Introduction to Genomics in Natural Populations

Eve198

Week 1: April 2nd

Maddie Armstrong & Rachael Bay

Introductions

Name, pronouns

Major, year in school

What drew you to this class?

Class outline

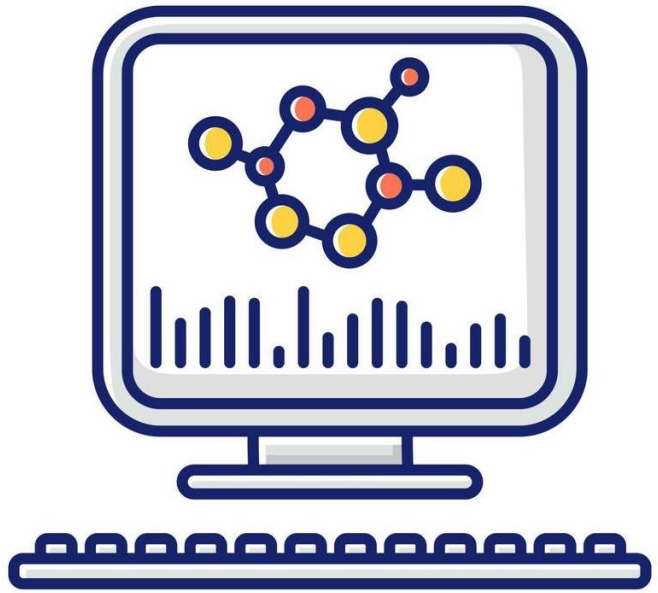
Week	Date	Topic
1	April 2nd	Introduction to genomics, learning how to navigate FARM & introduction to coding (pre-class assessment)
2	April 9th	Bash/UNIX coding: working with files
3	April 16th	Bash/UNIX coding: working with files continued
4	April 23rd	Mapping to a Genome, Calling Variants and Calculating Allele Frequencies
5	April 30th	Intro to R: Introduction and Data Manipulation
6	May 7th	Intro to R: Plotting and Making Figures
7	May 14th	Population Structure
8	May 21st	Allele Frequencies and PCAs
9	May 28th	Fst outliers
10	June 4th	Taking Bioinformatics beyond the class (post-class assessment)

Grading:

- Hands-on Coding Activities
- Participation in Creature-of-the-Week
- Attendance

Learning Objectives

- Use computing resources at UC Davis
- Write basic scripts in bash
- Perform genomic analyses modifying template scripts in R
- Describe the general bioinformatics pipeline
- Evaluate figures from published literature.



Why learn bioinformatics?

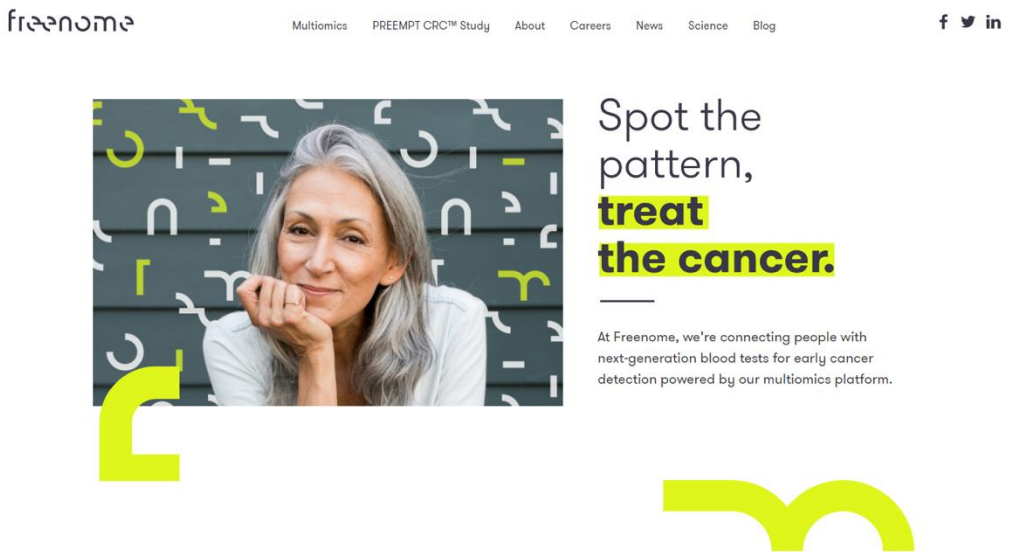
Data in Ecology and Genomics are getting bigger and bigger!

Students gain many transferable skills!

- Data science
- Personalized medicine
- NGO agency scientist
- Research scientist

Glossier.

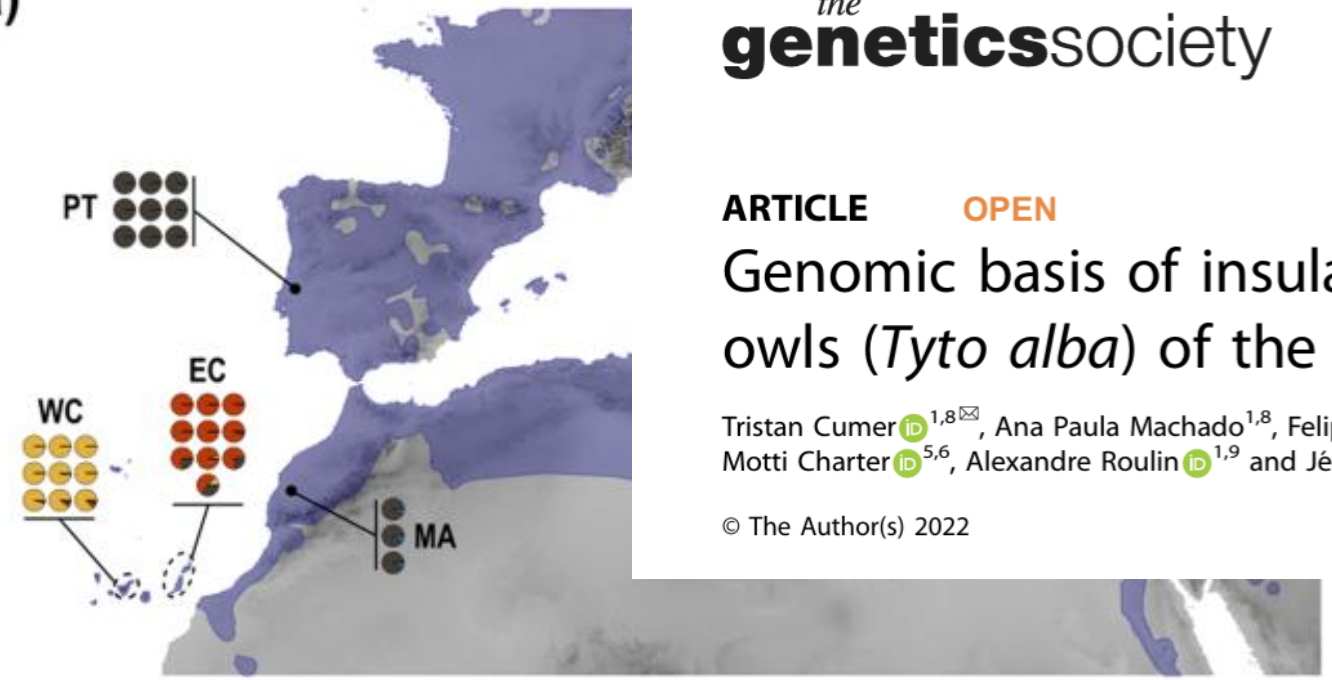
Spotify®



Creature of the Week: Barn Owls!




