IB 181L: Paleobotany

The 500-million year history of a greening planet

Course Summary and Syllabus

Course description

Overview of the course

This course serves as an introduction to the evolution of plants and terrestrial ecosystems through time. From the invasion of land to the present, we will follow the evolution of major plant groups through important moments of the Phanerozoic eon (the past 540 million years). By studying fossilized plant assemblages, we will interpret how major environmental changes unfolded across landscapes in the past and how plants have influenced the shaping of our planet. Lectures will be complemented by an interactive laboratory covering paleobotanical research techniques, study of fossil and living plant form and function in the lab and field, and analysis of peer-reviewed literature.

Course format

Four units: three hours lecture and a three-hour lab per week; additionally, there may be assignments.

Course schedule

Lectures	Tues-Thurs: 9:30 - 11:00 am	2063 Valley Life Sciences Bldg.	Cindy Looy
Lab 101	Wed: 2:00 pm - 5:00 pm	3007 Valley Life Sciences Bldg.	Riley Hayes
Lab 102	Fri: 9:00 am - 12:00 pm	3007 Valley Life Sciences Bldg.	Riley Hayes

Primary text

Kathy Willis and Jennifer McElwain, 2014. ***The Evolution of Plants***. Oxford University Press; 2nd Edition.

Basic contact information

Instructors	Email	Office hours
Cindy Looy	looy@berkeley.edu	TBD
Riley Hayes	riley_hayes@berkeley.edu	TBD

Course Policies

Exams

There will be two exams, one midterm and one final. These will be open-book exams, with short-answer, as well as multiple-choice questions plus some fill-in-the-blanks. The **Midterm** will cover topics in lecture, labs, and readings during the first six weeks of the course. The **Final** will cover topics in lecture, labs, and readings during the rest of the course. Although the exams are not cumulative, a good understanding of the foundational concepts covered during the first part of this course will still be important for the second part.

Grades

The class can be taken for a grade and as pass/no pass. A C- or higher is required to pass this clas (see also: https://registrar.berkeley.edu/academic-records/grades) The grades will NOT be curved. Written grade appeals are accepted in a time window starting three days after the initial grade has been assigned until ten days after. Before or after this period appeals will not be considered. Students who wish to review their exam should email the instructor. Be aware that re-grades can result in point deductions as well.

Grading break-down

Midterm (material from Part I):	25%
Final (material from Part II):	40%
Lab section performance (includes labs, good citizenship, and presentation):	25%
Quizzes:	10%
Total:	100%

Attendance and class participation

Attendance is highly recommended for lectures and ***required*** for lab sections. Part of your course grade will be based on your participation during section. However, obviously, if you have a legitimate reason for being late or missing a section entirely, like a family emergency or illness, please contact your TA Riley Hayes as soon as possible at (riley_hayes@berkeley.edu). Generally, we will require written proof of the situation. Of course, non-emergency, non-pre-approved absence in sections will likely result in the point deduction.

Please attend the section that you signed up for, but if you need to change to the other section, please coordinate with Riley.

Classroom etiquette

Being prepared, attentive listening and completion of in-class work is important. Perhaps needless to say: be courteous and be on time. Most importantly: respect your fellow students and their opinions. We would like everyone to feel comfortable in our class. Please, no class-irrelevant laptop, tablet, or cell phone use during class —it is often very distracting for your classmates.

Missed exams and missed or late assignments

You are expected to take all exams at their scheduled date and time, but we know all too well that the reality of life can ruin our best intentions and plans. How we deal with missed exams and missed/late assignments is something we decide together on an individual basis. If you know you are going to miss an exam, please contact Cindy well in advance. When you have missed an exam or assignment it is **up to you** to reach out about this so we can work something out before it's too late. Please rest assured that we want you to succeed in this class. We're always happy to help with scheduling conflicts and legitimate absence cases, but failure to bring it up can have unintended and usually avoidable consequences, so don't hesitate to talk to us.

Reporting illness and family emergencies

If illness or a family emergency does prevent you from attending class, attending section or making an exam, let one of us know as soon as possible. We will require written proof of the situation. Don't forget we are always happy to help if we can, so please talk to us so we can take your hardship into account or provide simple accommodations to mitigate the situation.

Extra credit opportunities

One extra credit exercise will be offered in lecture, points TBD.

