

Purdue University
Department of Biochemistry
BCHM 421
CRN 16278 and 16279
R for Molecular Biosciences
Syllabus
Spring 2026

COURSE INFORMATION

- Course: BCHM 421 R for Molecular Biosciences
- CRN: 16278 and 16279
- Instructional Modality: Face-to-Face
- Course Credit Hours: 3
- Prerequisites: (Undergraduate level [STAT 30100](#) Minimum Grade of D- or Undergraduate level [STAT 50100](#) Minimum Grade of D- or Undergraduate level [STAT 50300](#) Minimum Grade of D- or Undergraduate level [STAT 51100](#) Minimum Grade of D- or Undergraduate level [CHE 32000](#) Minimum Grade of D-) and (Undergraduate level [BIOL 11100](#) Minimum Grade of D- or Undergraduate level [BIOL 13100](#) Minimum Grade of D- or Undergraduate level [BCHM 30700](#) Minimum Grade of D-)
- Honors Contract: Recommended for students pursuing the Bioinformatics Minor. Talk to instructor the first week of class. More information will be shared on Brightspace as soon as it is available. Note, this class follows the requirements for the [College of Agriculture](#)

COURSE OBJECTIVES

Students will acquire, clean, explore and analyze biological data sets with R. Lectures and example data sets will show the link between data and complex biological phenomena through human observation or instrumentation. Students will learn how to organize data sets to optimize clarity and analytic possibilities while minimizing errors with examples drawn from the literature or biological databases. R programming will be taught starting with small-scale data such as drug sensitivity assays, qPCR, and metabolomics, moving to genome-scale analyses such as gene expression and pathway analysis later in the course. These skills will be taught in the light of enabling reproducible research through clear documentation of data sets and analyses. Relevant concepts from statistics will be reviewed, but it is assumed that students are familiar with basic statistical analyses.

LEARNING OUTCOMES

- Explain how complex biological phenomena are captured as data.
- Organize data sets by observations and variables using appropriate data types.
- Acquire, clean, and manipulate data sets and files programmatically.
- Develop data analysis workflows in R with clear documentation.
- Use R to manipulate and analyze DNA sequences.

- Use R to perform gene expression and pathway analysis.

LEARNING RESOURCES

We will use the **lab computers** to connect to the **Scholar cluster** for class. You may not use your personal computer in class unless you have the permission of the instructor. Outside of class, you can connect to Scholar with any computer that you like, and you should not require any special software (other than DuoMobile) to connect from the dorms or off campus.

You are free to use any **web resources** that you find to help you with the course material. This can include online forums such as [StackOverflow](#) to search for solutions. However, read the forum rules carefully before you post questions! R is very popular, so a well-crafted Google search will often reveal multiple solutions for your problems, and many of them may use complicated code.

The use of **AI** in this class is permitted, but you must include detailed information about the AI and how it was used, i.e. you must cite your sources! In general, I have found it easy to determine when students use AI in coding. If I conclude that you used AI without attribution or explanation, I may deduct all points for that answer.

There are no **textbooks** to purchase for this course. There will be required readings from these free e-books (links will be posted on Brightspace)

[R for Data Science](#), Garret Groolemund and Hadley Wickham

[Statistical Inference via Data Science](#), Chester Ismay and Albert Y. Kim

The Purdue University Library also has many e-books on R. I have provided two examples below:

[Hands On Programming with R](#), Garret Groolemund

[Introductory Statistics with R](#), Peter Daalgard

The instructor has also prepared a Libraries' research guide for bioinformatics that is useful for this course: [Bioinformatics Guide](#)

BRIGHTSPACE

All course material will be distributed via Brightspace. If you cannot find assignments or your grade looks incorrect, let the instructor or TA know as soon as possible so that we can fix the problem.