a)



the geneticssociety

www.nature.com/hdy

ARTICLE OPEN

Check for updates

Genomic basis of insularity and ecological divergence in barn owls (*Tyto alba*) of the Canary Islands

Tristan Cumer[1,8✉], Ana Paula Machado[1,8], Felipe Siverio[2], Sidi Imad Cherkaoui[3], Inês Roque[4], Rui Lourenço[4], Motti Charter[5,6], Alexandre Roulin[1,9] and Jérôme Goudet[1,7,9✉]

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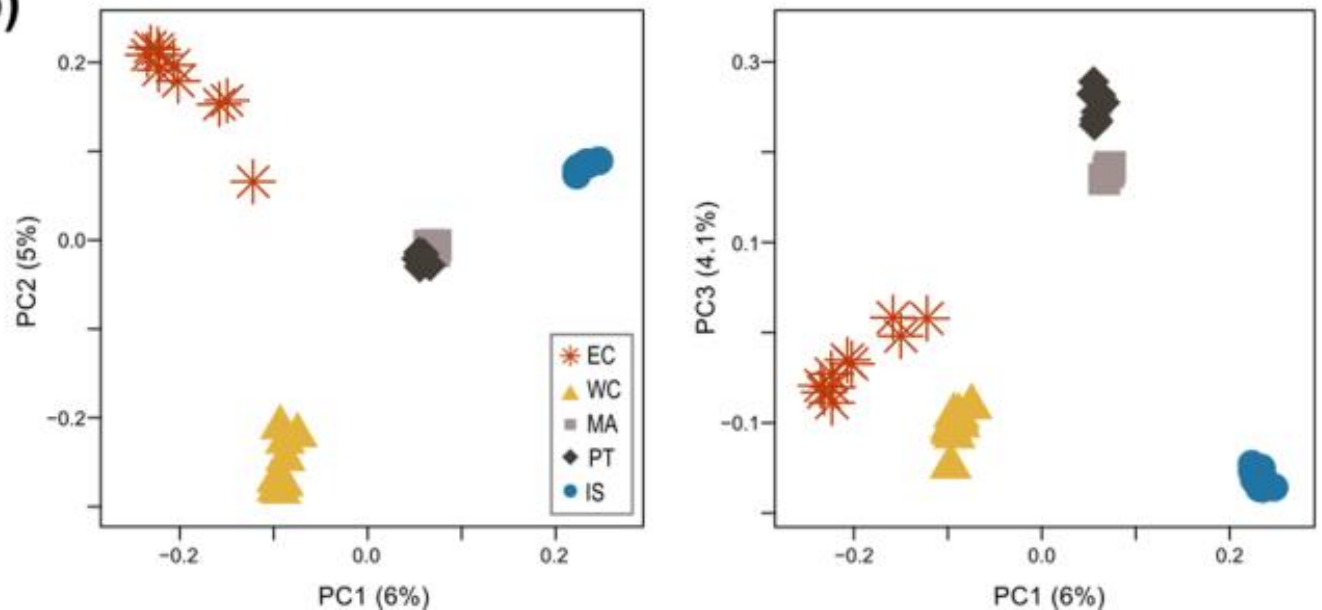
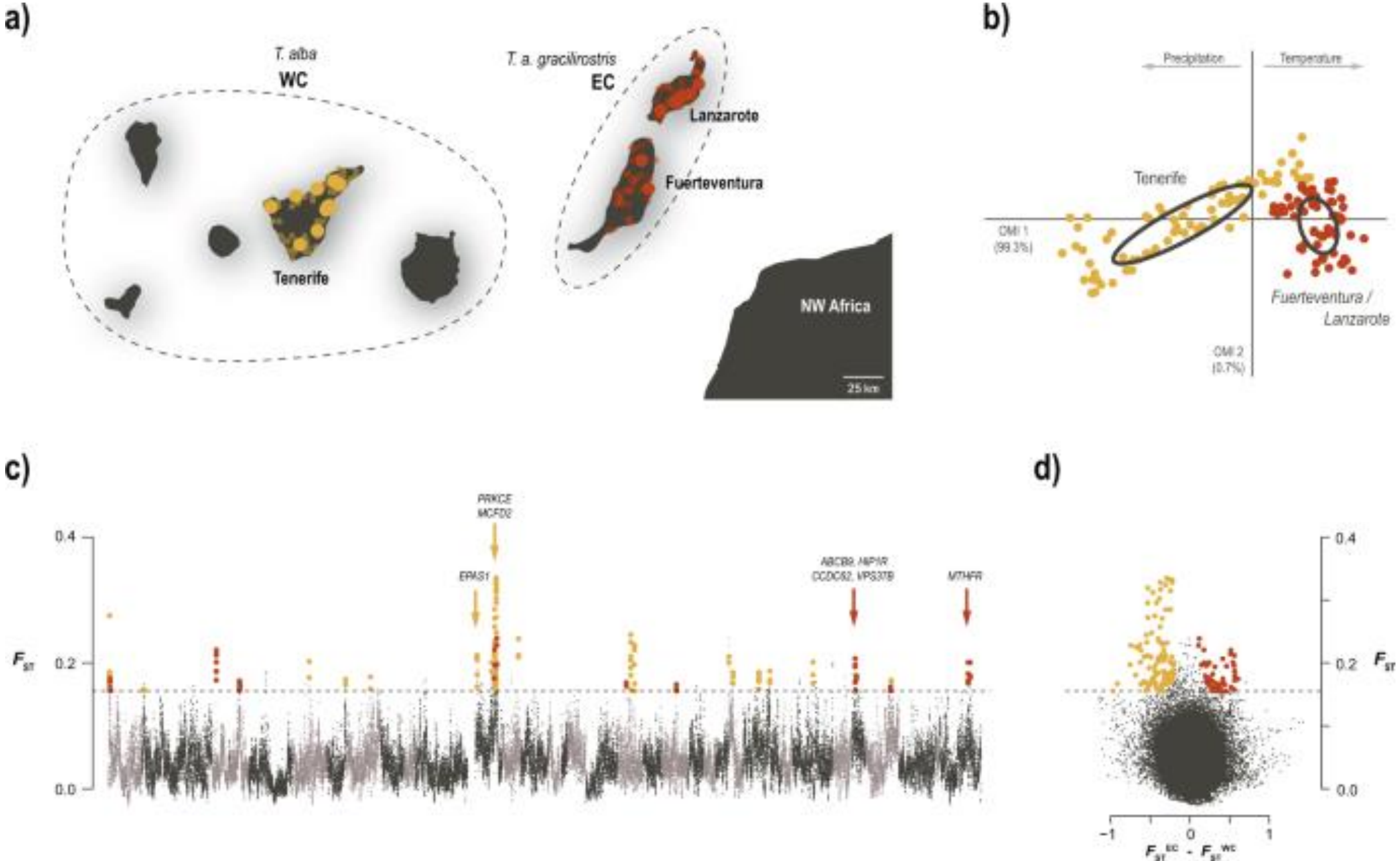
b)



