Cold Spring Harbor Laboratory

It’s Impossible to Keep Up

Career-spanning Learning in the Life Sciences

Jason Williams

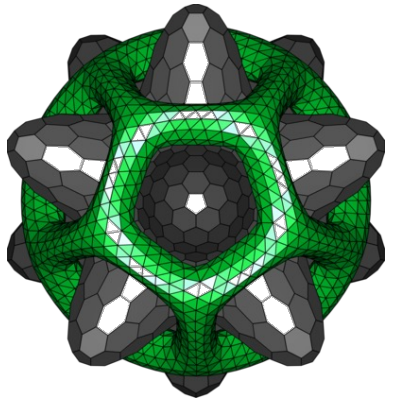
Cold Spring Harbor Laboratory, DNA Learning Center

 @JasonWilliamsNY

AgBioData Community Workshop – May 2023

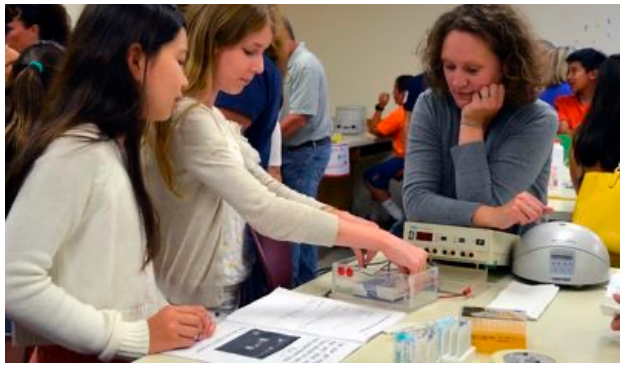
Cold Spring Harbor Laboratory

CyVerse



Journal of
Open Source Education

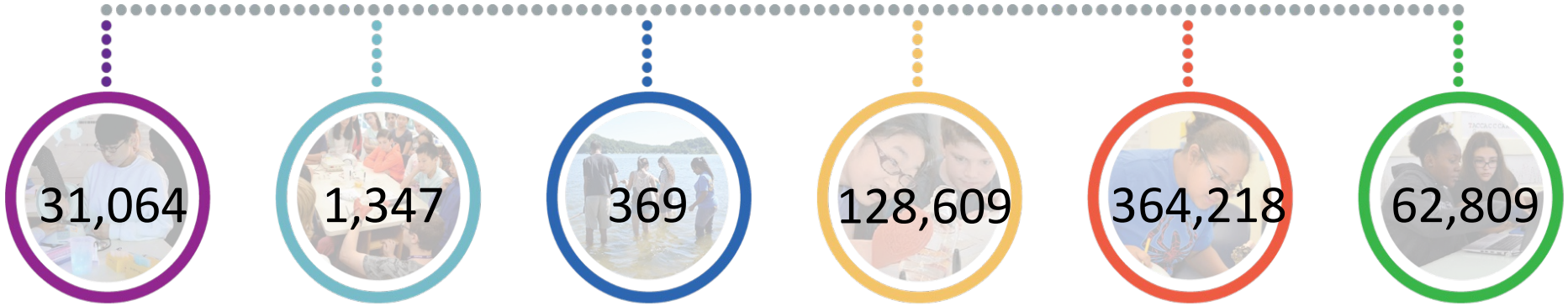
CSHL DNA Learning Center



Hands on education in molecular biology/bioinformatics for secondary students (Grade 6-12); secondary and undergraduate faculty training; websites/multimedia