ASSESSMENT

Assessment will be achieved with regular quizzes, homework, lab exercises, a midterm exam and one project. The final grade will be determined with the following weighting:

Assignments	Grading (percentage)
Quizzes	10%
Lab exercises	20%
Midterm exam	25%
Final Project	15%
Final exam (semi-cumulative)	30%
Class Notebook	0% (see below)
Attendance and participation	0% (see below)

Short **quizzes** will typically use Brightspace. Most questions will be multiple choice, TRUE or FALSE, or multi-select. These assignments are graded by Brightspace, and you have two attempts for quizzes. Only the high grade is retained.

Lab Exercises are programming assignments. This is NOT a computer science course. You will not be graded on elegant or efficient programming. Rather, you will be graded on accurately completing the assignment.

The **Midterm Exam** will be similar to the quizzes but significantly longer. The exam will use Brightspace, and it will be auto-graded. You only have one attempt on the midterm.

The **Final Exam** follows the same format as the Midterm exam. It is semi-cumulative in that you must rely on content from across the semester. However, the primary objective is to test you on material from the last half of the class. **The final will be given during finals week, and it is required for all students except for Seniors graduating in May!**

The **Final Project** is an extended lab exercise that you must complete in groups of 3 or 4 students. All students must participate to receive the grade. The group must include a list that indicates how each member contributed to the project, and all students are required to sign this statement.

The **Class Notebook** is an optional assignment that allows you to improve your grade on either the Midterm or Final exam. For the Notebook, you will use R markdown and a template provided by the instructor (see the important resources section on the class Brightspace page) to create a notebook that lists, synthesizes and applies concepts from the course using data sets that interest you. If you find written exams difficult, this is your opportunity to be creative and have fun with the course content. To grade the Notebook, the instructor will check your Notebook once a week starting during the second week of class. At the end of the semester, you can upload a final version of your Notebook. If you do, the grade on your low exam will be replaced by the mean of that exam and the notebook, e.g. if you received a 70 on the midterm and a 90 on the notebook, your midterm grade will be raised to 80. **I highly recommend that all students start a Notebook in the first few weeks of class.**

Attendance and participation will allow you to succeed in this course. I am generally generous with excused absences, but you must contact me in advance or provide a medical excuse. **If**

you feel unwell, please do not come to class, but send me a quick email letting me know the reason for your absence so that I can mark your absence as excused. I will use attendance when I assign your final letter grade. If you have excellent attendance (no unexcused absences), I will typically round your grade up to the higher letter grade, e.g. if you had no unexcused absences, e.g. I will round 89% to 90% giving you an A rather than a B in the course. Important, an excused absence does not necessarily allow an extension on any assignment, exam or quiz. Extensions will likely only be granted for absences that have been submitted through the Office of the Dean of Students.

Honors Contract Students

Students can take BCHM 421 as an Honors Contract course following the guidelines for the College of Agriculture. Grading is largely the same as the other students, but **Honors Contract** students must complete the following additional work:

- **Independent Final Project** – 15%. Students will develop, acquire data and implement an independent project rather than complete the group project that other students must complete.
- **Course Notebook** – Must be completed on a Pass/Fail basis.
- **Regular meetings with instructor** – Meet four to eight times during the semester or as necessary to plan and implement the **Independent Final Project** and complete the **Course Notebook**.

I highly recommend that students pursuing the Bioinformatics Minor take advantage of the Honors Contract.

Late Work

Late work will have points deducted, and assignments that are submitted more than three days late will receive zero credit. The reason for this policy is that it is critical that I release the answer keys for assignments as part of the course pedagogy. Late deductions are as follows: **Any work submitted the day after the due date (even 1 minute) will have 10% deducted. Any work submitted two days late will receive a 50% deduction. Any work submitted later than that will receive zero points.** Deadline extensions must be arranged in advance when possible and will likely require arrangements with the Office of the Dean of Students or the DRC (in advance).

The final date to withdraw from the course with a W for Spring 2026 is April 16. Each student will have up-to-date graded feedback before then.

