



COURSE OUTLINE

1. **Course:** BIOL 505, Medicinal Plant Biochemistry - Winter 2019

Lecture 01: MWF 14:00 - 14:50 in BI 561

Instructor	Email	Phone	Office	Hours
Dae-Kyun Ro	daekyun.ro@ucalgary.ca	403 220-7099	BI 393	TBA
Peter Facchini	pfacchin@ucalgary.ca	403 220-7651	BI 396	TBA

Course Coordinator: Dr. Dae-Kyun Ro

Course Site:

D2L: BIOL 505 L01-(Winter 2019)-Medicinal Plant Biochemistry

Note: Students must use their U of C account for all course correspondence.

Biological Sciences Department BI 186; (403) 220-3140; biosci@ucalgary.ca

2. **Requisites:**

See section [3.5.C](#) in the Faculty of Science section of the online Calendar.

Prerequisite(s):

Biology 331 and Biochemistry 393.

Antirequisite(s):

Credit for Biology 505 and Botany 503 will not be allowed.

3. **Grading:**

The University policy on grading and related matters is described in [F.1](#) and [F.2](#) of the online University Calendar. In determining the overall grade in the course the following weights will be used:

Midterm Exam	30%	In-Class	March 1, 2019
Seminar	20%		
Term Paper	20%		
Final Exam	30%		

Each piece of work (reports, assignments, quizzes, midterm exam(s) or final examination) submitted by the student will be assigned a grade. The student's grade for each component listed above will be combined with the indicated weights to produce an overall percentage for the course, which will be used to determine the course letter grade.

The conversion between a percentage grade and letter grade is as follows.

	A+	A	A-	B+	B	B-	C+	C	C-	D+	D
Minimum % Required	90 %	85 %	80 %	77%	73%	70 %	67 %	63%	60%	55 %	50 %

This course has a registrar scheduled final exam.

4. **Missed Components Of Term Work:**

In the event that a student misses the midterm or any course work due to illness, supporting documentation, such as a medical note or a statutory declaration will be required (see [Section N.1](#); for more information regarding the use of statutory declaration/medical notes, see [FAQ](#)). Absences must be reported within 48 hrs.

The regulations of the Faculty of Science pertaining to this matter are found in the Faculty of Science area of the Calendar in [Section 3.6](#). It is the student's responsibility to familiarize themselves with these regulations. See also [Section E.3](#) of the University Calendar.

5. **Scheduled Out-of-Class Activities:**

There are no scheduled out of class activities for this course.

6. **Course Materials:**

Course Materials: Text: Recommended: Plant Biochemistry and Molecular Biology. Hans-Walter Heldt., Oxford University Press, 1997; Biochemistry & Molecular Biology of Plants. Buchanan, B., W. Gruissem & R. Jones, American Society of Plant Physiologists, 2000.

7. **Examination Policy:**

No aids are allowed on tests or examinations.

Students should also read the Calendar, [Section G](#), on Examinations.

8. **Approved Mandatory And Optional Course Supplemental Fees:**

None

9. **Writing Across The Curriculum Statement:**

For all components of the course, in any written work, the quality of the student's writing (language, spelling, grammar, presentation etc.) can be a factor in the evaluation of the work. See also [Section E.2](#) of the University Calendar.

10. **Human & Living Organism Studies Statements:**

See also [Section E.5](#) of the University Calendar.

STUDIES IN THE BIOLOGICAL SCIENCES INVOLVE THE USE OF LIVING AND DEAD ORGANISMS. Students taking laboratory- and field-based courses in these disciplines can expect involvement with and experimentation on such materials. Students perform dissections on dead or preserved organisms in some courses. In particular courses, students experiment on living organisms, their tissues, cells, or molecules. Sometimes field work requires students to collect a variety of living materials by many methods, including humane trapping.

All work on humans and other animals conforms to the Helsinki Declaration and to the regulations of the Canadian Council on Animal Care. The Department strives for the highest ethical standards consistent with stewardship of the environment for organisms whose use is not governed by statutory authority. Individuals contemplating taking courses or majoring in one of the fields of study offered by the Department of Biological Sciences should ensure that they have fully considered these issues before enrolling. Students are advised to discuss any concern they might have with the Undergraduate Program Director of the Department.