https://www.nature.com/articles/s41437-022-00562-w



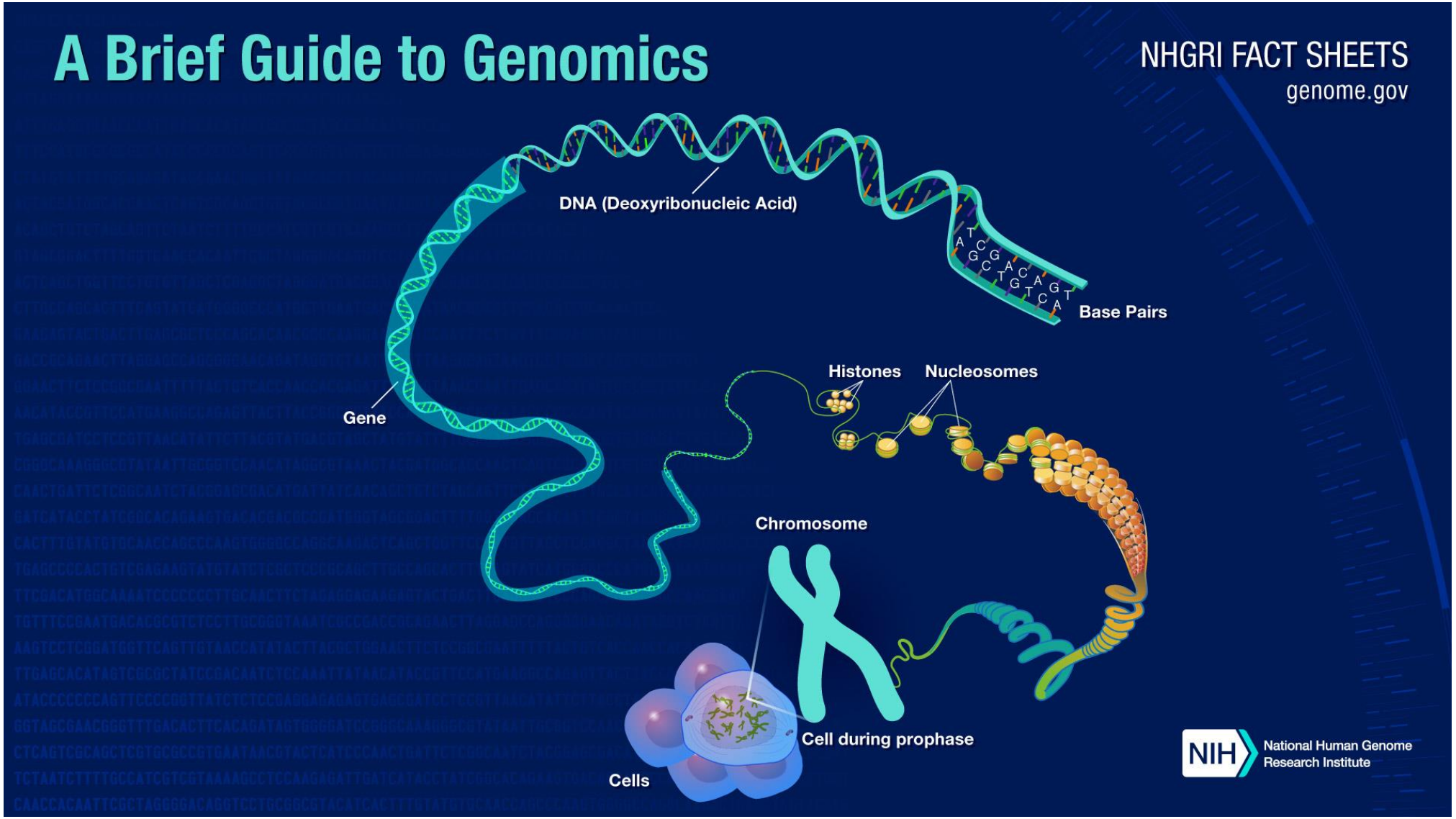
https://www.nature.com/articles/s41437-022-00562-w

Week 1 Objectives:

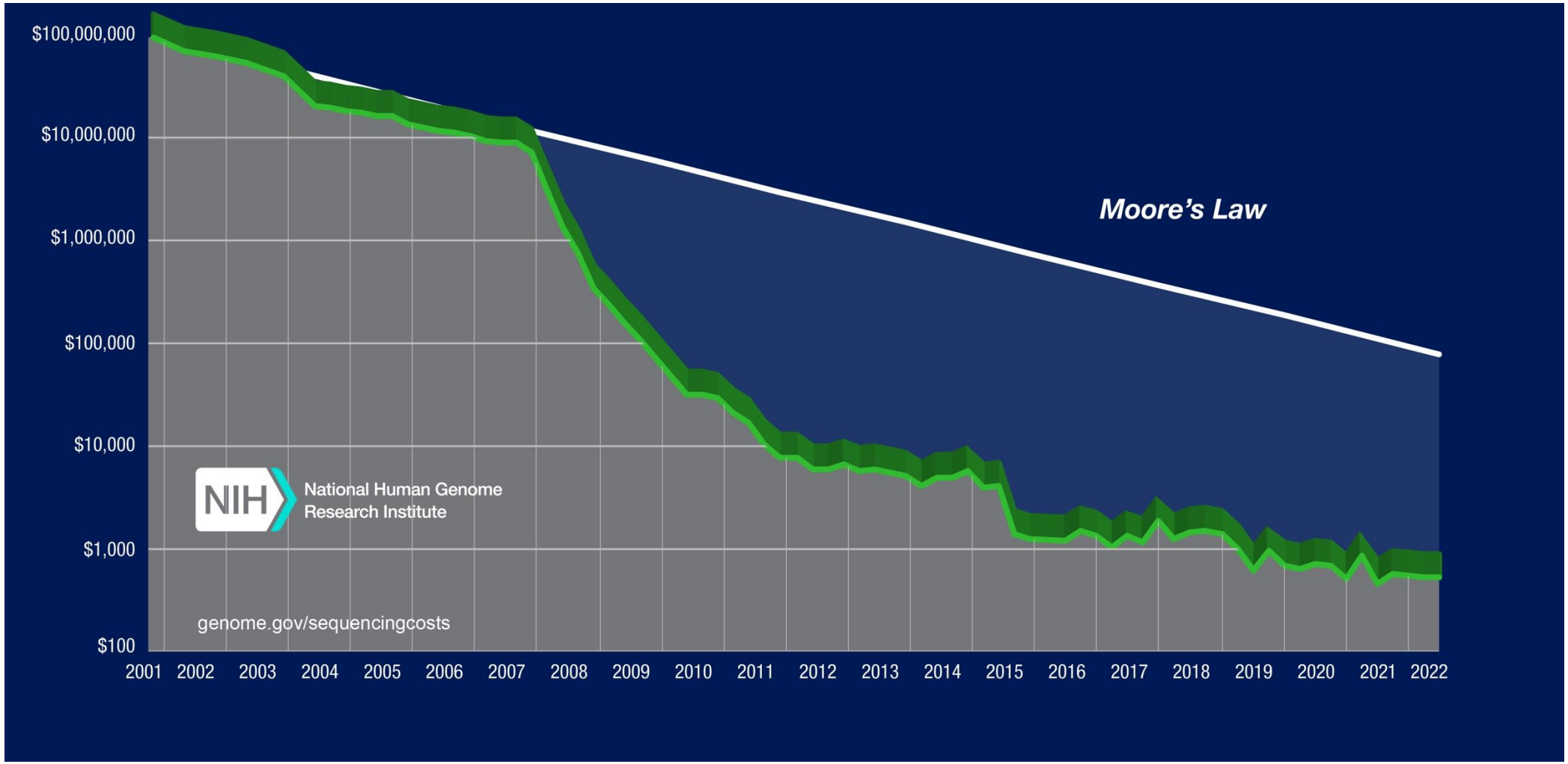
- Take Pre-class assessment
- Introduction to genomics & shell computing
- Accessing terminal via Farm OnDemand
- Learn how to use the command line interface to move around in your file system

