



COURSE OUTLINE

1. **Course:** BIOL 505, Medicinal Plant Biochemistry - Fall 2020

Lecture 01: MWF 14:00 - 14:50 - Online

Instructor	Email	Phone	Office	Hours
Dr Dae-Kyun Ro	daekyun.ro@ucalgary.ca	403 220-7099	BI 393	Tuesday 2-3 pm
Dr Peter Facchini	pfacchin@ucalgary.ca	403 220-7651	BI 396	TBA

Course Coordinator: Dr. Peter Facchini

Online Delivery Details:

This course is being offered online in real-time via scheduled meeting times, you are required to be online at the same time.

All online lectures will be delivered synchronously on the scheduled time and date. As this course involves frequent real-time discussion of the research articles and grant proposals with instructors and TAs, lectures will not be recorded and regular attendance at these lectures is mandatory.

Course Site:

D2L: BIOL 505 L01-(Fall 2020)-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 341 or 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:

Type of assessments	Percentage	Date	
Quiz 1	10%	Oct 2	
Quiz 2	10%	Oct 23	
Quiz 3	10%	Nov 20	
Quiz 4	10%	Dec 9	
Essay (Term-paper)	20%	Due on Oct 30	
Mock grant proposal	40%	Due on Nov 30	

Notes:

1. Quizzes will be "timed synchronous" assessments. Quizzes are designed to take 30 minutes to complete but students will be given 45 minutes to account for any issues. Randomized MCQ and/or short-answer questions will be given to students.

2. Workshop (how to write a good grant proposal and essay) is scheduled on Sep 25 to aid your writing.

3. Details of the essay and proposal format will be posted at D2L and will be discussed during online lectures.

4. For any synchronous assessment, time will be adjusted for SAS students if needed and accommodations for students will be done on a case-by-case basis.

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 %

4. Missed Components Of Term Work:

The university has suspended the requirement for students to provide evidence for absences. Please do not attend medical clinics for medical notes or Commissioners for Oaths for statutory declarations.

In the event that a student legitimately fails to submit any online assessment on time (e.g. due to illness etc...), please contact the course coordinator, or the course instructor if this course does not have a coordinator to arrange for a re-adjustment of a submission date. Absences not reported within 48 hours will not be accommodated. If an excused absence is approved, then the percentage weight of the legitimately missed assignment could also be pro-rated among the components of the course.

5. Scheduled Out-of-Class Activities:

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

6. Course Materials:

Course Materials: No textbook. Instructor's lecture files and reading materials (original research articles and reviews) will be used in this course.

In order to successfully engage in their learning experiences at the University of Calgary, students taking online, remote and blended courses are required to have reliable access to the following technology:

- A computer with a supported operating system, as well as the latest security, and malware updates;
- A current and updated web browser;
- Webcam/Camera (built-in or external);
- Microphone and speaker (built-in or external), or headset with microphone;
- Current antivirus and/or firewall software enabled;
- Stable internet connection.

For more information please refer to the UofC [ELearning](#) online website.

7. Examination Policy:

Quizzes are open book questions but must be individual work.

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 **ten business 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 submit the Reappraisal of Graded Term work form to the department in which the course is offered within 2 business days of receiving the decision from the instructor. The Department will arrange for a reappraisal of the work within the next ten business days. The reappraisal will only be considered if the student provides a detailed rationale that outlines where and for what reason an error is suspected. 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:** For more information, see www.ucalgary.ca/wellnesscentre or call [403-210-9355](tel:403-210-9355).
- c. **Sexual Violence:** 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 (syva@ucalgary.ca) or phone at 403-220-2208. The complete University of Calgary policy on sexual violence can be viewed at (<https://www.ucalgary.ca/policies/files/policies/sexual-violence-policy.pdf>)

- 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. **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.
- f. **Freedom of Information and Privacy:** This course is conducted in accordance with the Freedom of Information and Protection of Privacy Act (FOIP). 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.
- g. **Student Union Information:** [VP Academic](#), Phone: [403-220-3911](tel:403-220-3911) Email: suvpaca@ucalgary.ca. SU Faculty Rep., Phone: [403-220-3913](tel:403-220-3913) Email: sciencerep@su.ucalgary.ca. [Student Ombudsman](#), Email: ombuds@ucalgary.ca.
- h. **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.
- i. **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
Sep. 9	Introduction	DKR
Sep. 11	Bioactive natural products	DKR
Sep. 14	Terpenoid principles and history	DKR
Sep. 16	Terpenoid mechanism	DKR
Sep. 18	Terpenoid synthase	DKR
Sep. 21	Terpenoid precursor biosynthesis I	DKR
Sep. 23	Terpenoid precursor biosynthesis II	DKR
Sep. 25	Workshop - mock grant proposal and essay	DKR
Sep. 28	Carotenoid biosynthesis I	DKR
Sep. 30	Carotenoid biosynthesis II & review	DKR
Oct. 2	Quiz I	DKR
Oct. 5	Introduction to phenylpropanoids	DKR
Oct. 7	Phenylpropanoid metabolism I	DKR

Oct. 9	Phenylpropanoid metabolism II	DKR
Oct. 12	Thanksgiving	No lecture
Oct. 14	Fatty acid biosynthesis	DKR
Oct. 16	Polyketide I	DKR
Oct. 19	Polyketide II	DKR
Oct. 21	Polyketide III & review	DKR
Oct. 23	Quiz 2	DKR
Oct. 26	Terpenophenolics	PJF
Oct. 28	Benzyloquinoline alkaloids I	PJF
Oct. 30	Benzyloquinoline alkaloids II	PJF
Nov. 2	Benzyloquinoline alkaloids III	PJF
Nov. 4	Benzyloquinoline alkaloids IV	PJF
Nov. 6	Monoterpenoid indole alkaloids I	PJF
Nov. 9-13	Reading week	No lecture
Nov. 16	Monoterpenoid indole alkaloids II	PJF
Nov. 18	Monoterpenoid indole alkaloids III	PJF
Nov. 20	Quiz 3	PJF
Nov. 23	Tropane alkaloids	PJF
Nov. 25	Purine alkaloids I	PJF
Nov. 27	Pyrrolizidine alkaloids	PJF
Nov. 30	Cellular compartmentalization of alkaloid metabolism I	PJF
Dec. 2	Cellular compartmentalization of alkaloid metabolism II	PJF
Dec. 4	Glucosinolates I	PJF
Dec. 7	Glucosinolates II	PJF
Dec. 9	Quiz 4	PJF

Course Outcomes Biol 505

Terpenoids

- 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

Phenylpropanoids

- 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

Polyketides

- 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

Alkaloids

- 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 monoterpene 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.

Electronically Approved - Sep 01 2020 16:41

Department Approval

Electronically Approved - Sep 01 2020 17:29

Associate Dean's Approval