Students are expected to be familiar with [Section SC.4.1](#) of the University Calendar.

11. **Reappraisal Of Grades:**

A student wishing a reappraisal, should first attempt to review the graded work with the Course coordinator/instructor or department offering the course. Students with sufficient academic grounds may request a reappraisal. Non-academic grounds are not relevant for grade reappraisals. Students should be aware that the grade being reappraised may be raised, lowered or remain the same. See [Section I.3](#) of the University Calendar.

- a. **Term Work:** The student should present their rationale as effectively and as fully as possible to the Course coordinator/instructor within **15 days** of either being notified about the mark, or of the item's return to the

class. If the student is not satisfied with the outcome, the student shall immediately submit the Reappraisal of Graded Term work form to the department in which the course is offered. The department will arrange for a re-assessment of the work if, and only if, the student has sufficient academic grounds. See sections [I.1](#) and [I.2](#) of the University Calendar

- b. **Final Exam:** The student shall submit the request to Enrolment Services. See [Section I.3](#) of the University Calendar.

12. Other Important Information For Students:

- a. **Mental Health** The University of Calgary recognizes the pivotal role that student mental health plays in physical health, social connectedness and academic success, and aspires to create a caring and supportive campus community where individuals can freely talk about mental health and receive supports when needed. We encourage you to explore the mental health resources available throughout the university community, such as counselling, self-help resources, peer support or skills-building available through the SU Wellness Centre (Room 370, MacEwan Student Centre, [Mental Health Services Website](#)) and the Campus Mental Health Strategy website ([Mental Health](#)).
- b. **SU Wellness Center:** The Students Union Wellness Centre provides health and wellness support for students including information and counselling on physical health, mental health and nutrition. For more information, see www.ucalgary.ca/wellnesscentre or call [403-210-9355](tel:403-210-9355).
- c. **Sexual Violence:** The University of Calgary is committed to fostering a safe, productive learning environment. The Sexual Violence Policy (<https://www.ucalgary.ca/policies/files/policies/sexual-violence-policy.pdf>) is a fundamental element in creating and sustaining a safer campus environment for all community members. We understand that sexual violence can undermine students' academic success and we encourage students who have experienced some form of sexual misconduct to talk to someone about their experience, so they can get the support they need. The Sexual Violence Support Advocate, Carla Bertsch, can provide confidential support and information regarding sexual violence to all members of the university community. Carla can be reached by email (svsa@ucalgary.ca) or phone at [403-220-2208](tel:403-220-2208).
- d. **Misconduct:** Academic misconduct (cheating, plagiarism, or any other form) is a very serious offence that will be dealt with rigorously in all cases. A single offence may lead to disciplinary probation or suspension or expulsion. The Faculty of Science follows a zero tolerance policy regarding dishonesty. Please read the sections of the University Calendar under [Section K](#). Student Misconduct to inform yourself of definitions, processes and penalties. Examples of academic misconduct may include: submitting or presenting work as if it were the student's own work when it is not; submitting or presenting work in one course which has also been submitted in another course without the instructor's permission; collaborating in whole or in part without prior agreement of the instructor; borrowing experimental values from others without the instructor's approval; falsification/ fabrication of experimental values in a report. **These are only examples.**
- e. **Assembly Points:** In case of emergency during class time, be sure to FAMILIARIZE YOURSELF with the information on [assembly points](#).
- f. **Academic Accommodation Policy:** Students needing an accommodation because of a disability or medical condition should contact Student Accessibility Services in accordance with the procedure for accommodations for students with disabilities available at [procedure-for-accommodations-for-students-with-disabilities.pdf](#).

Students needing an accommodation in relation to their coursework or to fulfill requirements for a graduate degree, based on a protected ground other than disability, should communicate this need, preferably in writing, to the Associate Head, Undergraduate of the Department of Biological Sciences, Heather Addy by email addy@ucalgary.ca or phone 403 220-6979. Religious accommodation requests relating to class, test or exam scheduling or absences must be submitted no later than **14 days** prior to the date in question. See [Section E.4](#) of the University Calendar.