CSHL DNA Learning Center

588,416 Annual Exposures



DNALC Lab Field Trips

DNALC summer Campers

Extended Student Research

Labs at Licensed and Modeled Programs Worldwide

DNALC commercial Kits

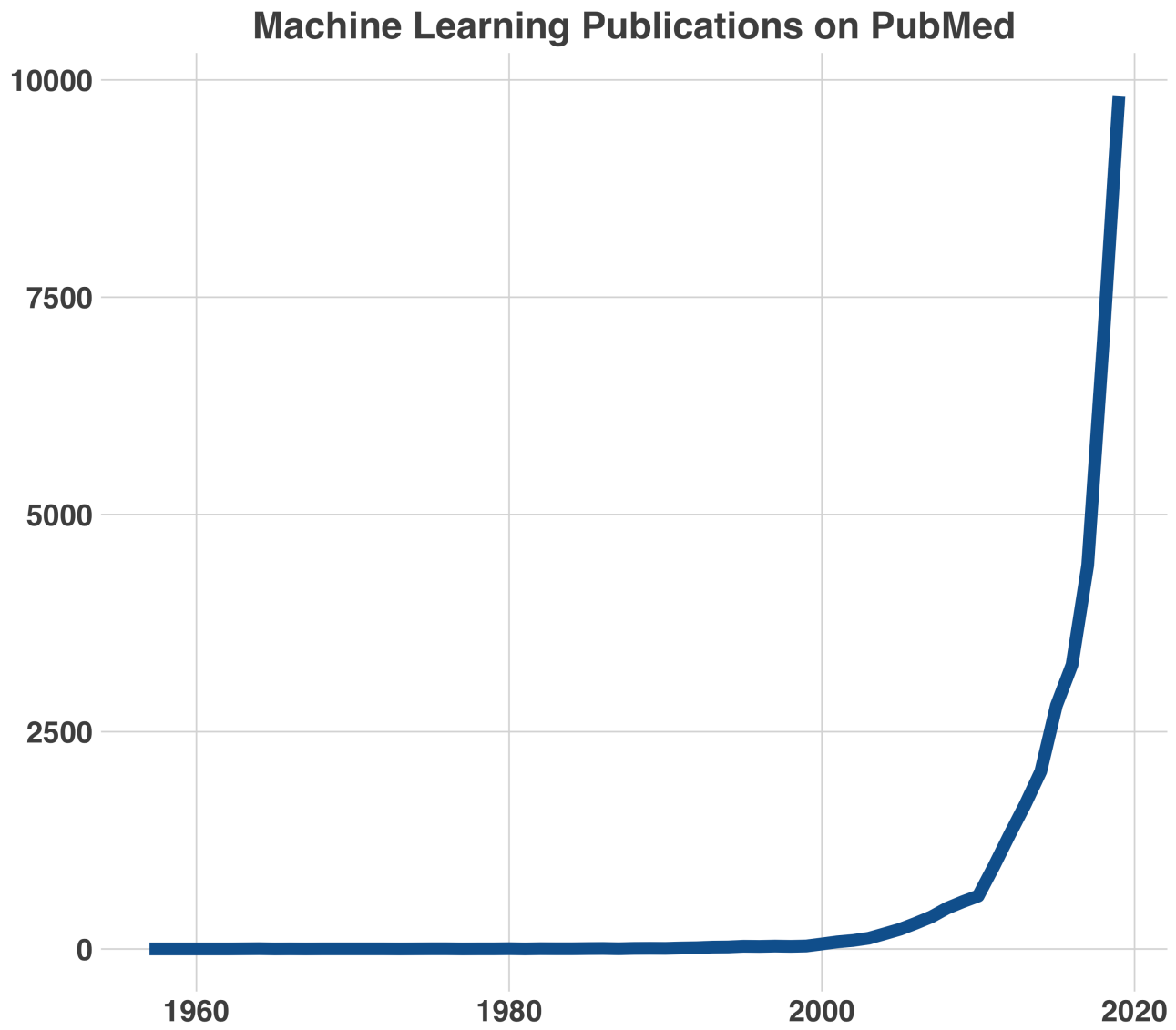
Online DNALC Sequence Analysis Projects

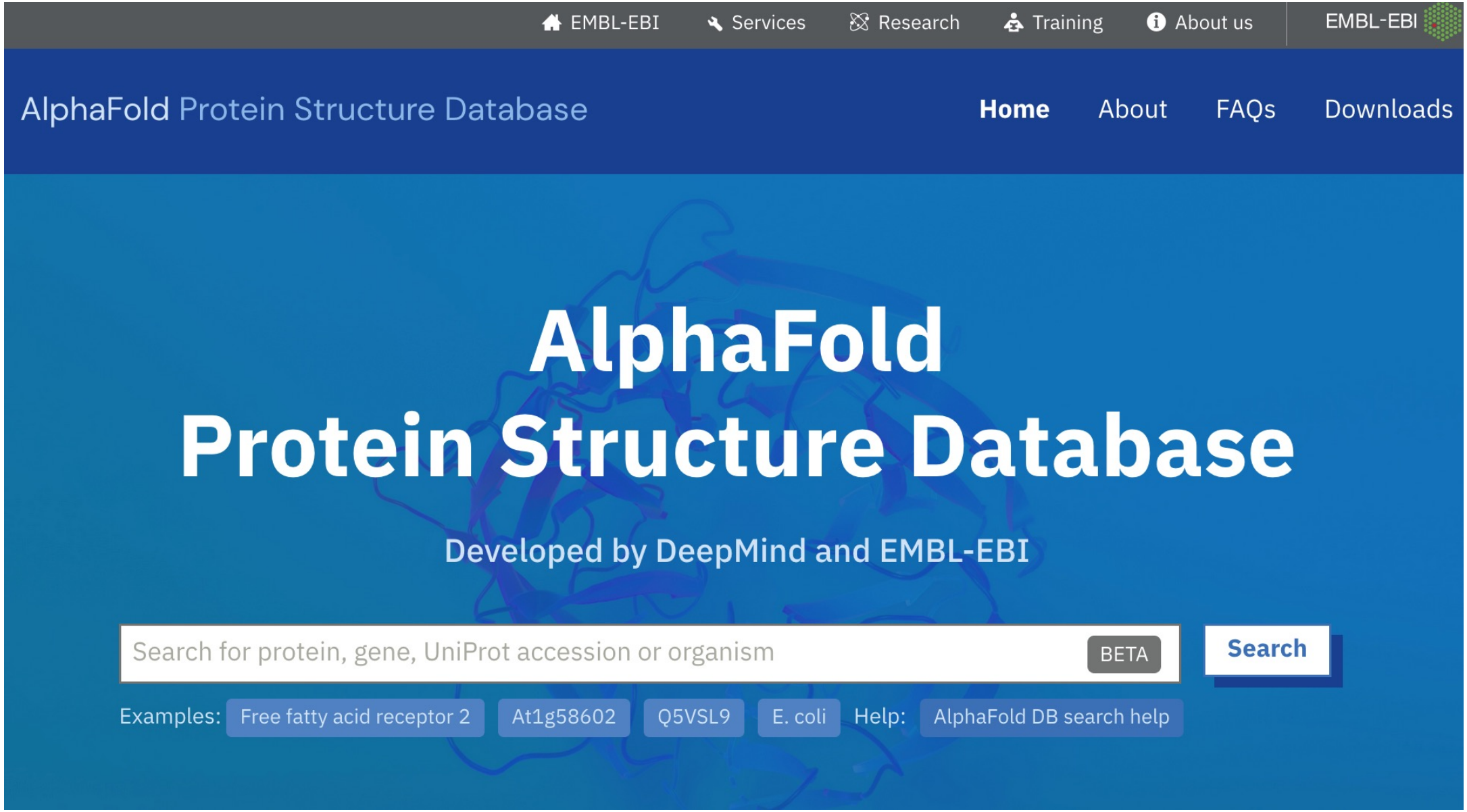
Keeping up with the future…

The future is computational

Help researchers and educators
learn how to use data and computation

The skillset is changing


Machine Learning Publications on PubMed
10000
7500
5000
2500
0
1960
1980
2000
2020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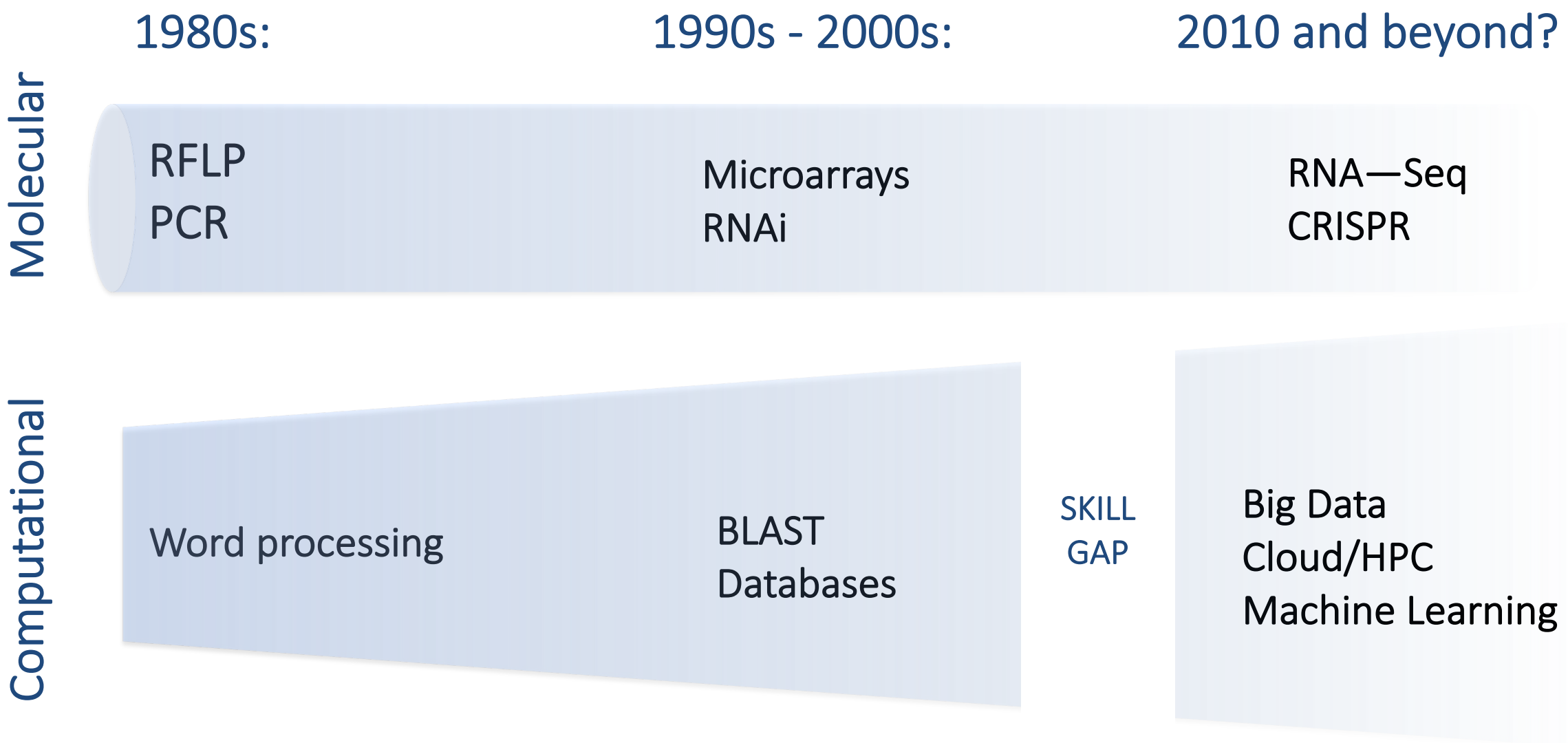
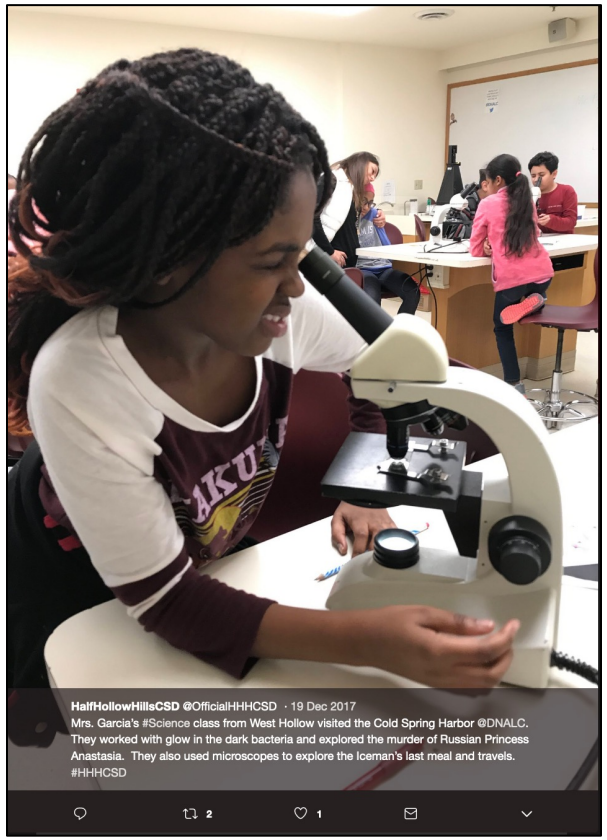
Search for protein, gene, UniProt accession or organism
BETA
Search
Examples:
Free fatty acid receptor 2
At1g58602
Q5VSL9
E. coli
Help:
AlphaFold DB search help