Statement on accommodation

Students who require accommodation for medical, religious, or other reasons should contact the instructor before the start of the lecture series. We will be happy to accommodate students with disabilities. We do however require a letter from the
Disabled Students' Program.

We would like everyone to get the most out of this course. If there is anything that prevents you fromdoing well in this class, please come and talk to us, so we can find out if there is something we can do to help.

Disclaimer

This syllabus is your handbook for the course. You are responsible for knowing and understanding all the information in it. Not knowing the requirements does not excuse you from fulfilling them. This syllabus may be subject to change. Please, check bCourses regularly for updates.

bCourses

When you are enrolled in this course, a tab for this course will be added to your personal bCourses account. **Make sure the IB 181 tab is active**. If the tab for this course does not appear on your bCourses site, go to 'My Workspace' then click 'Preferences' and add IB 181 to your active tabs. Here you will find this syllabus and a forum, where you can share your thoughts and questions with fellow students and the instructors.

Labs

Lab structure

Labs in this course are designed to achieve five objectives:

1) Test your knowledge of the reading materials via quizzes and discussion.
2) Equip you with hands-on experience in observing and interpreting both fossil and living plants to complement lecture and reading materials.
3) Provide opportunities to work and learn in teams
4) Present a scientific paper and evaluate your peers' presentations.

Typical Lab itineraries

Friday lab	**Wednesday lab**	**Activity**
9:00-9:10 am	2:00-2:10 pm	Arrive and prepare for quiz
9:10-9:45 am	2:10-2:45 pm	Quiz and quizcussion
9:45-9:5 am	2:40-2:55 pm	Lab introduction
9:55-11:40 am	2:55-4:40 pm	Lab exercise
11:40-noon	4:40-5:00 pm	Discuss lab exercise questions

Quizzes and quizcussion

During section a total of 10-minute quizzes will be given. These are meant as an incentive to make sure you are on top of your reading assignments. These short quizzes with several short-answer questions will cover the readings that are assigned for that week (see 'Schedule' below). Take good notes on key concepts and findings of your reading materials as you read. The quizzes are good practice for those on the midterm and final. After the quiz the so-called quizcussion will take place. In groups of 3-4 persons, you will have 10 minutes to discuss the questions from the quiz. One person will submit the answers for the group. Once everyone submits, we'll spend 10 mins discussing the questions together addressing any final confusion and or concerns.

Lab exercises

Lab exercises provide a list of short-answer questions and drawing exercises intended to delve into concepts discussed in lectures and readings. These exercises will be handed to Riley at the end of each lab and graded each week. Since these exercises will provide some of the content for the exams it is important that you ask questions to Riley during lab and/or office hours if any concepts are unclear.

Lab symposium

During the second to last lab students will couple up and give a presentation on a scientific paleobotanical paper or topic of their choice. We will have a list of papers that you can use but you can also try to find one on your own. Come and talk with Riley or Cindy for approval of your paper or topic at least two weeks before the symposium. If you have trouble deciding which paper to choose, we can help with that as well. If you are not presenting you have two tasks: Ask questions after the presentation; is there anything you don't understand? You will grade the presentation via a rubric you will receive in lab.