- g. **Safewalk:** Campus Security will escort individuals day or night (See the [Campus Safewalk](#) website). Call [403-220-5333](tel:403-220-5333) for assistance. Use any campus phone, emergency phone or the yellow phones located at most parking lot pay booths.
- h. **Freedom of Information and Privacy:** This course is conducted in accordance with the Freedom of

Information and Protection of Privacy Act (FOIPP). Students should identify themselves on all written work by placing their name on the front page and their ID number on each subsequent page. For more information, see [Legal Services](#) website.

- i. **Student Union Information:** [VP Academic](#), Phone: [403-220-3911](#) Email: suvpaca@ucalgary.ca. SU Faculty Rep., Phone: [403-220-3913](#) Email: sciencerep@su.ucalgary.ca. Student Ombudsman, Email: suvpaca@ucalgary.ca.
- j. **Internet and Electronic Device Information:** Unless instructed otherwise, cell phones should be turned off during class. All communication with other individuals via laptop, tablet, smart phone or other device is prohibited during class unless specifically permitted by the instructor. Students that violate this policy may be asked to leave the classroom. Repeated violations may result in a charge of misconduct.
- k. **Surveys:** At the University of Calgary, feedback through the Universal Student Ratings of Instruction ([USRI](#)) survey and the Faculty of Science Teaching Feedback form provides valuable information to help with evaluating instruction, enhancing learning and teaching, and selecting courses. Your responses make a difference - please participate in these surveys.
- l. **Copyright of Course Materials:** All course materials (including those posted on the course D2L site, a course website, or used in any teaching activity such as (but not limited to) examinations, quizzes, assignments, laboratory manuals, lecture slides or lecture materials and other course notes) are protected by law. These materials are for the sole use of students registered in this course and must not be redistributed. Sharing these materials with anyone else would be a breach of the terms and conditions governing student access to D2L, as well as a violation of the copyright in these materials, and may be pursued as a case of student academic or [non-academic misconduct](#), in addition to any other remedies available at law.

TENTATIVE LECTURE SCHEDULE

Date	Topic	Instructor
January 11	Introduction	DKR
January 14	Bioactive natural products	DKR
January 16	Terpenoid principles and history	DKR
January 17	Terpenoid mechanism	DKR
January 21	Terpenoid synthase gene family	DKR
January 23	Terpenoid precursor biosynthesis I	DKR
January 25	Terpenoid precursor biosynthesis II	DKR
January 28	Terpenoid biotechnology	DKR
January 30	Research tools to study plant metabolism	DKR
February 1	Carotenoid principles	DKR
February 4	Carotenoid metabolism	DKR
February 6	Introduction to phenylpropanoids	DKR
February 8	Phenylpropanoid metabolism I	DKR
February 11	Phenylpropanoid metabolism II	DKR
February 13	Antibiotics	DKR
February 15	Polyketide I	DKR
February 18-22	READING WEEK	
February 25	Polyketide II	DKR
February 27	Review	DKR
March 1	Midterm Exam, In Class, One Hour	
March 4	Terpenophenolics	PJF
March 6	Benzylisoquinoline alkaloids I	PJF
March 8	Benzylisoquinoline alkaloids II	PJF
March 11	Benzylisoquinoline alkaloids III	PJF
March 13	Benzylisoquinoline alkaloids IV	PJF
March 15	Monoterpenoid indole alkaloids I	PJF

March 18	Monoterpenoid indole alkaloids II	PJF
March 20	Monoterpenoid indole alkaloids III	PJF
March 22	Tropane alkaloids I	PJF
March 25	Tropane alkaloids II	PJF
March 27	Purine alkaloids I	PJF
March 29	Purine alkaloids II	PJF
April 1	Pyrrolizidine alkaloids	PJF
April 3	Cellular compartmentalization of alkaloid metabolism I	PJF
April 5	Cellular compartmentalization of alkaloid metabolism II	PJF
April 8	Glucosinolates I	PJF
April 10	Glucosinolates II	PJF
April 12	Cyanogenic glucosides	PJF