Biology skills timeline



I went to school for…

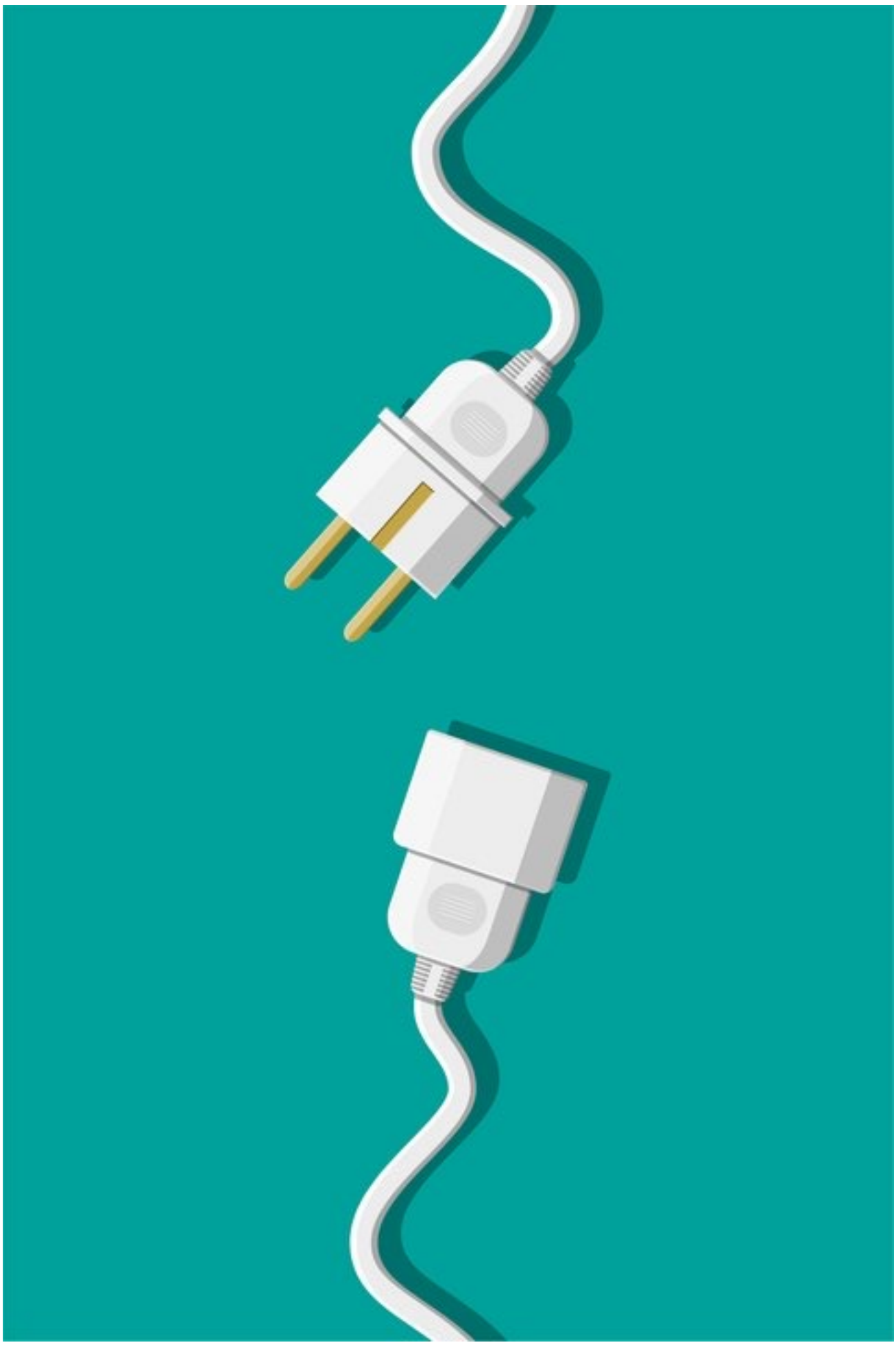


I need to know this for my research…

```
import urllib2
eutils = 'http://www.ncbi.nlm.nih.gov/entrez/eutils/'
efetch = 'efetch.fcgi?'
s = eutils + efetch

targets = ['J04243','M60064']
idString = 'id=' + ','.join(targets)
s += idString + '&db=nucleotide&rettype=fasta'
fileObject = urllib2.urlopen(s)
data = fileObject.read().strip()

entries = data.split('\n\n')
title, sequence = entries[0].split('\n', 1)
print title.split(' ',1)[0]

# prints:
# >gi|154102|gb|J04243.1|STYHEMAPRF
```

A scientific digital divide?

https://www.languagemagazine.com/2020/07/18/digital-divide-affecting-education-even-more/