Pre-Class Assessment!

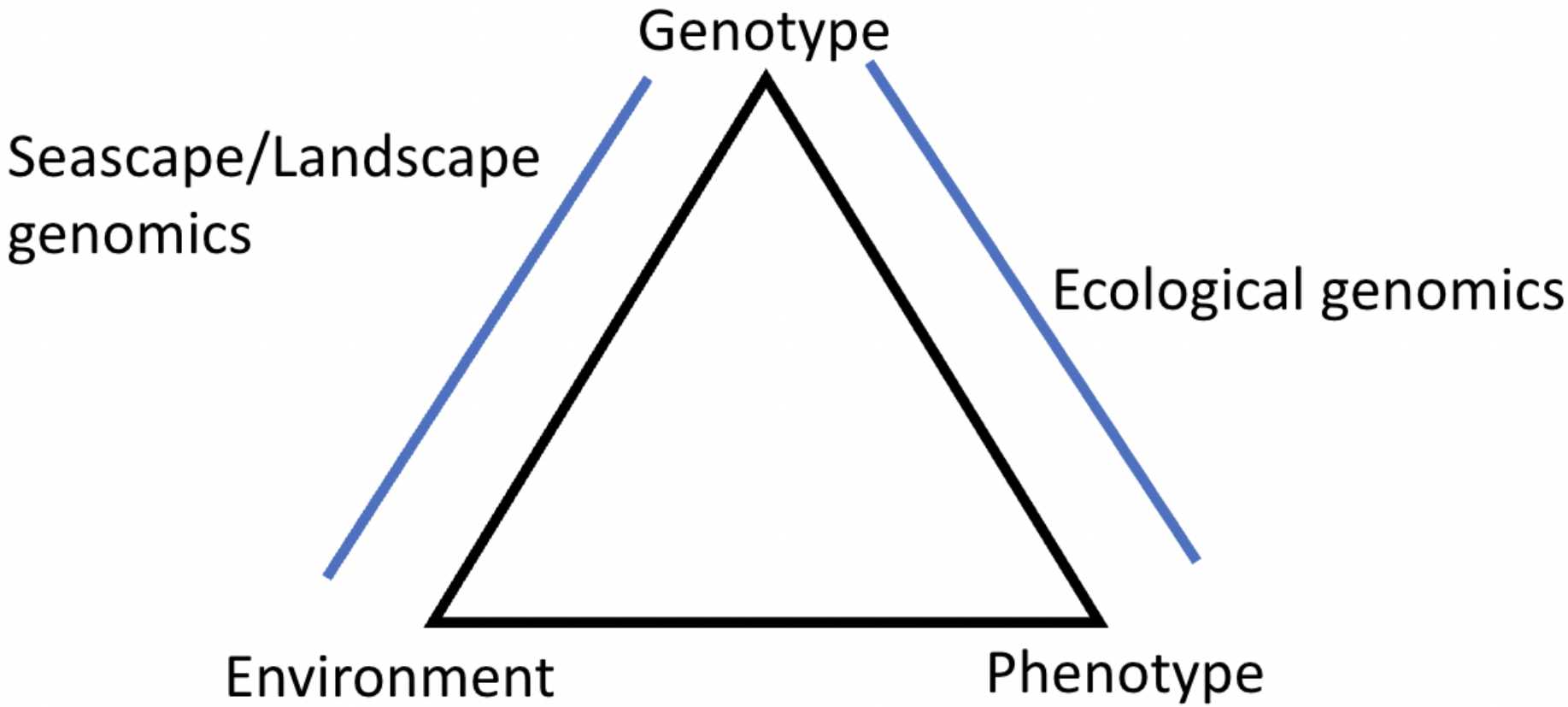
What is Genomics?



Genomics data is becoming more accessible & cheaper!



