Let’s Experiment: A Guide for Scientists Working at the Bench

Sarah Goodwin, PhD
Executive Director, iBiology
NIGMS IPERT grant (#5R25GM116704)
LET'S EXPERIMENT:

A Guide for Scientists Working at the Bench
How did we develop the content?

Research → Plan → Build → Test → Iterate → Feedback → Research

Feedback → Plan → Build → Test → Iterate → Feedback → Research
What students learn

Module 1: An Introduction to Experimental Design
(art and practice of experimental design, what experiment to do next, model systems)

Module 2: Key Elements of Experimental Design
(variables, controls, variation/noise, replication, sample size)

Module 3: Account for Bias
(rigorous research, experimenter bias, randomization, unbiased data analysis, p-values)

Module 4: Gear up to do the Experiment
(protocols, validating reagents, lab notebook)

Module 5: Getting the Experiment to Work
(piloting, troubleshooting, optimization, decreasing noise, orthogonal approaches)
Learning objectives seed the basic course structure
Diversity of components to enhance the learning experience

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Diverse voices
Videos

Conceptual

Case studies

36 total videos
9) Describe the controls you will use in your experiment.

10) How will the controls you listed above help you analyze and interpret your experiment? Are they addressing any potential confounding variables?

...
Self-reflective exercises are compiled into “My Experimental Plan”

**MY EXPERIMENTAL PLAN**

**The Experiment**

Q1. In 2-3 sentences, describe an experiment you plan to do (or are currently doing), and would like to use as the basis for the assessments in this course. If you aren’t at the point of doing an experiment, it could be one you’ve already done, one of the featured case studies, or one from your favorite publication.

“I am going to purify Patronin and see if it binds to the microtubule, and if so whether it binds selectively to one end.

**Background**

Q2. What’s the research question you’re trying to address?

“I want to see if Patronin binds and stabilizes microtubule minus ends

Q3. Do you have a hypothesis(es)? If so, what is it/are they?

“I hypothesize that Patronin binds and protects microtubule minus ends. It would be the first microtubule minus end regulatory protein.

Biology courses
What are the outcomes?

Preliminary data based on “hosted” course, Spring 2019
The data we collected...

**Surveys**

- Pre-course survey - 573 (38.9%)
- Post-course survey - 88 (6.0%)
- Follow-up (2 months later) - 25 (1.7%)

**Course Analytics**

- # assessments completed
- # videos viewed
Life science trainees enrolled in the course

(N= 573)
Course Enrollment

Inactive: 54.8%
Active: 45.2%
(N= 1472)
Course Engagement

Engaged 46.0%
Passed Course 21.4%
Very Engaged 32.6%

(N= 665)
Students made statistically significant knowledge & skill improvements

- 15 pre-/post- knowledge and skill self-assessments
- N = 77 (matched)
- Statistical test: Two Tailed Wilcoxon Signed-Ranks Test (p<0.05)

All assessments show statistically significant change!
I know how to address and account for experimental bias.

Before

After

(N= 77)
I know how to keep a rigorous and reproducible lab notebook

(N= 77)
Q18 - This course has enhanced/improved my process for designing an experiment: (percent)

(\(N=83\))
Post-course and follow-up data

95.2% were satisfied or very satisfied (N=84)

88.0% felt better prepared for their upcoming scientific endeavors (N=83)

66.7% implemented their experimental plan; 14.3% said they plan to (N=21)

57.1% met with mentors or colleagues (N=21)
Implementation

- Hosted course (1,472 students)
- Self paced course (552 students as of July)
- Taken as a part of a training course
- Adopted into institutional training curricula
Let's Experiment: A Guide for Scientists Working at the Bench

Planning Your Scientific Journey

All courses are free

Communicating your work

Launching in 2020!
Our team

Shannon Behrman
Associate Director, Scientific Training and Education

Alexandra Schnoes
Associate Director, Career and Professional Development

Nina Griffin
Editor and Producer

Noah Green
Course Manager and Evaluator

Daniel McQuillen
Web Developer