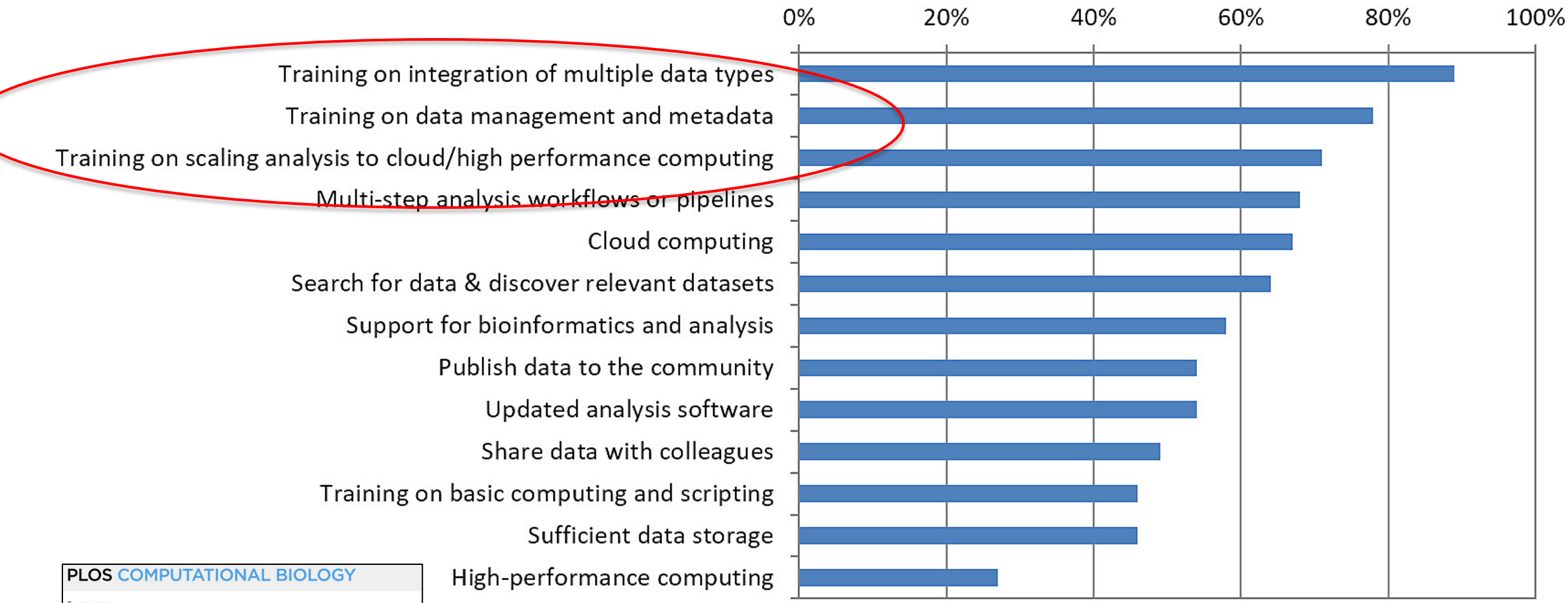


STEM Careers and the Changing Skill Requirements of Work

David J. Deming & Kadeem L. Noray

"… skill demands in STEM occupations have changed especially quickly. The faster rate of change in STEM is driven both by more rapid obsolescence of old skills and by faster adoption of new skills."

Training is the biggest need



PLOS COMPUTATIONAL BIOLOGY

OPEN ACCESS

EDUCATION

Unmet needs for analyzing biological big data: A survey of 704 NSF principal investigators

Lindsay Barone, Jason Williams, David Micklos

NIBLSE
Bioinformatics in Life Sciences Education

PLOS ONE

RESEARCH ARTICLE

Barriers to integration of bioinformatics into undergraduate life sciences education: A national study of US life sciences faculty uncover significant barriers to integrating bioinformatics into undergraduate instruction

95%

of respondents indicate that bioinformatics should be integrated into the life science curriculum;

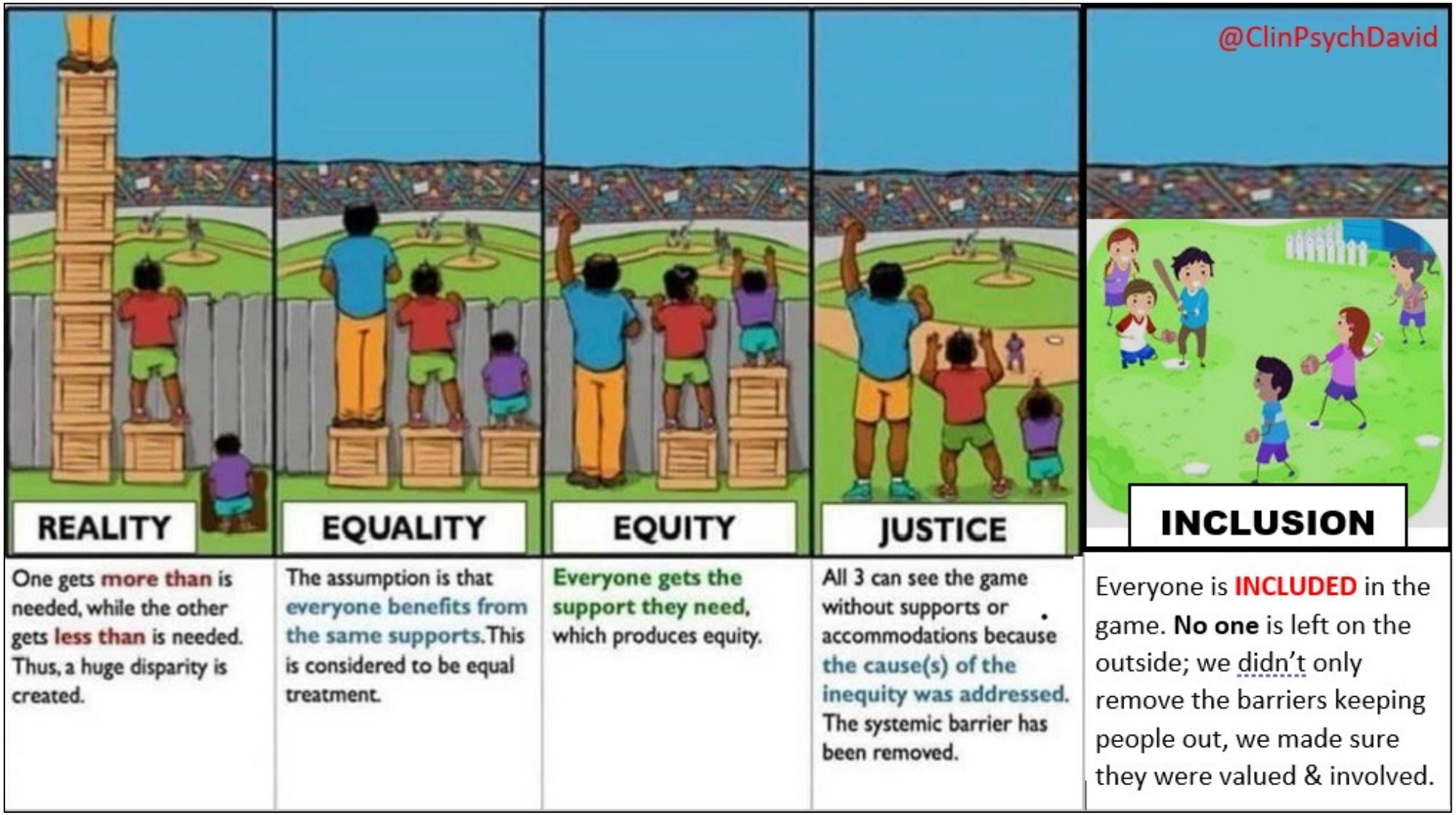
32% of faculty report achieving this

NIBLSE
Bioinformatics in Life Sciences Education

New faculty aren't integrating

Decade of Highest Degree	Formal Bioinformatics Training (%)	Faculty Integrating Bioinformatics (%)
1980-1989	8.4	35.4
1990-1999	11.3	41.9
2000-2009	35.1	41.7
2010-2016	48.3	25.2

These gaps multiply and perpetuate



Credit: Saskatoon Health Service; Revised version - David Murphy

How to solve these problems?

