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Spring 2-1-2022

### BIOB 170N.01: Principles of Biological Diversity

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#### Recommended Citation

Greene, Erick P. and Miller, Scott R., "BIOB 170N.01: Principles of Biological Diversity" (2022). *University of Montana Course Syllabi, 2021-2025*. 118.

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# PRINCIPLES OF BIOLOGICAL DIVERSITY

## BIOB 170, Spring Semester 2022



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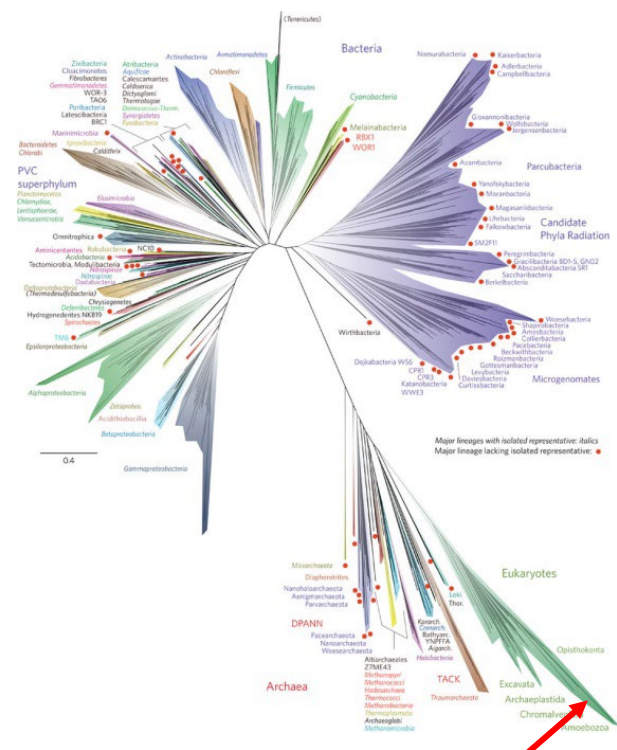
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### Overview and Objectives

We share this planet with an astounding variety of living organisms. Life arose on Earth about 3.8 billion years ago, and so there has been a LOT of time for species to evolve into a breath-taking diversity of forms. Living creatures are found virtually everywhere on Earth, from the stratosphere to the deepest parts of the oceans and land, from the hottest places (boiling hot springs and boiling deep sea thermal vents) to the coldest places (inside glaciers and frozen rocks in the Antarctic), and everywhere in between. Living organisms range in size from microscopic bacteria to gigantic redwood trees and blue whales.

With a new array of genetic tools, biologists are making astounding discoveries about how all living organisms are related to each other, and how and when major groups arose and diversified. This class is a broad survey that will introduce you to the fellow creatures to whom we are related, with whom we share the Earth, and on whom we depend. The class will be organized around the conceptual framework of the Tree of Life (shown on the right).

Molecular Tree of Life, showing genetic diversity of the major groups of organisms.



You are here!

### ***The structure of this class during the Coronapocene***

Life during the Coronapocene is stressful and difficult! Since omicron is predicted to spike during the first few weeks of class, we are going to start with remote lectures on zoom. But our plan is to switch over to in-person classes as soon as possible.

The class takes place MWF at 1 PM. Here is a zoom link for the beginning of the semester.

<https://umontana.zoom.us/j/98462831235>

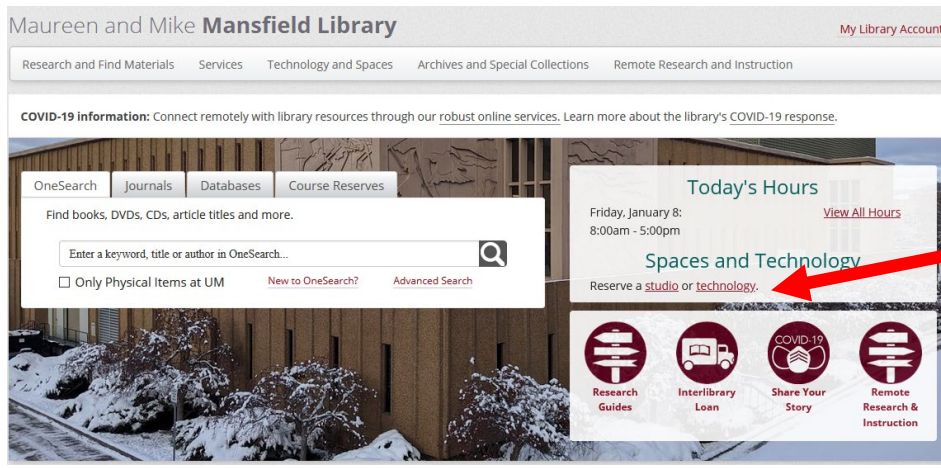
To participate on zoom  
you will need the following:

- A computer with a camera and a microphone.
- Good internet connection.

