

Moving diversity labs into the 21st century

RANDI MEWHORT

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Biology 108: Organisms in their Environment

From the origin of life on earth through the evolution of prokaryotic and eukaryotic organisms this course examines the diversity of life on earth. Using a phyletic approach to classification, the major taxonomic groups of organisms are introduced. These include prokaryotes, numerous protists, plants, fungi, and animals. Features that adapt these organisms to their environment are emphasized using Darwinian evolution as the underlying principle. Note: BIOL 108 and BIOL 107 may be taken in either order. Prerequisites: Biology 30.

Learning outcomes:

- Relate diversity of organisms in context of evolution by natural selection and the history of life
- Construct and defend phylogenetic systems
- Identify the key features of major taxonomic groups and relate to evolutionary processes
- Demonstrate proficiency in light microscopy
- Critically/ objectively evaluate biological information

Traditional labs:

“Tour of the kingdoms” approach – from the beginning of time for the course

- Look at slides
- Be able to identify those slides
- Mostly memorization and recalling of facts and recognition of slides

2) In our study of the algae we saw that different groups had different pigments. In the following table, indicate the presence (P) or absence (A) for the pigments we discussed using the specimens E, F, and cyanobacteria. Specimen D has been done for you. The Specimens are also being projected for you. (3 pts)

Specimen	Chlorophyll a	Phycoerythrin	Fucoxanthin
Cyanobacteria	P	A	A
D. Red algae	P	P	A
E. Brown algae	P	A	P
F. Ulva	P	A	A

“Band aid” Solutions:

- Students did not read ahead → instructors did longer and longer prelabs
 - Some moved to “integrated pre-labs”; some talking then some looking throughout the lab time
- Games and/or review activities e.g. Trivial Biology
 - Critical thinking exercises (complaints that questions were too hard)
 - Student review presentations
- So many resources on-line students were overwhelmed
 - Powerpoint slides with all the images
 - Extra resources such as video lectures
 - Review quizzes

TRIVIA #31:

- Diverse niches (5pts)
- Bilaterally symmetrical (4pts)
- Chitinous exoskeleton (3pts)
- Paired, jointed appendages (2pts)
- Evolved flight (1pts)

Arthropoda



Felt that labs need to change but...

- Content of the course was not changing – Faculty see value in a diversity course
- No budget to change the course material significantly
- Microscope skills valued
- Needed to work with entire team of lab instructors

Application of better teaching approaches:

We wanted students to:	So we
Come prepared to lab – so we wouldn't have to talk so much	Flipped the classroom and had prequizzes due an hour before lab on the theory
Make relevant biological observations	Have worksheets that need to be filled out for attendance credit
Be able to apply their learning	Have practical assessments where students need to use their learning on mystery specimens
Critically think about the material	Provide critical thinking questions for practice and assessments
Use microscopes	Worksheets require the use of the microscope and students must demonstrate that they can use the microscope

“Flipped the lab”; Active learning; Critical thinking

Prequiz lessons

- Open ahead of time on an even schedule, close far enough before lab student aren't late
- Don't need to be worth much
- Took the top 5 of 7 so that issues could be compensated for
- Opened the quiz the following week for studying

Worksheets and practical work:

- Students need practice with format
- Next year will be clear that “unknowns” or “mystery” specimens are from term work
- More feedback during term to students

Biology 108 Description of an Unknown

Name: _____

Worksheet:

ID#: _____

You have 20 minutes for this worksheet. You should complete a total of 2 worksheets and participate in the group quiz. The worksheets and the group quiz will count for 5% of your total course grade.

Using the area below, draw a properly labeled diagram of unknown _____ following Appendix B. **Include 4 labelled structures** on the diagram. (4 points)

NOTE: Your labelling will be marked based on what you record for your identification.

Members of this Kingdom share several characteristics and have evolved synapomorphies. Compare and contrast between the basal group of the Kingdom and the phyla of your unknown, as indicated below.