Improve the quality and application of professional development

Null effects of boot camps and short-format training for PhD students in life sciences

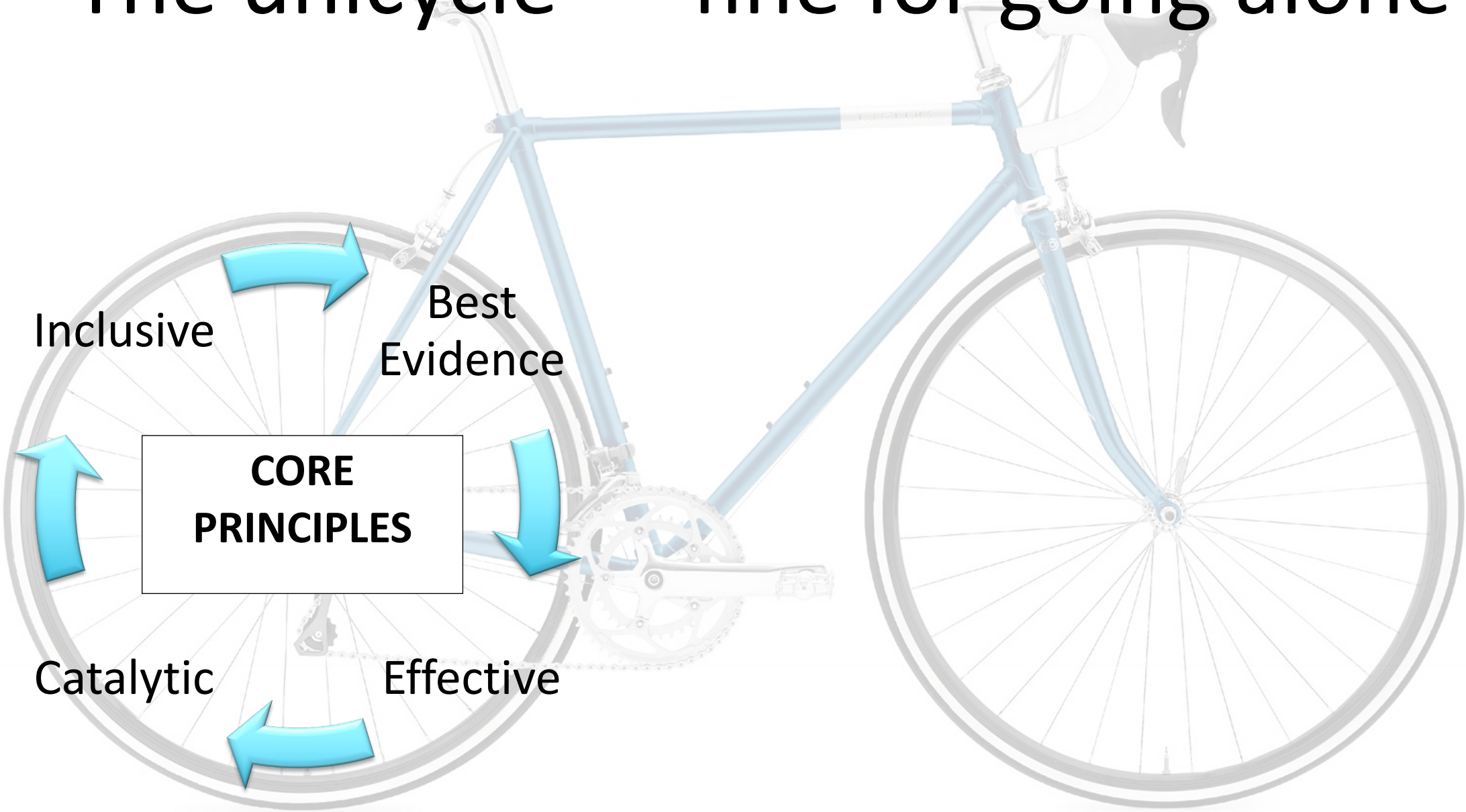
David F. Feldon[a,1], Soojeong Jeong[a], James Peugh[b], Josipa Roksa[c,d], Cathy Maahs-Fladung[a], Alok Shenoy[a], and Michael Oliva[a]

[a]Department of Instructional Technology & Learning Sciences, Utah State University, Logan, UT 84322-2830; [b]Department of Pediatrics, Cincinnati Children's Hospital Medical Center, Cincinnati, OH 45229-3026; [c]Department of Sociology, University of Virginia, Charlottesville, VA 22904; and [d]Curry School of Education, University of Virginia, Charlottesville, VA 22904

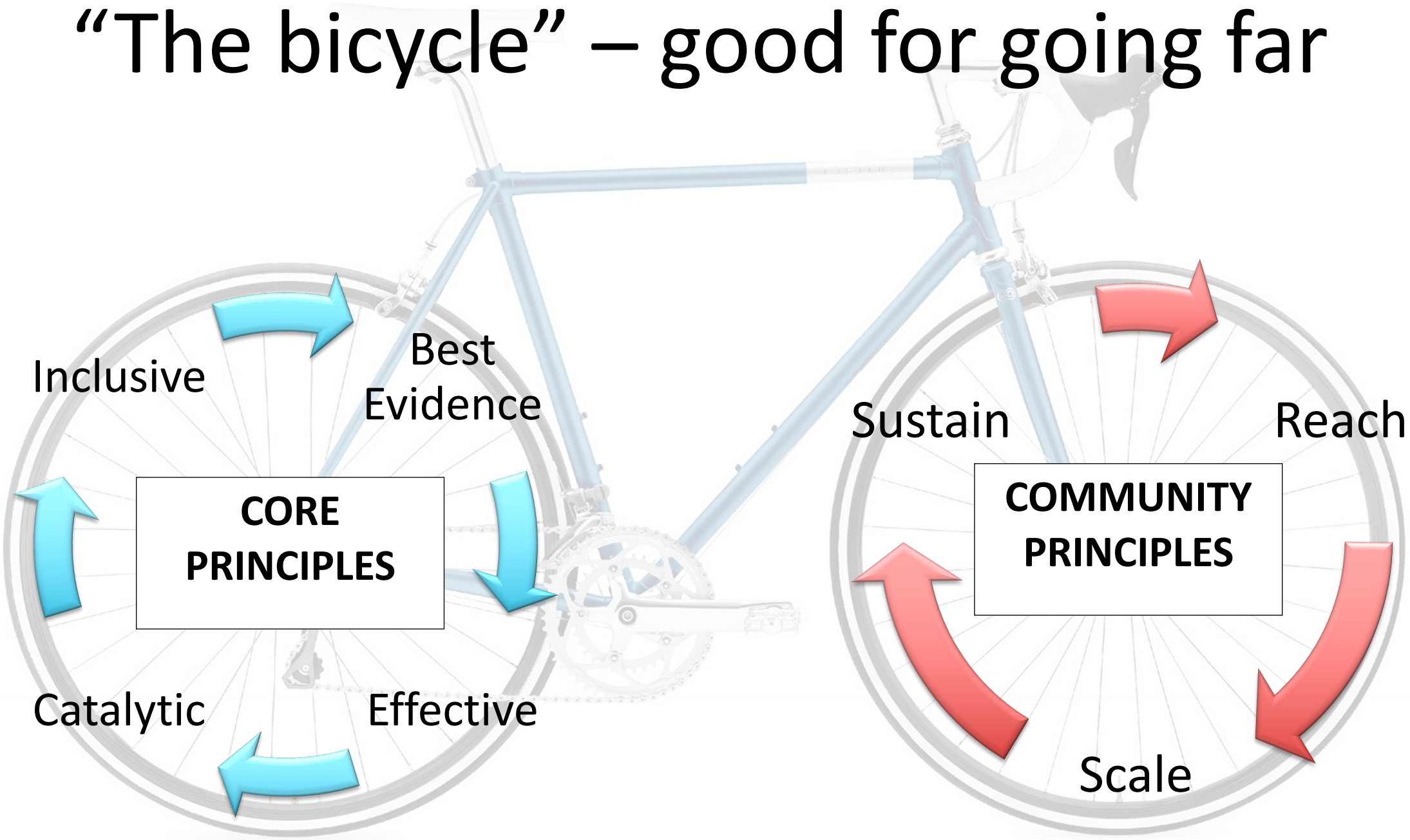
Edited by Dale Purves, Duke University, Durham, NC, and approved July 28, 2017 (received for review April 6, 2017)