Class schedule, lab readings an assignments

Dates		Lecture and lab topics
Jan 16	**Lecture 1**	Fossil plant preservation
Jan 18	**Lecture 2**	The paleobotanical toolbox
Jan 17/19	**Lab 1**	Fossilization and Preservation
Read for class	Hannah Bonner 2015 "A Cartoon prehistory of life on Earth" (will be provided)	
Jan 23	**Lecture 3**	Earliest plant life
Jan 25	**Lecture 4**	The transition to land
Jan 24/26	**Lab 2**	Transitioning to land and earliest land plants
Read for quiz 1	Willis and McElwain, 2014. pp. 58–62, 64–66, 77–83: *– Formation of Soils,* *– Development of suitable climatic and atmospheric conditions,* *– Reduction of dependence on water for reproduction,* *– Protection against desiccation* *– 3.4: Evolutionary trends: green algae to land plants*	
Jan 30	**Lecture 5**	Emerging terrestrial ecosystems
Feb 1	**Lecture 6**	A frozen ecosystem: the Early Devonian Rhynie Chert
Jan 31/Feb 2	**Lab 3**	Silurian and Devonian plants and their ecosystems
Read for quiz 2	Willis and McElwain, 2014. pp. 62–64, 66–71, 72–77, 83–89, 91: *– Modification of the life cycle* *– Development of specialized cells for water and nutrient uptake–3.3* *– 3.3 Examples of earliest land plants in the fossil record* *– Development of specialized cells for water and nutrient uptake* *– 3.5 Evolutionary trends in land plants: non-vascular to vascular–Summary*	
Feb 6	**Lecture 7**	Silurian and Devonian innovations - leaves and size
Feb 8	**Lecture 8**	Silurian and Devonian innovations - heterospory and seeds
Feb 7/9	**Lab 4**	Devonian innovations
Read for quiz 3	Willis and McElwain, 2014. pp. 98–113: *– 4.2 Major changes and innovations in the plant fossil record during the mid-Devonian to end-Carboniferous* *– 4.3 Evidence for further plant adaptations to land dwelling between mid-Devonian and end-Carboniferous (~394–299 Ma)* *– 4.4 Further adaptations to the plant life cycle*	
Feb 13	**Lecture 9**	The Late Carboniferous coal swamps
Feb 15	**Lecture 10**	Computer history meets paleobotany - guest lecture Ivo Duijnstee
Feb 14/16	**Lab 5**	Coal ball peels demo with Diane Erwin and Carboniferous coal swamps
Read for quiz 4	Willis and McElwain, 2014. pp. 146– 164: *– 5.1 Environmental changes during the Permian (299–252 Ma)* *– 5.2 Evolution of cycads, bennettites, ginkgos, glossopterids, and gnetales*	
Feb 20	**Lecture 11**	The Permian deglaciation and rise of gymnosperms
Feb 22	**Lecture 12**	The end-Permian biotic crisis

Feb 21/23	**Lab 6**	Midterm study guide and review

Read for quiz 5 Willis and McElwain, 2014. pp. 287–296:

– 8.3 Why no mass extinction in the plant fossil record?
– 8.4 Evidence for persistence in the plant fossil record
– 8.5 Adaptations of plants for persistence through intervals of environmental change

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Feb 27	**No lecture**	**MIDTERM EXAM**
Feb 29	**Lecture 13**	Early Triassic survival and recovery
Feb 28/Mar 1	**Lab 7**	Seed plant field trip botanical garden

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Mar 5	**Lecture 14**	Testing proposed drivers of the end-Permian crisis
Mar 7	**Lecture 15**	Mesozoic ecosystems - guest lecture Jaemin Lee
Mar 6/8	**Lab 8**	Gymnosperm diversification

Read for quiz 6 Willis and McElwain, 2014. pp. 173-178, 214-224, 231-238, 246-250, 254-263:

– 5.5 Biogeographical distribution of vegetation (201-182 Ma)
– 6.4 Evolutionary trends: gymnosperm to angiosperm
– 6.5 Biogeographical distribution of vegetation (~100-66 Ma)

Mar 12	**Lecture 16**	Mesozoic seed plant relationships
Mar 14	**Lecture 17**	Flowering plant origins
Mar 13/15	**Lab 9**	Gymnosperms and early angiosperms

Read for quiz 7 Willis and McElwain, 2014. pp. 196–216:

– 6.2 Nature and distribution of the earliest angiosperms
– 6.3 Why so late?

Mar 19	**Lecture 18**	From pollen to seed dispersal
Mar 21	**Lecture 19**	The rise of flowering plants - guest lecture Dori Contreras
Mar 20/Mar 22	**Lab 10**	Flowers and What's for dinner?

Read for quiz 8 Willis and McElwain, 2014. pp. 192-196, 265-269, 279-288:

– 6.1 small section: Leaves
– 8.1 Definition of mass extinction
*– 8.2 Evidence in the geologic record: plants vs. animals *Cretaceous-Paleogene boundary**

Mar 25-29	**Spring break**	**Enjoy!**

Apr 2	**Lecture 20**	Mesozoic munching – guest lecture Jack Tseng
Apr 4	**Lecture 21**	The Cretaceous-Paleogene biotic crisis and its aftermath
Apr 3/5	**Lab 11**	Plant-insect interactions

Read for quiz 9 Willis and McElwain, 2014. pp 225-231, 231-239, 288-297:

– 7.1 Environmental changes of the past 66 million years
– 7.2 Biogeographical distribution of global vegetation (~60-50 Ma)
– 8.5 Adaptations of plants for persistence through intervals of env. change

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Apr 9	**Lecture 22**	The PETM global warming event - guest lecture Ellen Currano
Apr 11	**Lecture 23**	The rise and demise of polar forests
Apr 10/12	**Lab 12**	Reconstructing paleoclimate

Read for quiz 10 Willis and McElwain, 2014. pp 307-332:
– 9.3 Mechanisms driving evolutionary change

Apr 16	**Lecture 24**	The Cenozoic cooling
Apr 18	**Lecture 25**	The Oligocene-Miocene rise of grasslands
Apr 17/19	**Lab 13**	Lab symposium
No quiz	Work on presentation	
Apr 23	**Lecture 26**	Quaternary climatic fluctuations and plant migration patterns
Apr 25	**Lecture 27**	The Anthropocene: our impact on the vegetation and climate
Apr 24/26	**Lab 14**	Final study guide and review
No quiz	Start reviewing the course materials	
Apr 29-May 3	**RRR week**	Review session date and time TBA Extra credit assignments due
May 8	**Exam week**	**FINAL EXAM 11:30 am - 2:30 pm** location TBA

UC Berkeley Honor Code

The student community at UC Berkeley has adopted the following Honor Code
"As a member of the UC Berkeley community, I act with honesty, integrity, and respect for others." The hope and expectation is that you will adhere to this code.

Collaboration and Independence
You will be working frequently groups this semester in both lecture and lab. In lab, you will be required to work in a group to present a discussion paper (you will evaluate and grade your peers' participation for these presentation projects). You will also be working in debate 'teams' for the two lab debates. In addition, partaking in study groups outside of class for the MIDTERM and FINAL is permitted and encouraged.

Reviewing lecture and reading materials and studying for exams can be enjoyable and enriching things to do with fellow students. This is recommended. However, unless otherwise instructed, homework assignments are to be completed independently and materials submitted as homework should be the result of one's own independent work.

Cheating
A good lifetime strategy is always to act in such a way that no one would ever imagine that you would even consider cheating. Anyone caught cheating on a quiz or exam in this course will receive a failing grade in the course and will also be reported to the University Center for Student Conduct. In order to guarantee that you are not suspected of cheating, please keep your eyes on your own materials and do not converse with others during the quizzes and exams.

Plagiarism
Failing to acknowledge work that is not your own is plagiarism and there are serious academic consequences for this. In the case of this course, any instance of plagiarism will result in an automatic zero

on the respective assignment. If you use information or an idea in any activity relating to this course that is not your own, (i.e. *there is literature in existence that suggests you were not the first person on this planet to think of an idea*) you must cite or acknowledge the primary source of that idea or information. Likewise, if you are citing a classmate you must acknowledge your source.

There are exceptions such as common knowledge (e.g. *there are 24hrs in a day, the sky is blue*). Please also cite the sources for photos, figures, and tables that are not your own used in your PowerPoints. If you need clarification regarding whether or not to cite a specific fact or information email Riley or contact the Student Learning Center for assistance. For additional information on plagiarism and how to avoid it, see, for example:

http://www.lib.berkeley.edu/instruct/guides/citations.html#Plagiarism
http://gsi.berkeley.edu/teachingguide/misconduct/prevent-plag.html

Academic Integrity and Ethics

Cheating on exams and plagiarism are two common examples of dishonest, unethical behavior. Honesty and integrity are of great importance in all facets of life. They help to build a sense of self-confidence, and are key to building trust within relationships, whether personal or professional. There is no tolerance for dishonesty in the academic world, for it undermines what we are dedicated to doing – furthering knowledge for the benefit of humanity.

Your experience as a student at UC Berkeley is hopefully fueled by passion for learning and replete with fulfilling activities. And we also appreciate that being a student can be stressful. There may be times when there is temptation to engage in some kind of cheating in order to improve a grade or otherwise advance your career. This could be as blatant as having someone else sit for you in an exam or submitting a written assignment that has been copied from another source. And it could be as subtle as glancing at a fellow student's exam when you are unsure of an answer to a question and are looking for some confirmation. One might do any of these things and potentially not get caught. However, if you cheat, no matter how much you may have learned in this class, you have failed to learn perhaps the most important lesson of all.