Use of Artificial Intelligence

The advent of Artificial Intelligence (AI) can accelerate and complement the learning process, and you may use open AI tools that are free and accessible to all Purdue University students in BCHM 421. If you use AI to solve or answer a problem, you must provide details of how AI was

used. At a minimum, this means sharing the name and URL of the tool. Additional details on how you used AI, e.g. your prompt, can allow the instructors to give you partial credit in those cases where AI leads you astray. You may not use AI for the Midterm Exam or Final Exam, and the consequences will be a zero on that Exam.

GRADING SCALE

Brightspace displays scores to two decimal places. I will round up to zero decimal places, e.g. 89.50 is 89 but 89.51 is 90. Good attendance and participation can easily improve your letter grade!

Score	Grade	Score	Grade
98.0 and above	A+	78.0 to 79.9	C+
92.0 to 97.9	A	72.0 to 77.9	C
90.0 to 91.9	A-	70.0 to 71.9	C-
88.0 to 89.9	B+	68.0 to 69.9	D+
82.0 to 87.9	B	62.0 to 67.9	D
80.0 to 81.9	B-	60.0 to 61.9	D-
		59.9 and Below	F

HOW TO SUCCEED IN THIS COURSE

Here are some things that you can do to succeed in this course:

- Come to class prepared by completing assignments on time.
- This is a 400-level course. You will be expected to search for and find some information that you need to complete assignments. Generally, the best place to find this information is in the course materials. AI seems simple and easy, but it often leads you astray!
- Ask questions! If you are confused, then the instructor may have explained the material poorly or even made a mistake.
- Collaborate with your fellow students. They can help you to find errors or provide alternate ways of achieving your tasks. I learn from students every semester.
- Practice, practice, practice and more practice. Coding is hard for many reasons. Typographical errors and syntax errors are unavoidable, but you will learn to find and correct them quickly with practice. Additionally, R provides a host of tools (functions) that allow you to manipulate, analyze and visualize data. These tools can be combined in numerous ways to achieve your ends, but only practice will allow you to understand the limitations and strengths of these tools.

- The Course Notebook is an optional assignment, but the best students typically create a Notebook (although they may not choose to have it graded). The Notebook gives you a chance to collate the course contents, create examples that are meaningful to you, and express your creativity.
- Come to office hours. Both the instructor and TA are available outside of class to answer your questions. There are scheduled office hours, but you can also request a meeting by email.

DISCLAIMER

Specific course policies are intended to be more flexible than the policies of Purdue University. If you believe that a course policy violates a university policy, please email the instructor.

The syllabus is subject to minor changes.

COURSE SCHEDULE

The course schedule will be shared on Brightspace. The schedule can be fluid, but exam dates will be provided well in advance.

Week 1	Learning R: Basics	Quizzes/homework/exercises
Week 2	Learning R: Data Types	Quizzes/homework/exercises
Week 3	Learning R: Data Viz	Quizzes/homework/exercises
Week 4	Learning R: Data Wrangling	Quizzes/homework/exercises
Week 5	Bioinformatics: Genomic Data	Midterm (tentative)
Week 6	Bioinformatics: Bioconductor	Quizzes/homework/exercises
Week 7	Bioinformatics: Sequences	Quizzes/homework/exercises
Week 8	Bioinformatics: Clustering	Quizzes/homework/exercises
Week 9	Bioinformatics: Protein Alignments	Quizzes/homework/exercises
Week 10	Bioinformatics: Gene Expression	Quizzes/homework/exercises
Week 11	Bioinformatics: Gene/Protein Function	Quizzes/homework/exercises
Week 12	Programming: R Shiny	Quizzes/homework/exercises

Week 13	Programming: R Shiny	Quizzes/homework/exercises
Week 14	Thanksgiving	Final Project
Week 15	Programming: R Shiny	Final Project
Week 16/Dead Week	Final Projects	Final Project

OBTAINING EXTRA HELP

The professor and the teaching assistant will do our best to provide extra help as needed. Please take advantage of the office hours or make an appointment.