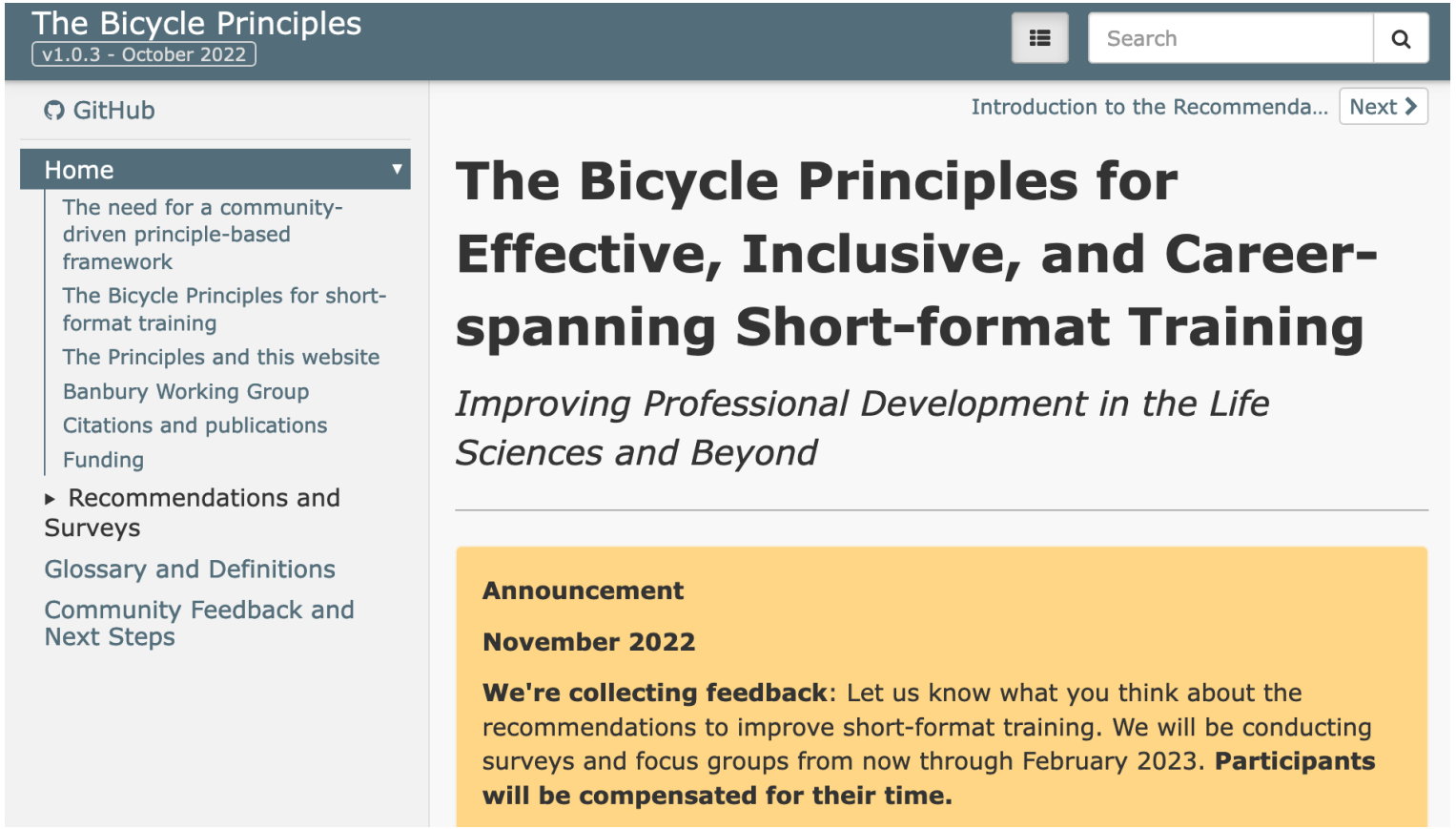
A minimal set of principles for effective, inclusive, and career-spanning learning

“The unicycle” – fine for going alone



“The bicycle” – good for going far





bikeprinciples.org

This material is based upon work supported by the National Science Foundation under DRL/EHR:2027025.

New Results

Follow this preprint

Optimizing Short-format Training: an International Consensus on Effective, Inclusive, and Career-spanning Professional Development in the Life Sciences and Beyond

Jason J. Williams, Rochelle E. Tractenberg, Bérénice Batut, Erin A. Becker, Anne M. Brown, Melissa L. Burke, Ben Busby, Nisha K. Cooch, Allissa A. Dillman, Samuel S. Donovan, Maria A. Doyle, Celia W.G. van Gelder, Christina R. Hall, Kate L. Hertweck, Kari L. Jordan, John R. Jungck, Ainsley R. Latour, Jessica M. Lindvall, Marta Lloret-Llinares, Gary S. McDowell, Rana Morris, Teresa Mourad, Amy Nisselle, Patricia Ordóñez, Lisanna Paladin, Patricia M. Palagi, Mahadeo A. Sukhai, Tracy K. Teal, Louise Woodley

doi: https://doi.org/10.1101/2023.03.10.531570

This material is based upon work supported by the National Science Foundation under DRL/EHR:2027025.

Example recommendations

A. Professionalize the training of short-format training instructors and instructional designers

Doctor studying a textbook

D. Operationalize equitable and inclusive practice in short-format training as an ethical obligation

Large crowd of people having fun

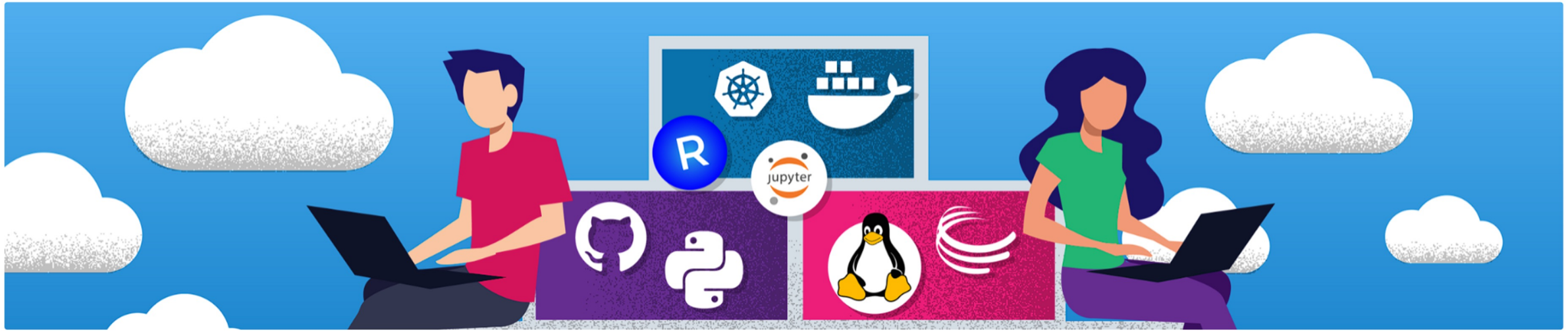
E. Deploy short-format training to counter inequity

Judge in robe fighting for justice

K. Communicate standards of instruction through badging

Scout earning a badge

Support infrastructure that works for research and education



foss.cyverse.org

Spring 2023 FOSS workshop will be virtual on Thursdays 11:00AM - 1:00PM US Arizona Mountain Standard Time starting January 19th, 2023

CyVerse's 10-week virtual workshop teaches you the principles, practices, and how-tos for doing collaborative open science using cutting-edge, open source cyberinfrastructure.

To see how our FOSS workshop can support your work, check out the workshop curriculum over the years:

Name	Dates	Description
Spring FOSS 2023	Jan 19 - Mar 30, 2023	Fifth virtual workshop series
Fall FOSS 2022	Sept 15 - Nov 18, 2022	Fourth virtual workshop series
Fall FOSS 2021	Sept 7 - Nov 18, 2021	Third virtual workshop series
Spring FOSS 2021	Feb 9 - Apr 21, 2021	Second virtual workshop series
Summer FOSS 2020	July 28 - Nov 3, 2020	First virtual workshop series
Spring FOSS 2020	Feb 17 - 21, 2020	Second in-person workshop at UArizona
Spring FOSS 2019	Jun 3-7, 2019	First in-person workshop at UArizona

Change requires more than sharing ideas.
We must build communities and support them.

