# Application: Inclusive and Accessible Scientific Computing in the Jupyter Ecosystem

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EOSS4: Essential Open Source Software for Science (Cycle 4)

**Summary**

**ID:** EOSS4-0000000164
**Last submitted:** Mar 29 2021 05:54 PM (BST)

## Applicant Details

**Completed** - Mar 29 2021

# Applicant Details

**Please complete the following information for the Applicant (required):**

The information entered should be for the individual submitting the application who will act as the main person responsible for the application and as its point of contact. Information about other Key Personnel on the proposal should be entered where requested in the Software Project Details part of the application. **Complete all fields in this task; all fields are required.**

To edit your name or email, please do so in your account information by clicking your name in the upper right corner and clicking My Account in the dropdown menu.

1. Name:  Tania Allard

2. Email:  taniar.allard@gmail.com

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3. Degrees (check all that apply)

## Responses Selected:

| |
|---|
| Bachelor's degree or equivalent |
| Master's degree or equivalent |
| PhD or equivalent |

# Proposal Details

*Please complete the following proposal information.* ***All sections are required.***

### 1. Proposal Title: Inclusive and Accessible Scientific Computing in the Jupyter Ecosystem

*To edit your proposal title, navigate to the main page; click on the three dots to the right of the application title (next to the Preview link); and select Rename from the dropdown menu. Proposal title is limited to a maximum of 75 characters, including spaces.*

### 2. Did you previously apply for funding for this or a related proposal under the CZI EOSS program?

Yes- please specify application number, e.g. EOSS-0000005345, EOSS2-0000005145: EOSS-0000000142 , EOSS2-0000000084

### 3. Have you previously received funding for this proposal under the CZI EOSS program?

No

### 4. Proposal Purpose:

*Limit to one sentence (maximum of 255 characters, including spaces)*

Bring the traditionally marginalized voices of disabled scientists into scientific computing communities via building and applying accessibility tools, standards, and community contribution practices in JupyterLab and the larger Jupyter ecosystem.

### 5. Amount Requested:

*Enter total budget amount requested in USD, including indirect costs; this number should be between $100k and $400k total costs and match total described in the Budget Description. Enter whole numbers only (no dollar signs, commas, or cents)*

400000

### 6. Proposal Summary/Scope of Work (required):

*Provide a short summary of the application (maximum of 500 words)*

For open-source projects such as JupyterLab to live up to their values and maximize their impact across society, they must ensure that the whole experience -both inside and outside the software itself- is accessible to all users. However, while a large community uses JupyterLab, it severely lacks in implementing accessibility standards, making it unusable for many differently-abled users. This proposal aims to improve JupyterLab to build tools and standards that make JupyterLab and Jupyter interfaces accessible to a broader audience. This work will provide a foundation that boosts accessibility in the Jupyter community and the broader PyData ecosystem. In doing so, Project Jupyter will set an example for accessible open-source communities in scientific computing.
We aim to achieve this in three ways.

First, we will focus our primary development efforts on manual and automated accessibility audits. These efforts will ensure that accessibility standards are consistently met (and problems identified) across many Jupyter tools. While various accessibility auditing and integration tests exist, these tests do not adequately account for the complex interactions involved in interactive computing software. Hence, Jupyter needs a unique testing solution based on combined existing accessibility tests and manual tester knowledge. This work will help us mitigate accessibility regressions and ensure new contributions to the project take accessibility into account.

Second, we will address Web Content Accessibility Guidelines violations in JupyterLab and other core Jupyter ecosystem projects it relies on (such as the infrastructural Lumino or the documentation theme PyData Sphinx) as well as derived projects such as JupyterBook. Web Content Accessibility Guidelines are the international standard and foundation for accessibility legislation in many countries. Gaining

compliance with these standards encompasses the development work needed to ensure that disabled scientists can use JupyterLab, related projects, and documentation.

Third, we will develop new documentation on best practices for development, documentation, design, and community guidelines and procedures to include accessibility as a critical part of the contribution process moving forward. We will also work on a set of guides focused on accessibility audits and the usage of Continuous Integration frameworks for accessibility testing. These additions will start with JupyterLab and other Jupyter projects but can serve as a framework for bringing accessible practices to the PyData and scientific computing ecosystems at large.

