**Biology 555: Paleobotany**

Tuesday-Thursday 9:30-10:45 , GSB 1374

Lab, Thursday 1:30-4:20, Wilson 140

Instructor: Dr. Patricia G. Gensel, Coker 414

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**Textbook:**

None; but become acquainted with Stewart and Rothwell, 1993 (SR); Willis and McElwain (WMc), 2014, and Taylor, Taylor and Krings, 2010 (TTK). These and some other texts are on reserve at the Undergraduate Library. Readings will be assigned and provided either as pdfs or online journal articles; information is also provided in the required Bio 555 course pack available at Student Stores.

**Course Goals:**

A major goal is to acquaint you with evidence of the past history of plant groups and floras, including the existence and nature of now-extinct plant types (over 90 % of all species that ever lived are extinct). Using this evidence, we will develop an understanding of the significance of the fossil record as a means of measuring the past history of plants, how they have changed through time, and the interplay between plants, other organisms, and their environments. This includes understanding their role in testing and understanding phylogenetic relationships of extinct and living plants, as well as in paleoecological interpretations and climate reconstruction, stratigraphy, and biogeography. Also, you will obtain a background which will enable you to read paleontological literature, particularly about plants, critically evaluate interpretations or conclusions made from fossils, and develop and test your own hypotheses. Some broader paleobiological issues, such as extinctions, past climates, coevolution/ plant-animal interactions, time of origin of major groups of organisms, and paleoecology and its relevance to environmental issues prevailing today will be incorporated as we examine the evolutionary history of various plant groups.

**Some basic information:**

1. Scheduling of topics:

Unless otherwise indicated on the lecture and lab schedule, labs will illustrate and supplement lecture topics. See lab syllabus for other lab-based activities.

1. Assignments and Grading:

There will be 2 lecture exams, each = 45 points plus one final exam = 70 points. The final will be at least partially cumulative. Quizzes and written responses will total 25 points. There also will be two projects at 25 pts each, designed to tie together some of the information obtained from fossils and illustrate the variety of questions that can be asked once the record is known. One is centered on Ancient forests (especially Devonian-Carboniferous) and the other will deal with Extinctions (see below). Your final grade is determined by dividing total points earned by maximum points possible (235). The percentage scale I employ is close to: A=90% or above, B=80% or above, C=70 %or above, D=62%or above. Sometimes there is some final scaling of grades, but this gives you an estimate of the minimum grade you may have earned.

1. Readings:

The assigned readings are designed to provide essential background information, or are papers that deal with issues such as problems in analysis of particular fossils or questions, extinction in the plant fossil record, factors influencing evolution, or “classic” accounts of floras, major evolutionary events, etc. The books on reserve are a resource also. You should take good notes in any lecture, or about other students’ presentations. **Any posted PowerPoints represent only part of the information needed to do well in this course.** The lab guide is also intended as a useful resource. Numerous papers will be made available to illustrate some fossils and aid you in interpreting specimens in lab; unless otherwise indicated, you do not have to read them completely but should look at the parts indicated.

1. Projects:

There will be two investigative projects; you can use literature and some of the fossils where appropriate. Project 1) Fossil forests, due OCT 15; and 2) Extinctions, due Nov 26. These will include both written and oral reports and discussion. Specifics about these will be presented in class.

1. Field Trips and Reflections:

There will be at least two required field trips- most likely on a weekend day. Summaries about these will be required in the lab component of the course and count towards the lab grade.

Books we will often refer to:

Willis and McElwain, 2001. *The Evolution of Plants.* Oxford Press.

Niklas, 1997. *The Evolutionary Biology of Plants*, U. Chicago Press

Kenrick and Crane, 1997. The origin and early diversification of land plants. Smithsonian Press.

Taylor TN, Taylor E., and Krings, M. 2008. *Paleobotany: The Biology and Evolution of Plants.* Academic Press.

Graham,A 1999. Late Cretaceous and Cenozoic history of North American Vegetation. Oxford University Press.

“The professor reserves to right to make changes to the syllabus, including project due dates and test dates (excluding the officially scheduled final examination), when unforeseen circumstances occur. These changes will be announced as early as possible so that students can adjust their schedules.”