If you don't have these here are some suggestions.

- The Mansfield Library will check out everything you need to have good zoom connections: laptops, webcams, microphones and speakers.
- If your wifi or internet connection is not good (the video or audio freezes up), you have several options. First, if you live near UM, you can go to Mansfield Library and you can get a safe, enclosed room just for yourself. These places have good wifi.
- Second, the library will check you out a "wifi hotspot" for 30 days at a time. These are small boxes that plug into your computer and connect to satellites to provide good wifi. They will give you good internet connections where ever you are. What the heck - you could take your laptop up to the top of MT Sentinel and join our class from there!
- To check out any of this gear, go to the Mansfield Library main web page, and click on the "technology" link in the "Spaces and Technology" box.





## ***A Few Words on Our Class Philosophy and the Corona Virus***

Our goal is to make this class as fun, engaging and interesting as possible. We hope that the omicron variant peaks and then diminishes rapidly so we can get back to in-person classes soon. But we are all going to have to be flexible about what this semester might hold in store for us. We will give you frequent updates about any changes.

To reduce stress, we have made the grading based on many low-stakes activities (more details below). We did this to allow you to focus on the class material and not stress out about a few high-stakes exams. There will also be opportunities for extra credit activities. These will be announced throughout the class.

Once we switch back to in-person classes, we ask that you monitor your own health. If you are not feeling well or test positive for COVID, PLEASE DO NOT COME TO CLASS. You can get tested for COVID at Curry Health Center (call 243-4330). Just as a reminder, if you have any of the following symptoms, take care of yourself and stay away from school until you are better:

- Fever or chills
- Cough
- Shortness of breath or difficulty breathing
- Fatigue
- Muscle or body aches
- Headache
- New loss of taste or smell
- Sore throat
- Congestion or runny nose
- Nausea or vomiting
- Diarrhea

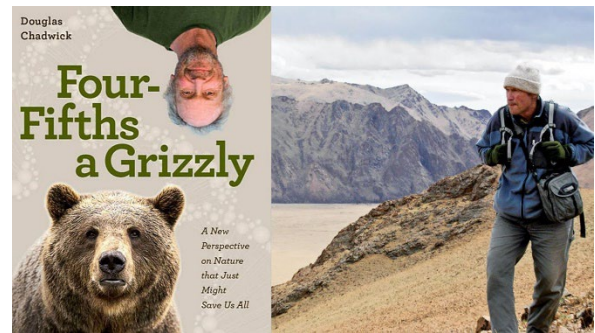
You will not be penalized for missing classes if you are not feeling well. We will be flexible and make sure that you will be able to keep up with the class remotely. Please let us know if you need extra time to complete quizzes and activities. If you have an extended quarantine period, the Office for Disability Equity (ODE) <https://www.umt.edu/disability/> can provide additional help for you.

## **Moodle Site**

Our course Moodle site is the central hub for important information for the course. It will have copies of the lectures, additional videos and other resources you will need, quizzes and deadlines. Make sure that you check it regularly and know how to navigate the site for information. This syllabus is a road map to where we are going, but it may change a bit as the class progresses.

## **Textbook**

The required book is the new book “Four Fifths a Grizzly” by award-winning author and wildlife biologist Douglas Chadwick. It is available in the bookstore, or you can find it at local bookstores or online.



We will be using chapters from **Principles of Life** (3rd edition) by Hillis, Sadava, Hill and Price. We will provide pdf copies of the relevant chapters (free of charge – you don’t have to buy this very expensive book). If you took Biology 160 last semester, you have access to it.

## **iClickers**

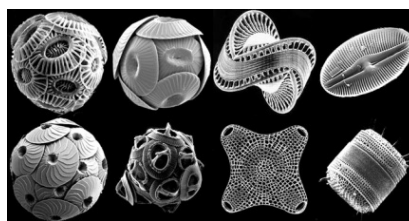
We will be using iClicker questions a lot in class - probably every day, or nearly so. To answer the iClicker questions, you will need the iClicker Student App installed on your phone or other device. Detailed instructions are in the “Important Course Material” in the PDF “Instructions for iClicker Student App.”