Building community

LIFESCITRAINERS.ORG

ACCELERATING SCIENTISTS

Why short-format training?

In many areas of the life sciences new technologies and approaches (especially, but not only computational ones) are changing rapidly. It's not possible for formal training (undergraduate/graduate) to keep pace, but short-format training can fill these gaps. Short-format training comes with its own set of challenges, and this community works together to address them.

How I Teach Life Scientists…by Using Reproducible and Scalable Learning Environments

May 12, 2022 /// No Comments

The combination of Docker + cloud computing service enables a teacher to create a highly scalable and flexible learning environment

Continue reading »

How I Teach Life Scientists…to Build Reproducible, Scalable Workflows with Nextflow

April 20, 2022 /// No Comments

The term "reproducible research" has been used to describe the idea that a scientific publication should be distributed along with all the raw data and metadata used in the study, all the code and/or computational notebooks needed to produce results…

Continue reading »

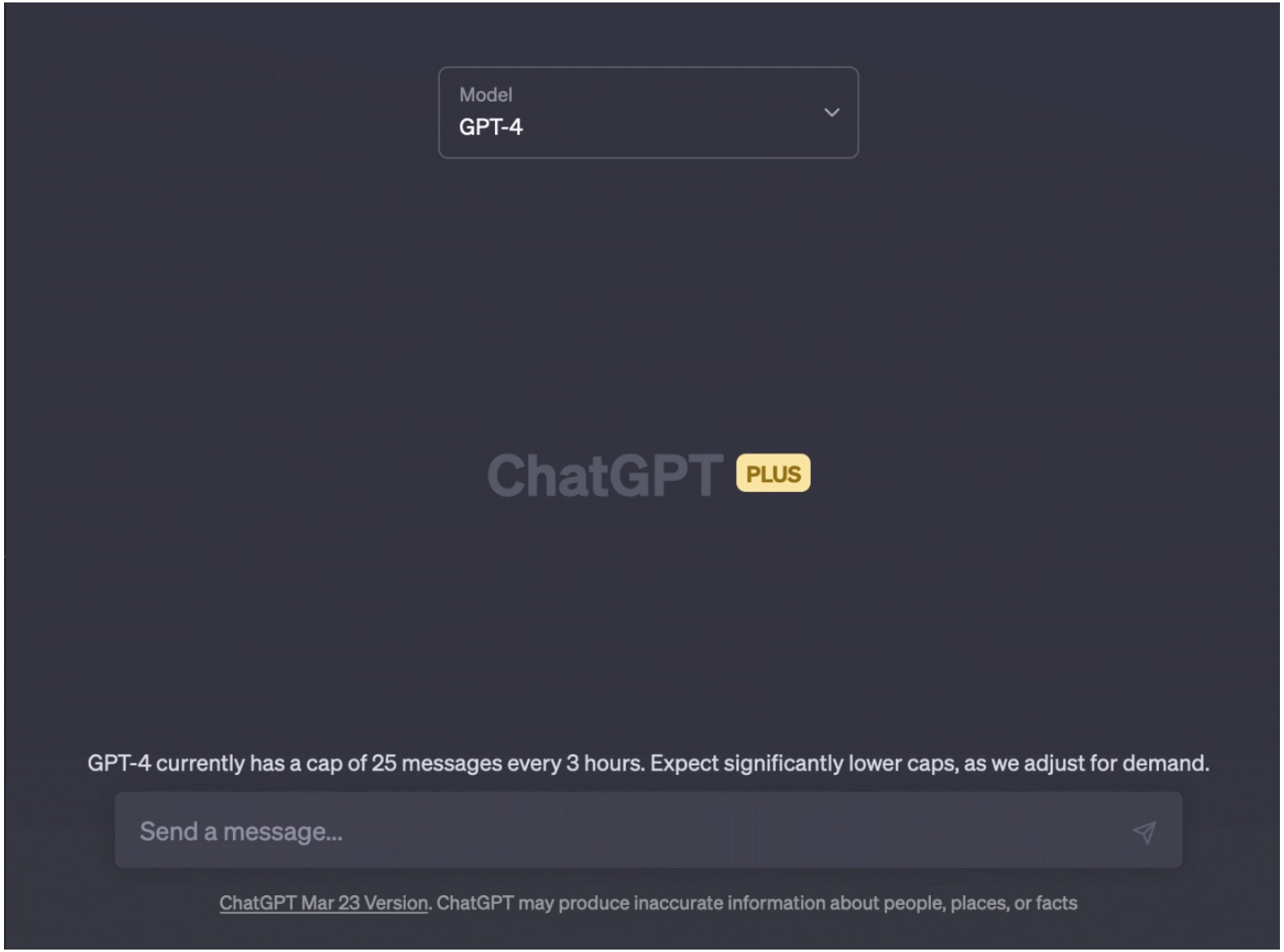
March 2022: Community Discussion – The Return to In-Person Training

March 14, 2022 /// No Comments

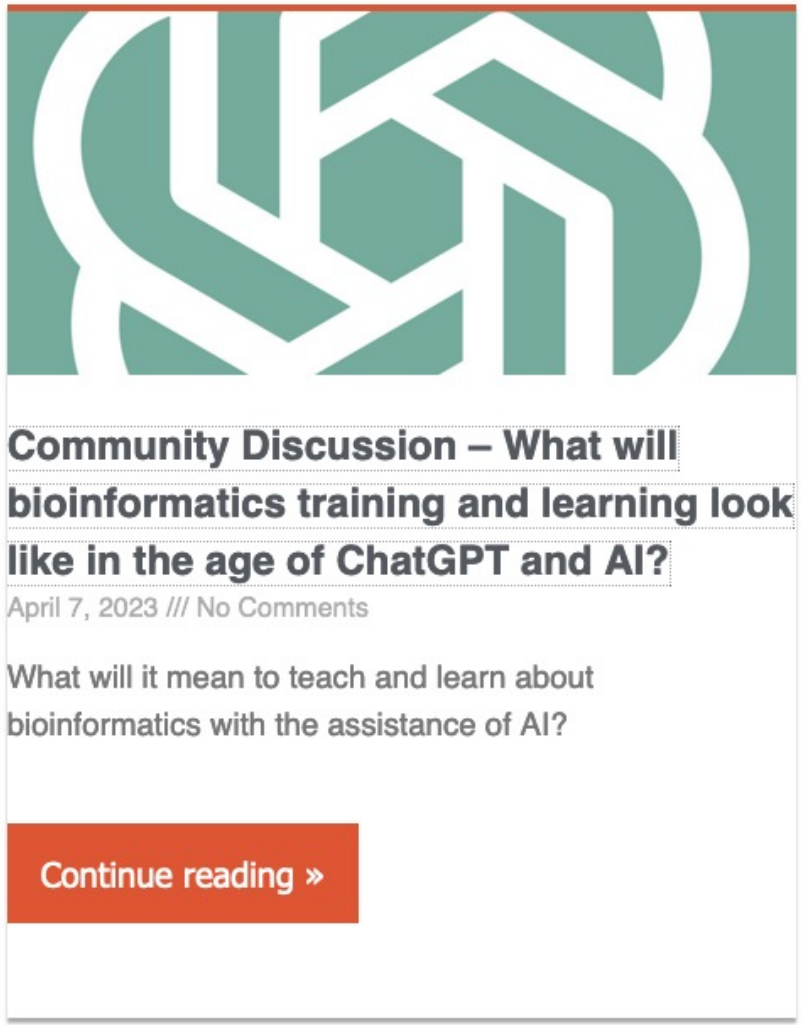
Many instructors have or shortly will be running their first in-person events since the pandemic, what will change?

