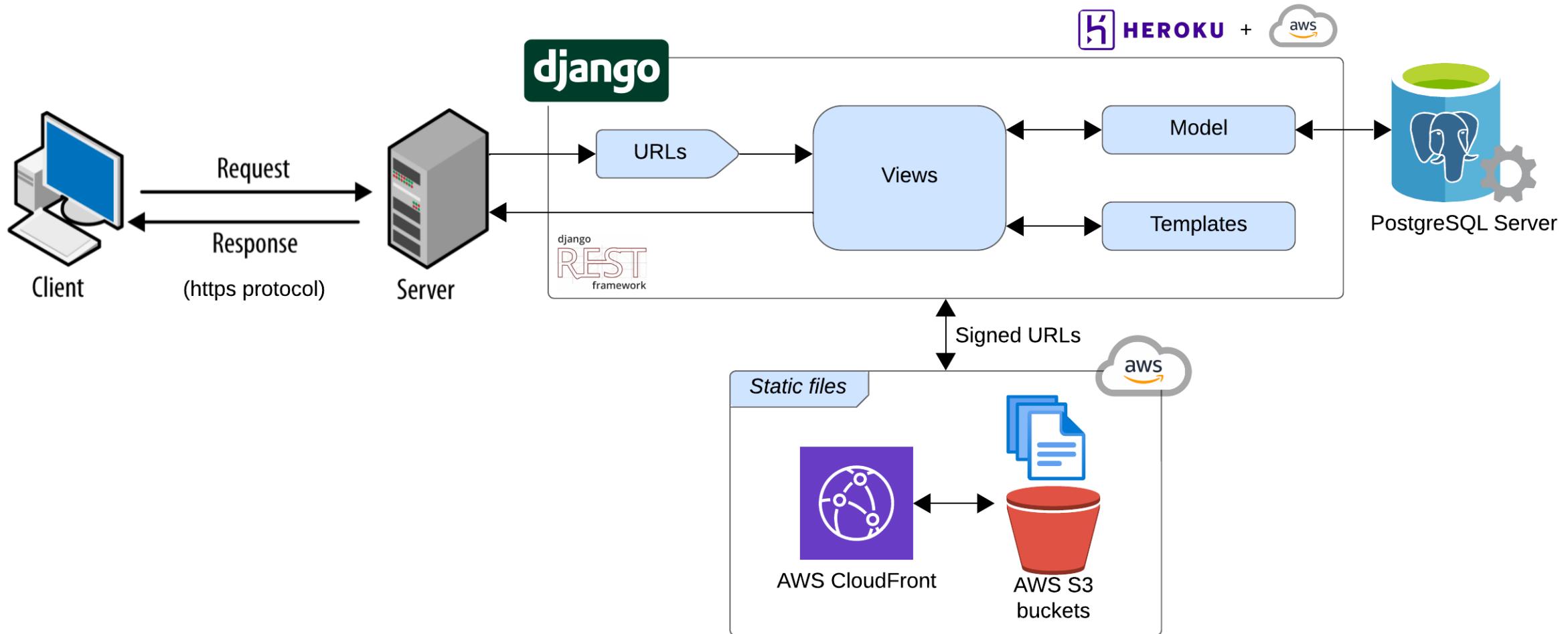
Join BrainSTEM and streamline your lab's experimental data collection and analysis. Organize, collaborate, and share publicly with ease - all on our flexible platform.

Create an account



support.brainstem.org

Architecture diagram of BrainSTEM



Global Active Projects Filter

Quickly focus on your active projects or collaborations with a single click

Recover Deleted Entries & Tracked Changes

Know exactly who edited what



Simultaneous Edit Warning



2FA + Email Confirmation

Multitab Forms with Autosave

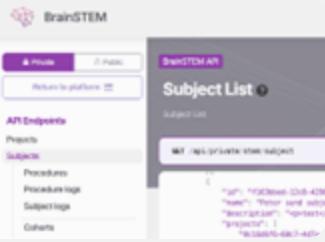
Organize complex metadata in intuitive sections

Redesigned Sidebar & Icons

Navigate your projects, subjects, and sessions with ease

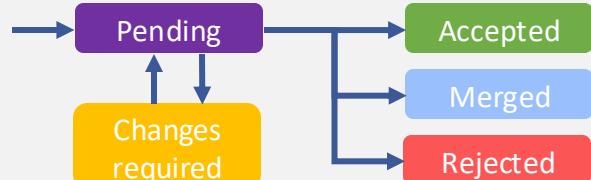
Web API Redesign

Easy Navigation of API Endpoints



Submission Approval System

Shared resources submitted by users go through a transparent approval process.



Data Acquisition (23 types)

 Procedures
(27 types)

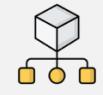
Wide selection of types of...

 Manipulations
(15 types)

Equipment (53 types)

 Subject Logs
(13 types)

Documentation & Support



Data Fields



API + API Tools



Relationships & Schemas



Tutorials



Coordinates



BrainSTEM

2025: What's New

A major update focused on Adoption, Collaborations, Control, and Efficiency.



Inventories + Consumable Stocks



Subject Cohorts

Acknowledgement and funding

- Alisa Surkis - U19 Datacore Director
- György Buzsáki
- Rodrigo Amaducci (Postdoc)
- Mingze Dou (Master's student)
- U19 Group Leaders, students, and postdocs
- Quoin: Eli Taft, Lorena Carballo, and Jack Miszencin
- Andrew Max, full-stack developer

What's Next?

- BioRxiv manuscript
- Templates for modules
- Semantic search
 - "Find thalamic recordings from a sleeping animal with a Neuropixels probe."
 - "Show subjects with an inhibitory-acting virus injections in the Visual cortex"
- Continue enriching shared resources and schemas
- Continue outreach activities
- Incorporation of feedback from users



Help us with feedback, contribute schemas, or suggest features!

Q&A