## **Grading Scheme**

Just getting through the Coronapocene is stressful enough for all of us, so we have decided that your grade will be based on many lower-stakes (but rigorous) ways to generate points.

## **Grading Rubric**

Pre-week quizzes	20	(we will drop your lowest 3)
Post-week quizzes	20	(we will drop your lowest 2)
iClicker questions in class	15	(we will drop your lowest 5)
Team activities	10	(we will drop your lowest 2)
Test 1	10	
Test 2	10	
Final test	15	
Total	100	



**Pre-week Quizzes (on Moodle):** Before each week, you will be assigned readings and/or videos. The pre-week quizzes will help you prepare for the material that we will cover during

the next week. They are low-stakes, in the sense that each one is not worth much, and you will have plenty of time and you can do the quizzes at your own pace.

**Post-week quizzes:** The post-week quizzes will test you on the material we covered the previous week. These quizzes will be more detailed than the pre-week quizzes, and will be similar to the questions on the tests.

**iClicker Questions:** We will be using iClickers just about every day. This will give you and us immediate feedback about how well you are understanding concepts. You can also review the iClicker questions at any time, and use them to study for the tests. The iClicker points are for PARTICIPATION! You will get full points if you participate, and you won't lose points if you get questions wrong.

**Team Activities:** You will be assigned to a small collaborative team of students. We will use team-based activities to emphasize problem-solving, to facilitate discussion of concepts in class with your fellow students, and to enable you to apply and integrate the material and concepts. We have a group of fantastic Learning Assistants this semester. They are undergraduate students who took the class last year and did well. They will be helping out creating and running the Team Activities.

## Course Outline

Week	Class day	Date	Topic
1	1	Jan 19	Introduction to class
	2	Jan 21	Tour through the Tree of Life
2	3	Jan 24	The Central Dogma, and why COVID-19 is unusual!
	4	Jan 26	Tree thinking and phylogenies
	5	Jan 28	Viruses – the MOST important thing NOT on the Tree of Life
3	6	Jan 31	Viruses
	7	Feb 2	Brief history of life on Earth 4 billion years in 40 minutes!
	8	Feb 4	A Yellowstone tour of microbial diversity I
4	9	Feb 7	A Yellowstone tour of microbial diversity II
	10	Feb 9	A Yellowstone tour of microbial diversity III
	11	Feb 11	Guest Lecture: Dr. Matt Church. <i>Prochlorococcus</i> – perhaps the most numerous species on Earth?
5	12	Feb 14	A Yellowstone tour of microbial diversity IV
	13	Feb 16	Russian Dolls: Endosymbiosis and the origin of Eukaryotes
	14	Feb 18	TEST 1
6		Feb 21	No classes
	15	Feb 23	Prokaryotic versus Eukaryotic genomes (ZOOM)
	16	Feb 25	Protists I: Tour through the seven major groups of Eukaryotes
7	17	Feb 28	Protists II: Tour through the seven major groups of Eukaryotes
	18	Mar 2	Protists III: Tour through the seven major groups of Eukaryotes
	19	Mar 4	Introduction to fungi

8	20	Mar 7	Guest Lecture: Dr. Ylva Lekberg. The Wood Wide Web – the amazing world of Mycorrhizal fungal networks
	21	Mar 9	Death zombie fungi, ants and fungal gardens, and Chytrids
	22	Mar 11	Just what is a species?? Lichens – symbiotic macro organisms built from microbial parts!
9	23	Mar 14	The greening of the Earth – what does it take to get onto the land? Non-vascular plants
	24	Mar 16	Getting tall – the sky is the limit Seedless vascular plants
	25	Mar 18	What good is a seed? Gymnosperms
10	March 21-25		Spring Break
11	26	Mar 28	The “Abominable Mystery” and the Floral Big Bang. Angiosperms
	27	Mar 30	Will trade reproduction for food: Pollination ecology and coevolution
	28	Apr 1	TEST 2 (covers material since TEST 1) Getting your seeds around – seed dispersal
12	29	Apr 4	The three C’s – Choanocytes, Ctenophores and Cnidarians
	30	Apr 6	Guest Lecture: Doug Chadwick – author of your textbook!
	31	Apr 8	Animal body plans and the “holey” grail: sponges to Protosomes
13	32	Apr 11	Shed that skin - Ecdysozoans
	33	Apr 13	An inordinate fondness for beetles
	34	Apr 15	Don’t be an Ass: Deuterostomes Echinoderms – our surprisingly close relatives
14	35	Apr 18	Get a backbone! Fishy business
	36	Apr 20	A short history of fishing
	37	Apr 22	Getting onto the land: Tiktaalik to amphibians
15	38	Apr 25	Amniotes – what good is an egg?
	39	Apr 27	Amniotes – what good is an egg?
	40	Apr 29	One bone, two bones, many bones, digits! How to build a tetrapod. (ZOOM)
16	41	May 2	How to build an animal: Our shared genetic toolkit
	42	May 4	Guest Lecture: Dr. Jeff Good Hominid evolution
	43	May 6	Wiggle Room
		May 12	Final Exam: 3:20-5:20 PM