## 7. Landscape Analysis (required):

*Briefly describe the other software tools (either proprietary or open source) that the audience for this proposal is primarily using. How do the software projects in this proposal compare to these other tools in terms of user base size, usage, and maturity? How do existing tools and the project(s) in this proposal interact? (maximum of 250 words)*

We are not aware of any web-based browser or desktop interactive scientific computing interfaces that disabled scientists can successfully use with default accessibility settings. From experience, they are at best able to use combinations of tools to express themselves in code; at worst, they cannot access the tools they need and are, therefore, barred from opportunities in education and industry. To our knowledge, many educational institutions have considered using Jupyter for teaching and the democratisation of scientific computing. However, they cannot accomplish this mission due to the current state of inaccessibility in Jupyter. Finally, many industry projects and bioinformatics teams have drifted away from tools in the Jupyter ecosystem and opted for other technologies with better in-built accessibility standards and capabilities (e.g. VSCode).

Even as it neglects the estimated 20% of the population that is disabled,
Jupyter is extraordinarily successful and has a significant influence on the pathways available to people in data science. Nevertheless, as Jupyter interfaces are inaccessible, this creates a technical barrier to data science success and a source of inequity in the ecosystem, which runs directly counter to the project's mission.

Jupyter is not only a standard for scientific computing; its ecosystem supports and influences established projects like VSCode, nteract, and Google Colab. Abiding by Web Content Accessibility Guidelines in Jupyter will transform the many projects that Jupyter is a part of and spring more comprehensive accessibility changes. Leading to a more inclusive scientific computing ecosystem and increased access to computational literacy to more prospective scientists.

## 8. Value to Biomedical Users:

*Briefly described the expected value the proposed scope of work will deliver to the biomedical research community (maximum of 250 words)*

The Jupyter ecosystem is a critical cornerstone of technology for biomedical science education, research, and manufacturing. Jupyter represents an ecosystem of open source tools that enable researchers to work with code and data in a single interface. Jupyter's growth in the classroom and laboratory speak to the value of these technologies in science. The current state of these tools, however, make them usable only by abled individuals.

Disability affects roughly 20% of the population, meaning that for every million Jupyter users, we exclude ~200,000 prospective scientists from participating. Also, software that lacks accessibility features can have significant ethical and legal implications in various contexts.

Our proposed work aims to make JupyterLab's computing interface, its documentation, and associated documentation generation tools inclusive to disabled scientists. We will align JupyterLab, and its documentation with Web Content Accessibility Guidelines that set the standards for interfacing with assistive technology. A successful effort will open up biomedical computational literacy for scientists with visual, auditory, physical, speech, cognitive, language, learning, and neurological disabilities. This accessibility effort will also help bring traditionally excluded voices and users into the Jupyter ecosystem, diversify it, and contribute to its long-term sustainability.

## 9. Open Source Software Projects

How many software projects are involved in your proposal (maximum of five)?

5

*Complete the table for each software project. You may need to use the scroll bar at the bottom of the table to scroll right to view and to complete all fields. Alternatively, you can tab to move through and complete the fields. If multiple software projects are involved, details must be entered for all of them. All fields are*

required. All URLs should be in the format *https://example.com* and **only one primary link should be provided where requested**:

| | Software project name | Homepage URL | Hosting platform | Main code repository | Description of software project |
|---|---|---|---|---|---|
| 1 | JupyterLab | https://jupyterlab.readthedocs.io/en/latest/ | GitHub | https://github.com/jupyterlab/jupyterlab | JupyterLab is the next-generation web-based user interface for Project Jupyter. |
| 2 | Project Jupyter | https://jupyter.org/ | GitHub | https://github.com/jupyter | Project Jupyter exists to develop open-source software, open-standards, and services for interactive computing across dozens of programming languages. |
| 3 | pa11y-ci | https://pa11y.org | GitHub | https://github.com/pa11y/pa11y-ci | A command-line tool which iterates over a list of web pages and highlights accessibility issues. This is a CLI that's more geared towards use in CI. |
| | | | | | Jupyter Book is an open-source |

| 4 | Jupyterbook | https://jupyterbook.org/intro.html | GitHub | https://github.com/executablebooks/jupyter-book | tool for building publication-quality books and documents from computational material. |
| 5 | Robot framework | https://robotframework-jupyterlibrary.readthedocs.io/en/latest/ https://robotframework.org/ | GitHub | https://github.com/robots-from-jupyter/robotframework-jupyterlibrary | Robot Framework is a generic open source automation framework. It can be used for test automation and robotic process automation (RPA). A Robot Framework library for automating (testing of) Jupyter end-user applications and extensions |