Pairing genetic data with environmental/phenotypic data



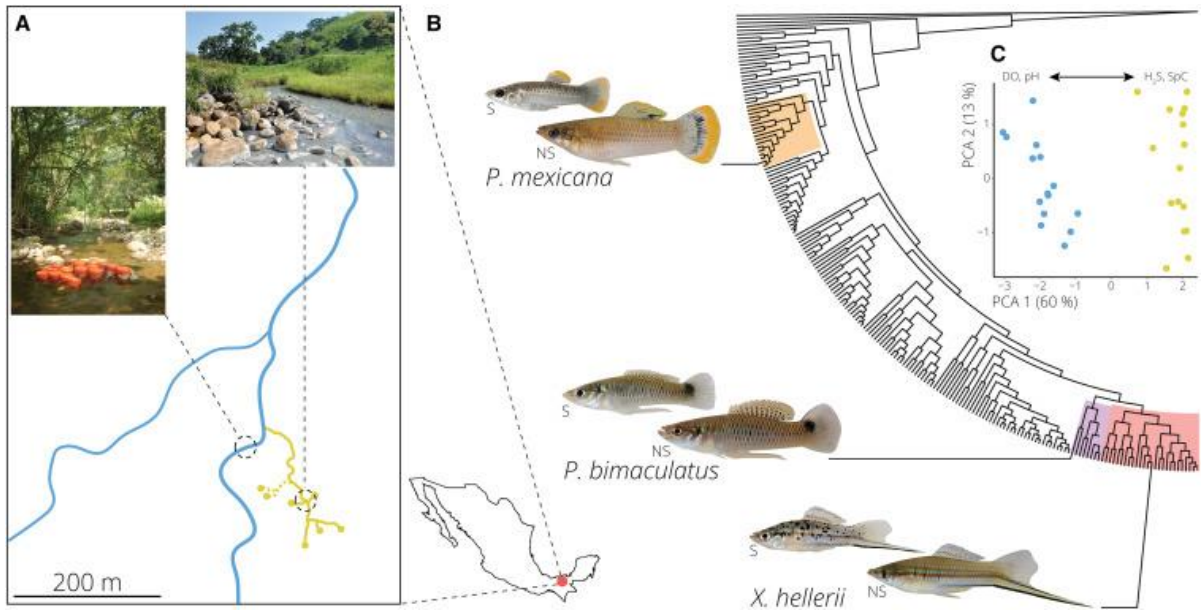
Current Biology

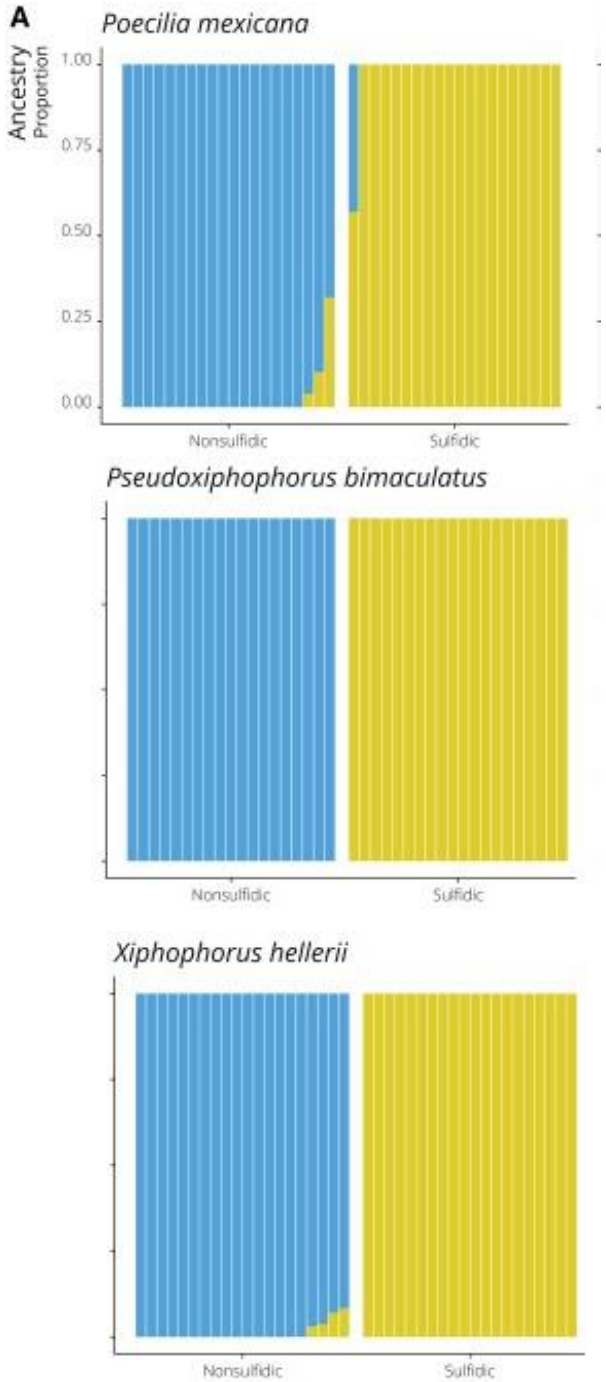
Volume 34, Issue 21, 4 November 2024, Pages 4968-4982.e7

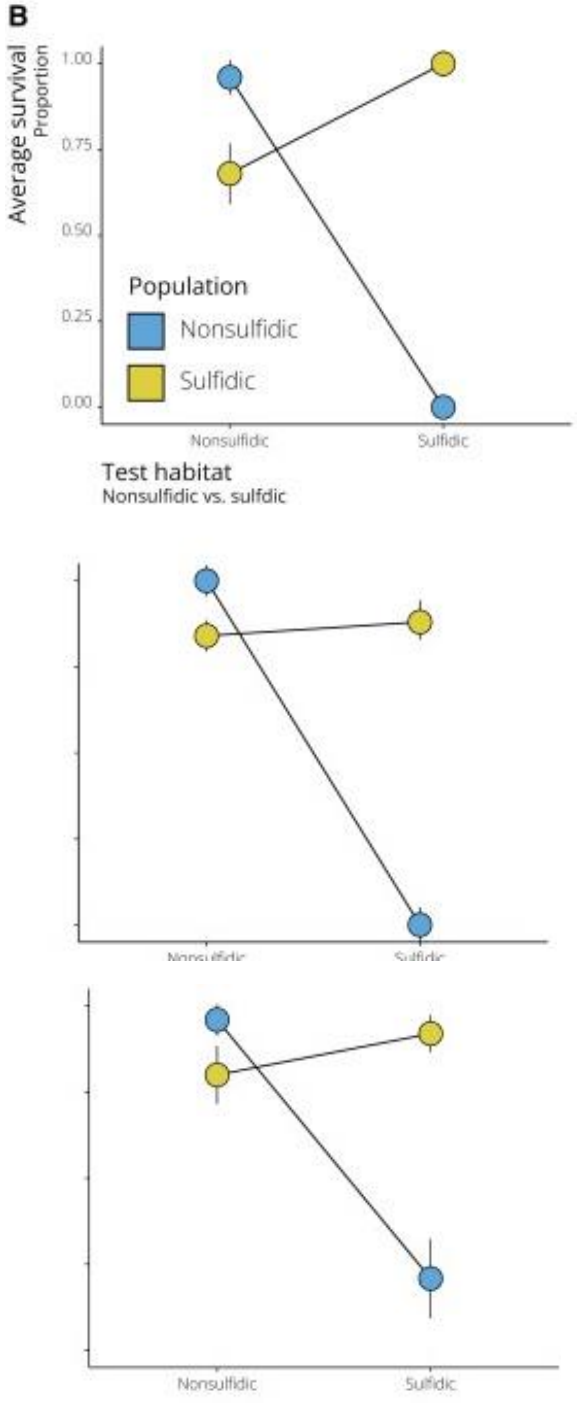
Article

Integrative analyses of convergent adaptation in sympatric extremophile fishes

Ryan Greenway [1], Rishi De-Kayne [2], Anthony P. Brown [3 8], Henry Camarillo [1 9], Cassandra Delich [1], Kerry L. McGowan [3], Joel Nelson [3], Lenin Arias-Rodriguez [4], Joanna L. Kelley [2] ✉, Michael Tobler [5 6 7 10] ✉







