Using OSF with lab and lecture projects

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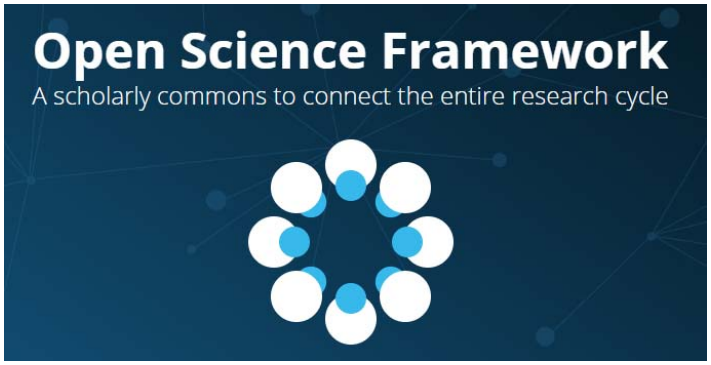
Using the Open Science Framework

- Research lab project and data management
- Lecture-based research experience for undergraduates
- Project management of the CGEMS site



Research Project Management with undergraduate students

Problems:

- Lots of turnover --> Issues with continuity
- Inexperienced --> Need to be shown hows and whys of data management

Open Science Framework can mitigate these issues!

General setup for lab projects

Each project has a site

- Students are added as contributors with "read + write" access
- Components delineate experiments or research areas
    - *Makes it easier to make specific parts of a project public later*

Procedures and Final results are displayed in the wiki

- Intermediate or other results are included in component folders with data/experiment titles
- **Try** to keep analysis and results files in distinct folders

Mendeley/Zotero reference area

Link in other resources like *Github* or *Dropbox* as needed

Examples from the Berndsen lab

Publicly available project:

Tetherin SNP modeling

Summary

OSF provides a flexible framework for project management

- Provides data storage and management
- Continuity of techniques and project knowledge

Wiki panes are useful as notebooks for describing data and protocols

Reference panes make important papers part of the project

Lecture-based research experience for undergraduates

How to get students to apply and retain knowledge?

- Active learning or engaging the student to participate in the learning process aids in understanding and retention
    - Lab courses are often use to supplement learning from the lecture
    - POGIL or flipped classrooms: students work on a project to apply knowledge and content to demonstrate concept
- Promote critical thinking and adaptability --> Scientific process
- Teach students to communicate scientific material effectively

Course-embedded Undergraduate Research Experience

- Research project that integrates into the course curriculum to reinforce learning objectives
- Examples at JMU:
  - Intro Biology Lab sequence
  - Organic Chemistry Lab for Chemistry majors

What about for a lecture course?

Biochemistry (CHEM361) at JMU

- Lecture of 55 to 130 students with one/two instructor(s)
- ~70% students have no prior research experience
  - *Ranges from 50 to 95%*
- Mostly non-chemistry majors
  - *Biology, Health Science, Biotechnology*
- Diverse professional goals
  - *~1/3 to professional school, 1/3 graduate school, 1/3 job or other*

Problems to solve when I started...

- **Large lecture section** with no associated lab course
- **Materials and infrastructure** to facilitate student interactions and active learning
- **Diverse student backgrounds, abilities, and interests**
- **Management** of the student data
- **Wanted students to think about biochemistry!**

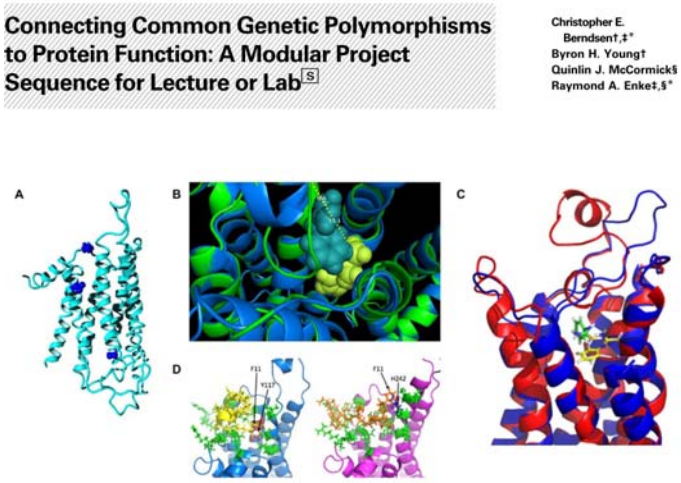
My solutions

- Large lecture section with no associated lab course
  - **POGIL-stylebased classroom activities and used Socrative to monitor students in real time and give feedback**
- Materials and infrastructure to facilitate student interactions and active learning
  - **Used Canvas to facilitate peer groups, Socrative to check answers, in-class activities**
- Diverse student backgrounds, abilities, and interests
  - **By lecturing less, I spent more time talking to students in small groups or one-on-one**