Basal group's environment (check one): Aquatic Terrestrial Parasitic

Unknown's environment (check one): Aquatic Terrestrial Parasitic

(1 point)

Compare (provide two similarities in character traits) (2 points):

Critical thinking questions expanded

Critical Thinking:

Both Kingdom Fungi and Kingdom Plantae have spores. Are spores a shared, derived characteristic between these Kingdoms? Justify your answer based on phylogenetic evidence.

Do Fungi exhibit an alternation of generations lifecycle? Comment on how they do or do not exhibit this lifecycle with respect to the ploidy of individuals and relative time an organism is haploid or diploid.

Overall...

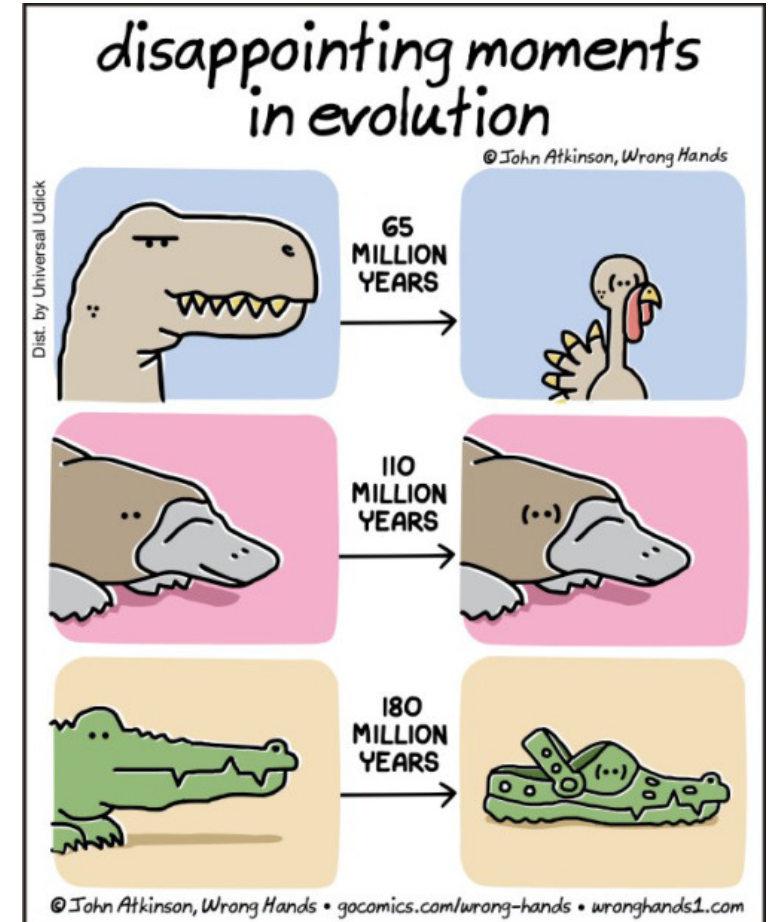
- Previous comments on the course had requested more assignments/ quizzes
- Student in general appreciated prequizzes
 - several comments that the lab that did not have a prequiz was confusing and difficult
- Decrease of comments that the lab was useless or was only memorization

Positives:

- Instructors noticed increased engagement of students in lab and students used more of the scheduled lab time
- Quality of questions asked in lab was more conceptual and at a deeper level
- Seem to know that they did not understand some concepts earlier

Mistakes:

- Needed to do more training for the practical worksheets
- Grades were inflated due to too many marks associated with participation activities
- Overambitious with what students could do in this format
 - Touring is efficient...
- Also uncovered that our students do not get natural selection or how a character may be adaptive, including how it might relate to diversity...



For next year...

- More worksheets through the term
- Using a Pass/Fail approach for participation
 - deduction to lab grade applied in case of failure – Feel free to ask about this!
- Thoughts on reducing some of the content
- Bringing in case study writing assignments on natural selection/ adaptations