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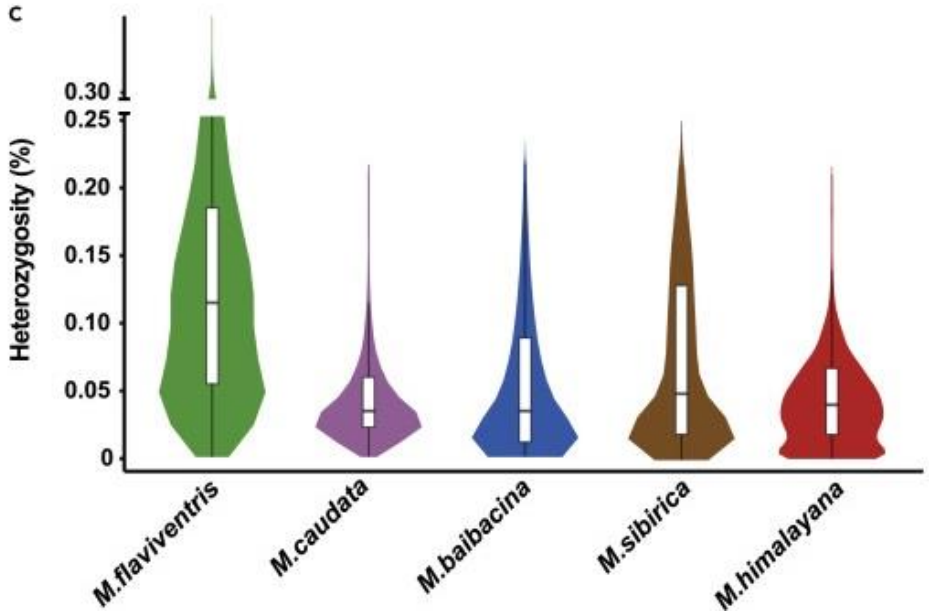
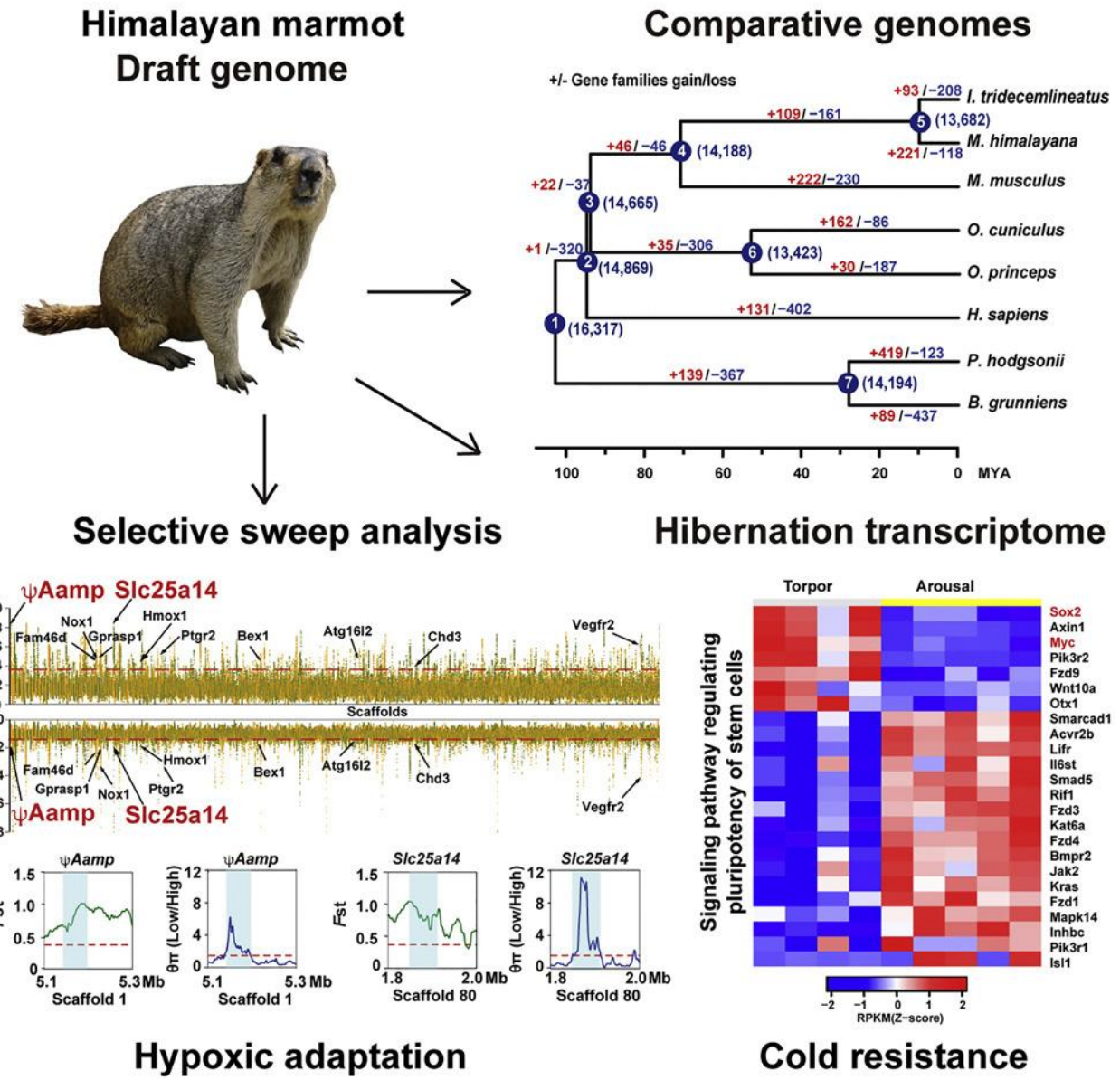
ARTICLE · Volume 11, P519-530, January 25, 2019 · Open Access Download Full Issue

Hypoxic and Cold Adaptation Insights from the Himalayan Marmot Genome

Liang Bai [1,2,11] · Baoning Liu [1,2,11] · Changmian Ji [3,11] · … · Hongkun Zheng [3] · Jianglin Fan [10] · Enqi Liu [1,2,12] … Show more