Continue reading »

I don’t know what the future looks like



I don’t know what the future looks like



April post/Meeting info

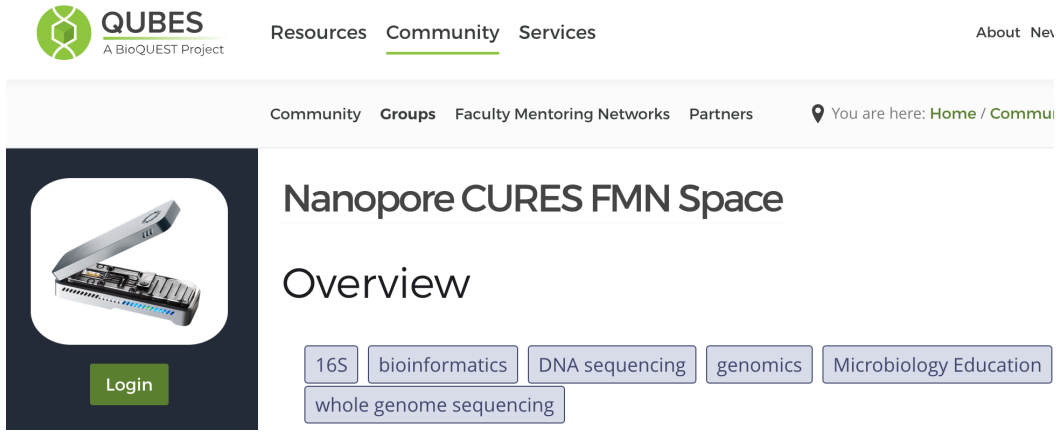
Banbury working group (May 2022)

"The illiterate of the 21st century will not be those who cannot read and write, but those who cannot learn, unlearn, and relearn"

– A. Toffler

Thanks!

Nanopore Network

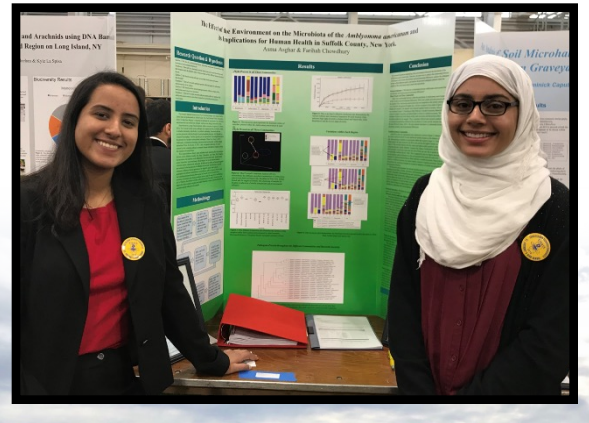


Developing Foundations for Nanopore DNA Sequencing Course-based Undergraduate Research Experiences at Minority-Serving Institutions

- Pilot (2-years)
- Simplify lab and bioinformatics protocols
- Support faculty needs and understand barriers to use

DUE# 2216349

DNA Barcoding Programs



NYC URBAN BARCODE PROJECT

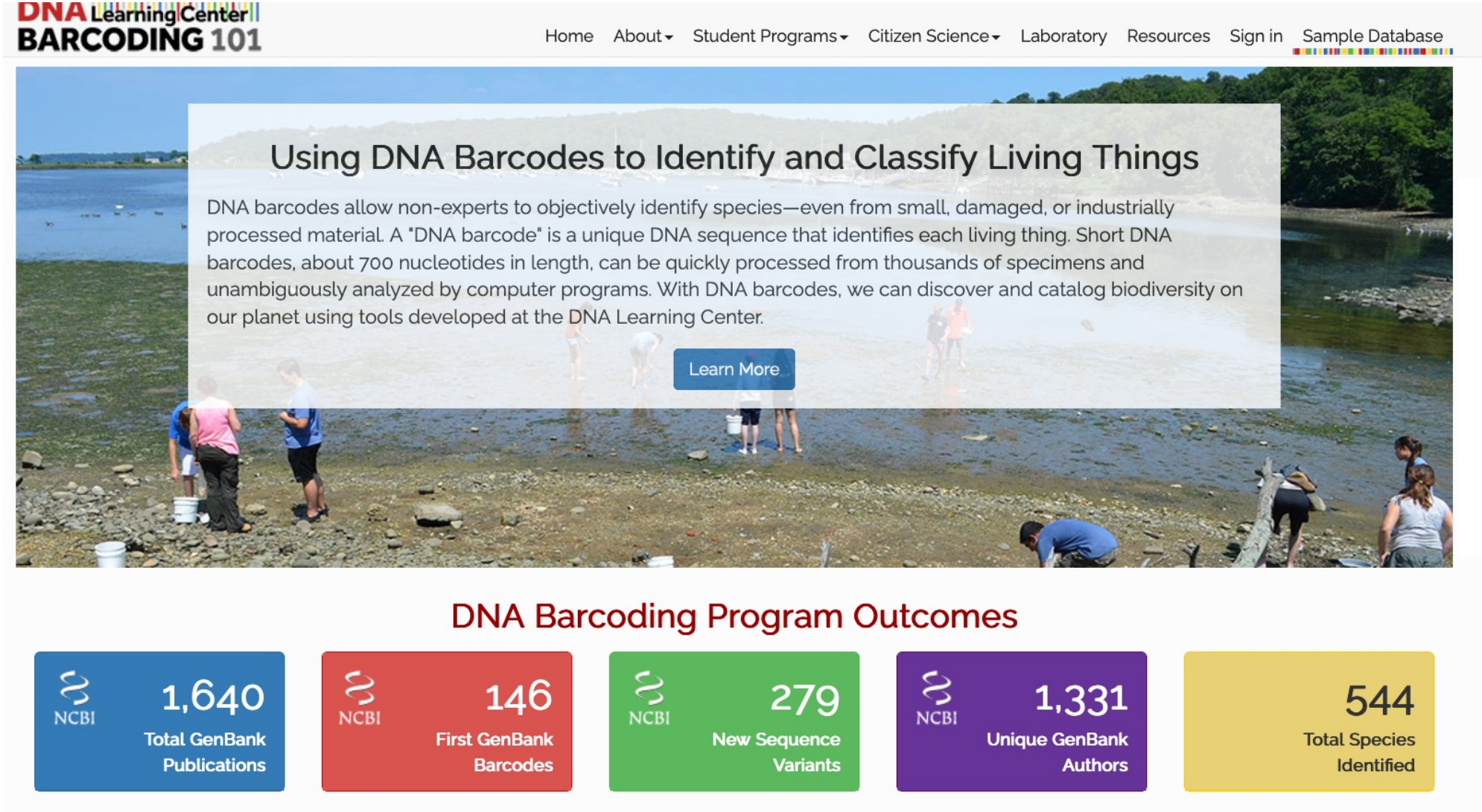
URBAN BARCODE RESEARCH PROGRAM

BARCODE LONG ISLAND

NIH NIGMS

SEPA SCIENCE EDUCATION PARTNERSHIP AWARD

SUPPORTED BY THE NATIONAL INSTITUTES OF HEALTH



DNA Barcoding Program Outcomes

1,640	Total GenBank Publications
146	First GenBank Barcodes
279	New Sequence Variants
1,331	Unique GenBank Authors
544	Total Species Identified

INNOVATEBIO
National Biotechnology Education Center

Envisioning the Next Bioscience Workforce: A Summit on Industry Trends and Needs

NSF

Monday, June 26, 2023

8:30 a.m.– 6:30 p.m. EDT

NATIONAL ACADEMY OF SCIENCES, WASHINGTON, D.C.