### **List of Learning Outcomes:**

- 1) Understand how biologists construct phylogenies. How do we interpret them and what do they tell us about life on Earth?
- 2) Have a sense of the history of life on Earth. How long ago did life arise? For how long has life existed as single-celled organisms? When did multicellular life arise?
- 3) Understand the role that endosymbiosis has played in the evolution of major groups of organisms.
- 4) Know a few key organisms in each of the main groups we will be talking about.
- 5) Have a sense of how we (try to) characterize biological diversity.
- 6) Understand how biodiversity has changed through time. What were the major extinction crises? What is happening during the Anthropocene?
- 7) Have fun! We don't need space travel to discover amazing forms of life – we share a planet with an astounding diversity of living creatures, most of which have not been “discovered.” Most organisms on Earth have not been described or given names!

### **How to succeed in this class**

If you want to do well in this class, here are some things you need to do:

- **Attend the Classes if you can (either in the Zoomosphere and especially in-person)!**  
Many studies have found that one of the best predictors of success is how often you attend class.
- **Come prepared – be responsible for your learning**  
We will be covering a lot of material in this class, and so you should take the assigned readings and Pre-week and Post-week quizzes seriously.
- **Interact with your Team Members during Team Activities**  
This is a chance to interact with some of your classmates on problems and activities. You will benefit from working with your group - the whole is bigger than the sum of the parts!
- **Make use of your Learning Assistants!**  
Your group will be working with a Learning Assistant. These are undergraduate students who took this class last year and did really well. They will be a HUGE resource for you.





- **Make use of our Office Hours**

We have an office hour a week, and don't be scared of us! We actually love to help you out with any questions you are having with the material. If you can't make the regular office hour just let us know and we will set up other times to meet. Our office hours are:

Erick Greene: Mondays 10-11 AM

<https://umontana.zoom.us/j/92030578180?pwd=Z2pqMk5Tc2tOLzBVR1BtMmVxbENuQT09>

Scott Miller: Fridays 2-3 PM

<https://umontana.zoom.us/j/99455939808>

- **Let us know if you need help.**

If you have problems with class material, deadlines, personal problems or any other issues related to the class we urge you to talk with us as **EARLY** as possible. We will be better able to help you if you talk with us as problems arise. You will find that we are extremely sympathetic and flexible if you talk with us early.

### **Miscellaneous Important Stuff**

#### **Emails**

We are required to email you with you official UM email. If you email us from your personal email (e.g. gmail, yahoo, etc.) we are not allowed to respond. If you do not receive official emails from us you should check your spam filters; group emails may end up in your junk email.

**Students with Disabilities** (<https://www.umt.edu/disability/>)

The University of Montana assures equal access to instruction through collaboration between students with disabilities, instructors, and Office for Disability Equity. If you think you may have a disability adversely affecting your academic performance, and you have not already registered with ODE, please contact them at 243-2243. We will work with you and ODE to provide an appropriate modification.

#### **Survival during the Coronapocene**

This is a very stressful time for all of us. If you are struggling, there are LOTS of resources. If you are depressed, struggling or have health or mental health issues, don't be shy! Get some help. Curry Health Center has lots of ways to help you. Call them at 243-4330 or drop by.

If you are struggling, please stay in touch with us. We can be very flexible with deadlines and such if you let us know early. If you talk to us at the end of the semester we are less likely to be able to help.