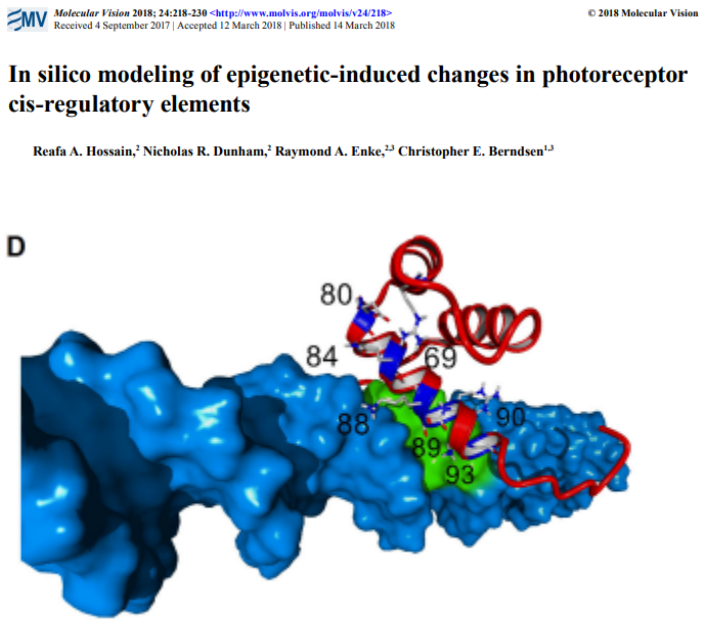
My solutions continued

- Management of the student data
  - **Word --> Sharepoint/OneNote --> Open Science Framework**
- Wanted students to think about biochemistry!
  - **Course-based project connecting DNA sequence to protein structure/function**

Published results from the course-based activity



Berndsen, et al., 2016



Hossain, et al., 2018

General setup of the CURE project

Instructor assigns:

- A part of a target protein to analyze
- Templates for online notebook and final report
- Brief review of field, question, and direction to follow
- List of possible online tools to use
- Access to Open Science Framework project folder

Students then:

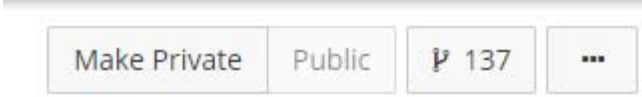
- Predict changes in weak interactions, pK_A values, broader changes in protein structure or active site
- Rationalize why the change could occur based on biochemical knowledge
- Connect to protein function/human disease
- Propose how the conclusions could be supported with “real” experiments

Open Science Framework

- Tried asking students to keep a notebook using **Word/Docs** --> :(
- Used JMU's access to Sharepoint and **OneNote** --> :(
  - ~10% of students could not get access to OneNote
  - Was a good solution otherwise
- Present solution is the **Open Science Framework**