Received: 4 October 2022 | Revised: 28 February 2023 | Accepted: 8 March 2023

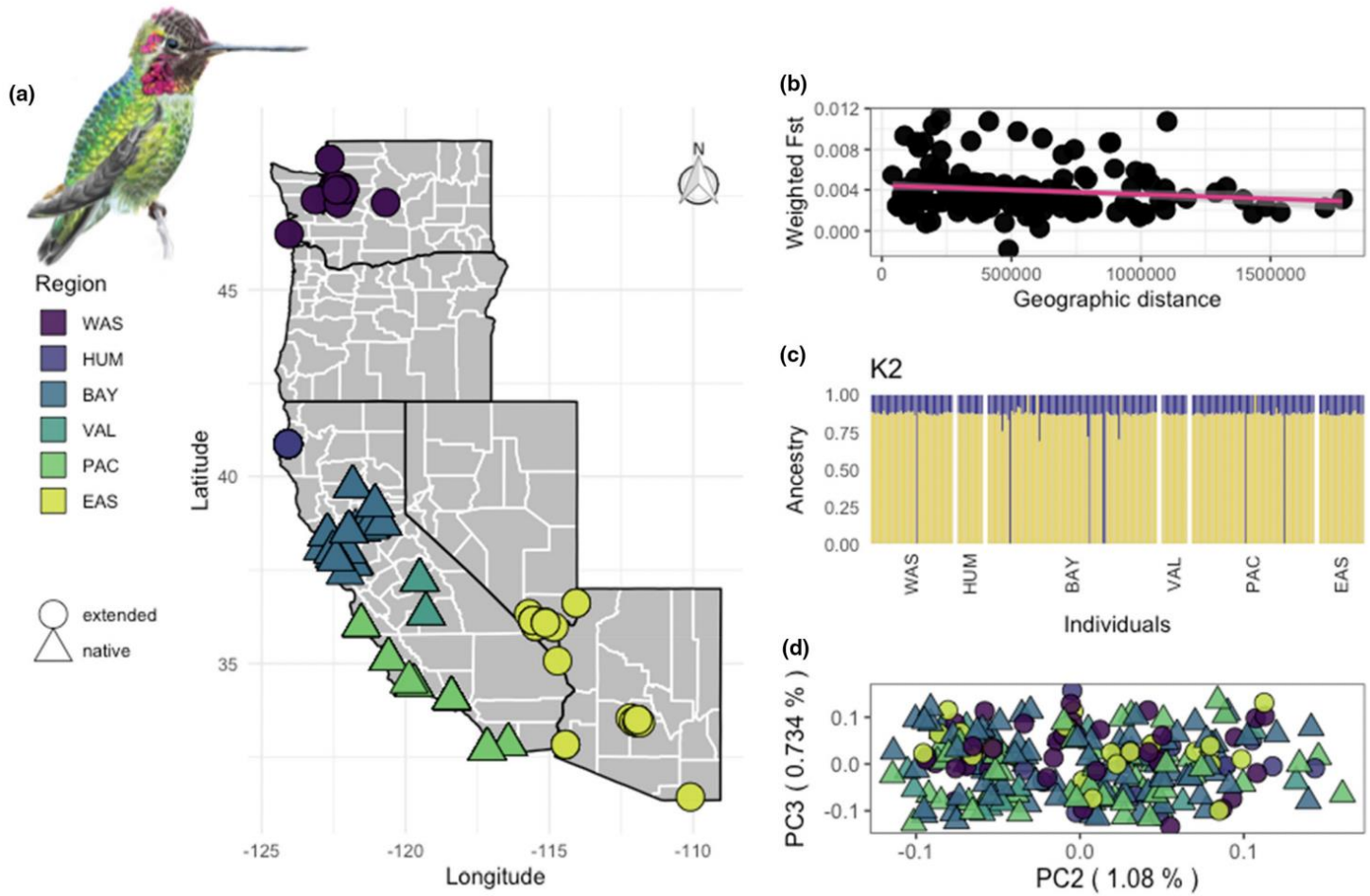
DOI: 10.1111/mec.16928

MOLECULAR ECOLOGY WILEY

ORIGINAL ARTICLE

Widespread gene flow following range expansion in Anna's Hummingbird

Nicole E. Adams[1] | Ruta R. Bandivadekar[2] | C. J. Battey[3] | Michael W. Clark[1] | Kevin Epperly[4,5] | Kristen Ruegg[6] | Lisa A. Tell[2] | Rachael A. Bay[1]

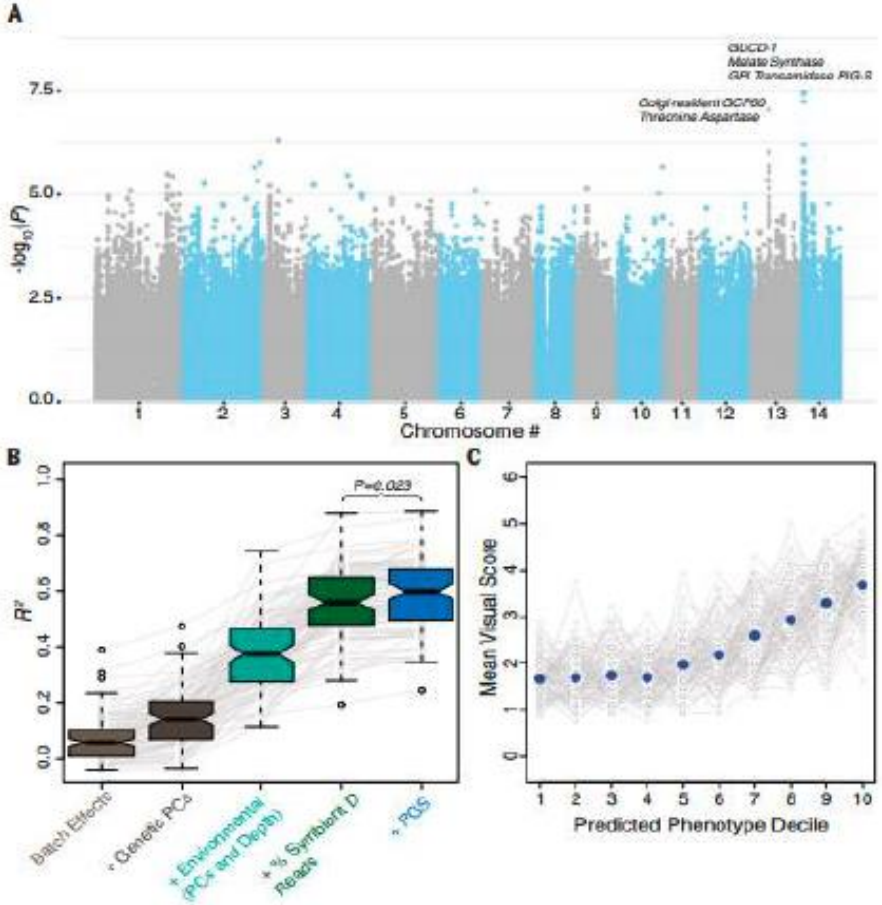


RESEARCH ARTICLE SUMMARY

CORAL GENOMICS

Population genetics of the coral *Acropora millepora*: Toward genomic prediction of bleaching

Zachary L. Fuller*, Veronique J. L. Mocellin, Luke A. Morris, Neal Cantin, Jihanne Shepherd, Luke Sarre, Julie Peng, Yi Liao, Joseph Pickrell, Peter Andolfatto, Mikhail Matz†, Line K. Bay*†, Molly Przeworski*†