Course Outcomes Biol 505

Terpenoid

- To know the definition and history of terpenoids
- To understand the chemical mechanism of prenyl diphosphates (e.g., GPP, FPP) and terpene formations – how the carbocations can be formed, how the carbon backbones are rearranged, and how the carbocation cascade reactions can be terminated.
- To know the definitions of different subclasses of terpenoids (monoterpene, sesquiterpene, diterpene, carotenoid etc)
- To understand how the terpene synthase (TPS) was first isolated and their gene sequences were determined. What insights can we obtain from the sequence information?
- To conceptually understand how TPS enzyme mediated the biosynthesis of specific terpene.
- To know the evolutionary origin of TPS
- To know the mevalonate (MVA) and methylerythritol phosphate (MEP) pathway for IPP formation – starting precursors, linkage to primary metabolism, rearrangement of carbon backbone formation, key features in energetics, and key rate-limiting enzymes
- To know the lineage-specific occurrences of MVA and MEP pathway
- To know the subcellular compartmentalization of MVA and MEP pathway, and uses of the compartmentalization in biological engineering
- Be familiarized with the structural elucidation of terpenoids
- To know several terpene hydrocarbon-modifying enzymes
- To understand biochemical roles of key enzymes in carotenoid biosynthesis
- To understand approaches to develop nutrition-enhanced crops (bio-fortified crops)
- Bio-engineering principles of microbial synthesis of artemisinin

Phenylpropanoid

- To know the definition of phenylpropanoid
- To know precursors of shikimate pathway
- To know three key enzymes and reactions in the core PP pathway
- To know the evolutionary origin of PAL
- To understand key structural features of several different subclasses of PP products and the key enzyme(s) for each subclass
- To understand the lignin biosynthesis
- To know how the floral colors are determined and how the floral colors can be altered
- To know the history and rationale for the discoveries of transposable elements and RNA interference
- To understand the importance of Myb transcription factors in PP metabolism

Polyketide

- To know the mechanism of the first synthetic sulfa drug
- To understand the biosynthesis and development of different variants of penicillin
- To understand the sharing and different features of penicillin and cephalosporin
- To be familiarized with structures of penicillin, cephalosporin, chloramphenicol, tetracycline, aminoglycoside, macrolide (or macrolactone) quinolone
- To understand the strategies to develop new antibiotics that can kill drug-resistant bacteria

- To know the definition and central precursor of polyketide products.
- To understand several key reactions in fatty acid and polyketide biosynthesis (AT, acyl transferase; KS, keto synthase; KR, keto reductase; DH, dehydratase; ER, enoyl reductase, TE, thioesterase)
- To understand the role of ACP (acyl carrier protein) and the essential co-factor in ACP
- To know the history and key findings in the creation of Canola
- What makes the polyketide synthases produce far more diverse natural products than fatty acid synthase does?
- To know differences between Type I modular and Type I iterative PKS
- To understand why the lovastatin biosynthesis challenges scientists
- To know the differences among Type I, Type II, and Type II PKS

Alkaloid

- Describe the general chemical structure, distribution in nature, and biosynthesis in plants of benzylisoquinoline alkaloids
- Describe the general chemical structure, distribution in nature, and biosynthesis in plants of monoterpenoid indole alkaloids
- Describe the general chemical structure, distribution in nature, and biosynthesis in plants of tropane alkaloids, calystigines and nicotine
- Describe the general chemical structure, distribution in nature, and biosynthesis in plants of glucosinolates and cyanogenic glycosides
- Define the current state of research on the biochemistry, cell biology and biotechnology of plant specialized metabolites
- Describe the general chemical structure, distribution in nature, and biosynthesis in plants of terpenoids
- Describe the general chemical structure, distribution in nature, and biosynthesis in plants of phenylpropanoids
- Define the basic strategies for the metabolic engineering of plant biosynthetic pathways.
- Describe the contribution of natural products in pharmaceutical industries.

Department Approval:

Electronically Approved

Date: 2018-12-20 15:39