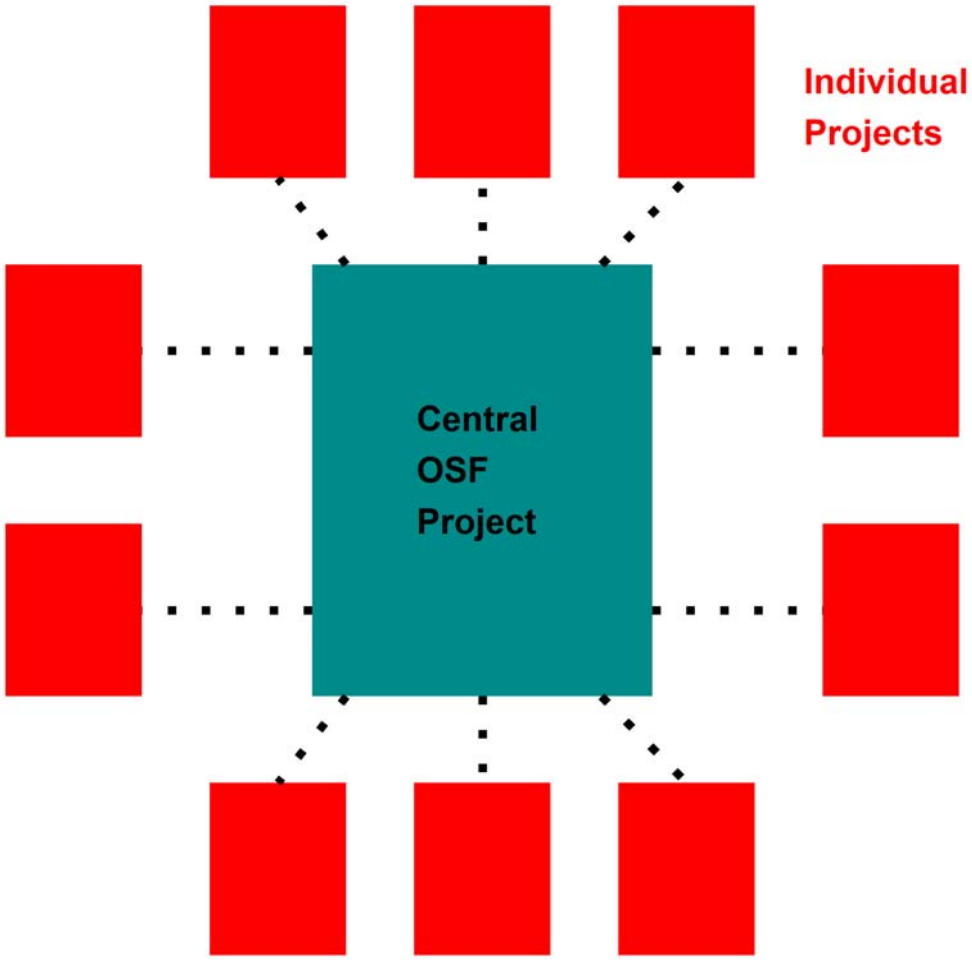
Two ways to manage student notebooks

1. Fork and go do Science (2016-2018)



2. Research Community (going forward)

Fork and go do Science (2016-2018)



Fork and go do Science (2016-2018)

- Instructor creates a public base notebook and populates with necessary materials
- Students "fork" project and give the instructor access

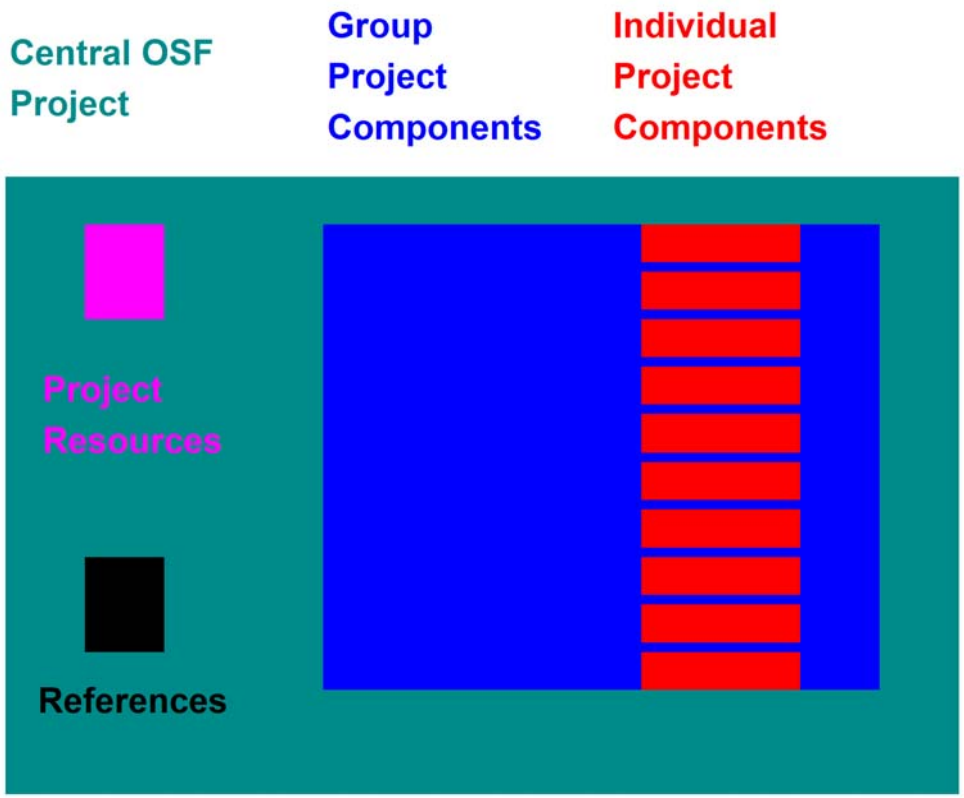
What works:

- All the data can be kept in a central place
- Easy to see when students did the work
- No access problems
- Students have freedom to manage project as they wish

What needed improvement:

- Creates a lot of divergent notebooks
- Hard to distribute new information to all the projects
- Students have freedom to manage project as they wish

Research Community



Research Community

- Instructor creates a project and populates with necessary materials
- Students ask to be contributors

Group Project:

- Students in groups create component
  - research background on target gene/protein
  - Use wiki to illustrate the known aspects of gene/protein
- Learn to use OSF and visualization software together

Individual Project:

- Within group component, students create research component for their part of the research
  - Data repository for individual project and notebook
  - Use wiki to highlight results like a notebook
- Students see how others solved similar problems

Summary

Lecture based research project for biochemistry

OSF facilitates data management and storage

In the future, OSF will be the hub for the students working to learn and collaborate on their research project.

Making the CGEMS workshop site

Using the Wiki and Markdown language

What is Markdown language?

- plain-text syntax that can be converted simply to HTML or other formats quickly
- can be read easily with minimal tags or code to indicate formats such as **Bold** or *Italic*

OSF uses an interface that contains features known to uses of Word/Docs to make wiki easier to write in markdown

```
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## Using the Wiki and Markdown language

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markdown]
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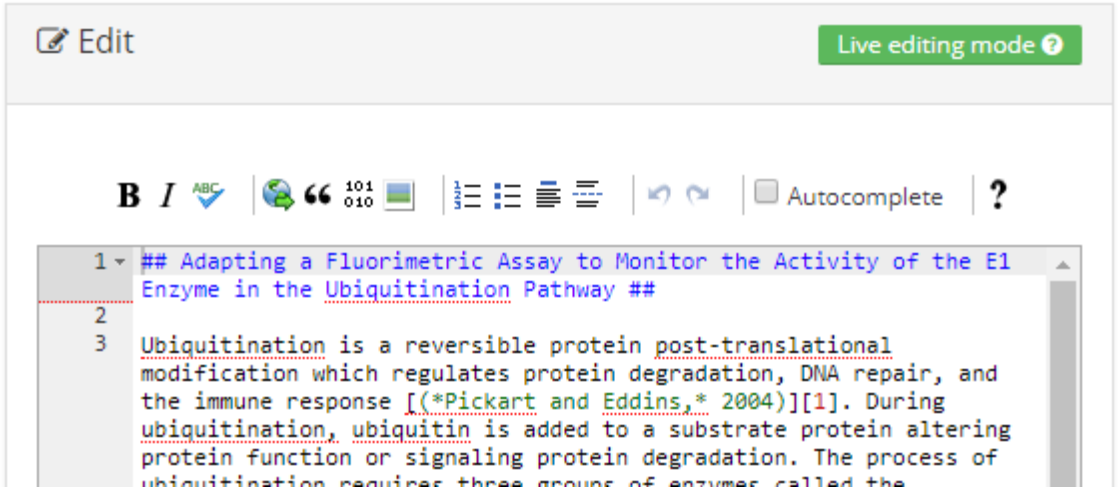
(This entire presentation was written in a version of markdown)

OSF interface for the Wiki



'##' indicates a header

'*' on either side of a word or phrase converts to italics

'**' on either side of a word or phrase converts to bold

While you type, you can preview the result of the markdown to HTML conversion

Let's make a wiki page

Group work

In groups we will:

1. Create a component for the data for each team in the *Salmonella Isolate Data and Analysis Files* component
    - Name the component after your isolate (*example*: DG7)
2. Within the new component, modify the home wiki page with information on your isolate

Throughout the workshop:

- Fill in additional components for new experiments
- Wiki pages using markdown language and the notebook template provided