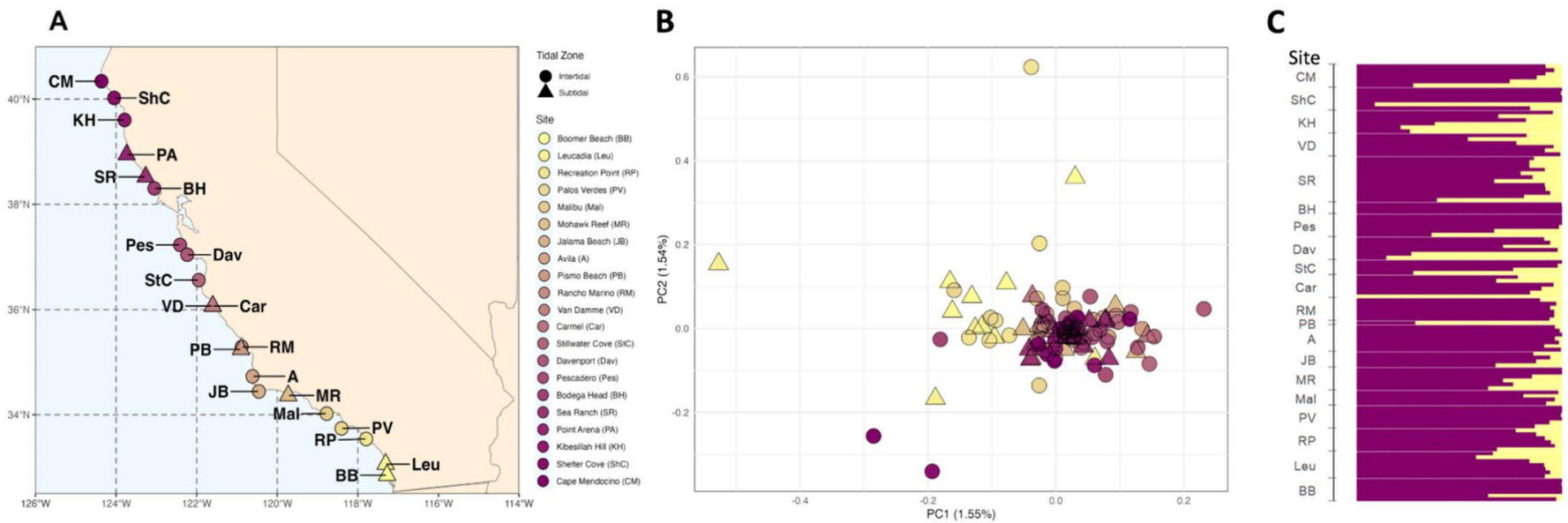
MOLECULAR ECOLOGY

ORIGINAL ARTICLE | Open Access

Selection Over Small and Large Spatial Scales in the Face of High Gene Flow

Camille Rumberger, Madison Armstrong, Martin Kim, Raquel Ponce, Josue Melendez, Melissa DeBiasse, Serena Caplins, Rachael Bay

First published: 19 February 2025 | https://doi.org/10.1111/mec.17700



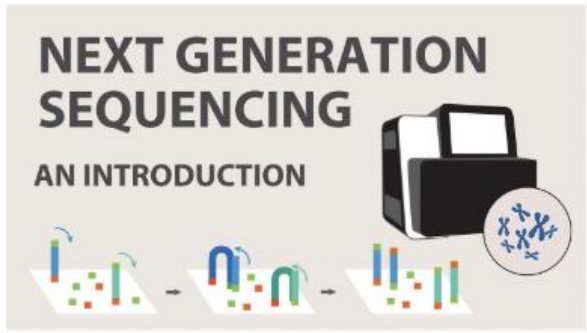
How do we do it?

Research idea/question

Design experiment

Lab experiment
Field collection scheme

Extract DNA/RNA



https://www.youtube.com/watch?v=jFCD8Q6qSTM&ab_channel=AppliedBiologicalMaterials-abm

Download data

Perform analyses

Present results at conference
Publish paper

Shell Computing: Why is it useful?

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- Automate repetitive tasks aka less boring!

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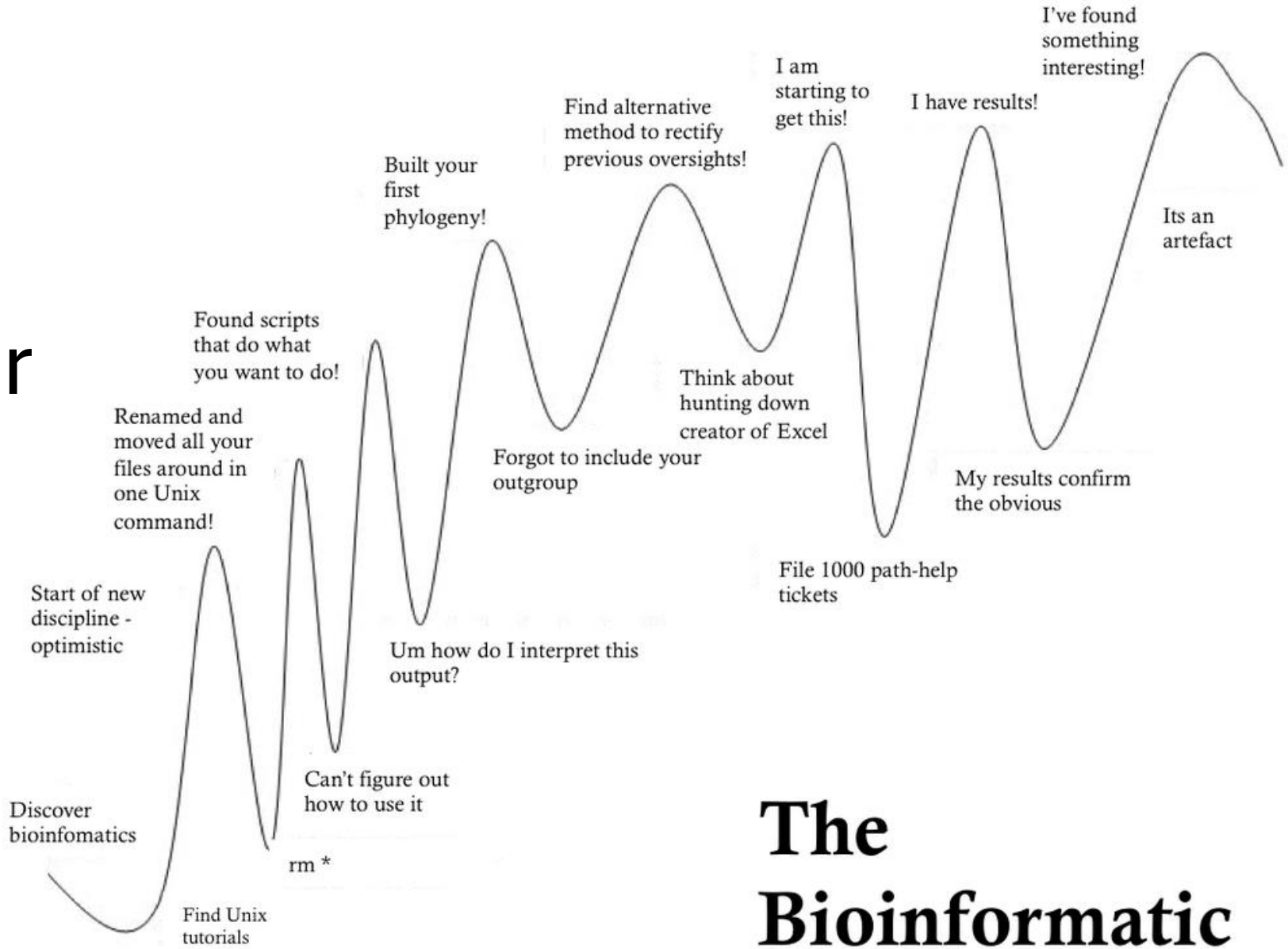
Shell Computing: Why is it useful?

- Accessibility of tools
- Automate repetitive tasks aka less boring!
- Makes your work less error prone
- Makes your work more reproducible

Let’s navigate to Farm OnDemand now and our course website for the rest of class!



https://pbs.twimg.com/media/Boy6GT1IYAAsmfA.png:large