**TENTATIVE SCHEDULE: not all reading assignments are included- more soon!.**

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| Class Date | Topic Covered | Assigned Reading  (Before Lecture) |
| T Aug. 20 | Background and Overview:   * Why study fossils? * Major events in the fossil record * Major plant groups * Deposition, fossilization, and preservation types of plants | TTK Ch. 1 (pdf) |
| Th Aug. 22 | Discussion of Geological Time:   * How are rocks dated and correlated? * Evolution   <http://www.ucmp.berkeley.edu/help/timeform.php> | Search online about geological time and how it is measured (relative vs. absolute). Some starting resources are listed to the left |
| T Aug. 27 | Basic features of plant organization | Bold Ch. 13 (pdf) |
| Th Aug. 29 | Plant organization, cont’d: Reproductive Features | Bold Ch. 13 (pdf) |
| T Sep. 3 | Earliest forms of life: not plants, but microbes | WMc Ch. 2 (pdf)  Knoll (2012)  Wellman & Strother (2015) |
| Th Sep. 5 | Spores and Pollen:   * What are they? * How do they relate to studies of plant evolution | Steemans et al. (2009)  “Tree Thinking” essay and problems (pdf)  Other readings tba |
| T Sep. 10 | Origin of land plants: earliest forms | WMc Ch. 3  Wellman & Strother (2015)  Edwards & Kenrick (2015) |
| Th Sep. 12 | Radiation of early plants: Early Devonian | Kenrick and Crane (1997)  Gensel (2008)  Wellman & Gray (2000) |
| T Sep. 17 | Lycopsid evolution:   * Separate lineage from early in time * Forests in the Devonian | Gensel & Berry (2001)  Pigg (2001) |
| Th Sep. 19 | **Exam 1: Background through Early Devonian Plants** | |
| T Sep. 24 | Sphenopsids:   * What are they related to? * What is their origin? * Evolution of early groups | tba |
| Th Sep. 26 | Middle-Late Devonian Plants: Cladoxyls, and Iridopterids, and Rhacophytaleans, oh my! | Summary by Berry (pdf) |
| T Oct. 1 | Ferns:   * Origins * Early Forms | Rothwell & Stockey (2008) |
| Th Oct. 3 | Fossil Ferns; Mesozoic forms | Collinson paper |
| T Oct. 8 | Progymnosperms, Secondary Xylem, What makes a tree? | Dannenhoffer et al. (2007)  Beck (1960 or 1962) |
| Th Oct. 10 | Evolution of seed plant reproduction, Early seed plant groups | Prestianni (2010; pdf) |
| T Oct. 15 | **Reports for Fossil Forests Project** | |
| Th Oct. 17 | **Fall Break** |  |
| T Oct. 22 | Major late Paleozoic seed plants:   * Lyginopterids, Medullosans, etc. | Texts on reserve |
| Th Oct. 24 | Other seed plants:   * Cycads and Bennettitales | tba |
| T Oct. 29 | Other Mesozoic seed plants:   * Ginkgos * Glossopterids * Caytonialeans | Taylor & Taylor (2009; pdf) |
| Th Oct. 31 | **Exam 2: Lycopsids to Bennettitales** | |
| T Nov. 5 | Conifers and Cordaites | tba |
| Th Nov. 7 | Modern Conifers and their impact on ecosystems | Banks “Riddle of Pine Cones” |
| T Nov. 12 | Origin and early radiation of angiosperms:   * Basics * Leaves * Pollen * Flowers | tba |
| Th Nov. 14 | Angiosperm evolution, cont’d | tba |
| T Nov. 19 | Cretaceous and Tertiary floras | tba |
| Th Nov. 21 | Tertiary floras, climates, and biogeography 1 | tba |
| T Nov. 26 | Reports for Extinction Events Project | tba |
| Th Nov. 28 | **Thanksgiving** |  |
| T Dec. 3 | Tertiary floras, climates, and biogeography 2 | tba |
| T Dec. 10 | **Final Exam: 8 AM** |  |