CLASS ATTENDANCE

This course follows the [University Academic Regulations regarding class attendance](#), which state that students are expected to be present for every meeting of the classes in which they are enrolled. Attendance will be taken at the beginning of each class and lateness will be noted. When conflicts or absences can be anticipated, such as for many University-sponsored activities and religious observations, you should inform me of the situation as far in advance as possible. For unanticipated or emergency absences when advance notification is not possible, contact me as soon as possible by email or phone. For absences that do not fall under excused absence regulations (see below), this course follows the following procedures:

1. Do not come to class if you feel ill, but DO email me at ppascuzz@purdue.edu, with the subject line: BCHM421 absence. I do not need details about your symptoms. Just let me know you are feeling ill and cannot come to class. If it is an emergency situation, please follow the University regulations on emergent medical care (see below).
2. Unless it falls under the University excused absence regulations (see below), any work due should be submitted on time via our course Brightspace.
3. If that day's class involves assessed work such as a test or presentation, you and I will plan if and how you can make up the work, following the assignment guidelines. This plan must be done before the next class period, so again, email me immediately when you know that you will miss class.
4. The most important consideration in any absence is how it will affect your achievement of the assignment objectives and the course learning outcomes.

For cases that fall under **excused absence regulations**, you or your representative should contact or go to the [Office of the Dean of Students \(ODOS\) website](#) to complete appropriate forms for instructor notification. Under academic regulations, excused absences may be granted by ODOS for cases of grief/bereavement, military service, jury duty, parenting leave, or emergent medical care. The processes are detailed, so plan ahead.

PROTECT PURDUE

Any student who has substantial reason to believe that another person is threatening the safety of others by not complying with Protect Purdue protocols is encouraged to report the behavior to and discuss the next steps with their instructor. Students also have the option of reporting the behavior to the [Office of the](#)

[Student Rights and Responsibilities](#). See also [Purdue University Bill of Student Rights](#) and the Violent Behavior Policy under University Resources in Brightspace.

ACADEMIC MISCONDUCT

Academic misconduct of any kind will not be tolerated in any course offered by the Department of Biochemistry. Information on Purdue's policies with regard to academic misconduct can be found at http://www.purdue.edu/studentregulations/student_conduct/regulations.html

Any incidence of academic misconduct will be reported to the Office of the Dean of Students. Academic misconduct may result in disciplinary sanctions including expulsion, suspension, probated suspension, disciplinary probation, and/or educational sanctions. In addition, such misconduct will result in punitive grading such as:

- receiving a lower or failing grade on the assignment, or
- assessing a lower or failing grade for the course

Punitive grading decisions will be made after consultation with the Office of the Dean of Students. Please note reported incidences of academic misconduct go on record for reference by other instructors. Further, a record of academic misconduct is likely to influence how current/future situations are handled.

To provide you with an unambiguous definition of academic misconduct, the following text has been excerpted from "Academic Integrity: A Guide for Students", written by Stephen Akers, Ph.D., Executive Associate Dean of Students (1995, Revised 1999, 2003), and published by the Office of the Dean of Students in cooperation with Purdue Student Government, Schleman Hall of Student Services, Room 207, 475 Stadium Mall Drive West Lafayette, IN 47907-2050.

"Purdue prohibits "dishonesty in connection with any University activity. Cheating, plagiarism, or knowingly furnishing false information to the University are examples of dishonesty." [Part 5, Section III-B-2-a, *Student Regulations*] Furthermore, the University Senate has stipulated that "the commitment of acts of cheating, lying, and deceit in any of their diverse forms (such as the use of substitutes for taking examinations, the use of illegal cribs, plagiarism, and copying during examinations) is dishonest and must not be tolerated. Moreover, knowingly to aid and abet, directly or indirectly, other parties in committing dishonest acts is in itself dishonest." [University Senate Document 72-18, December 15, 1972]

More specifically, the following are a few examples of academic dishonesty which have been discovered at Purdue University.

- substituting on an exam for another student
- substituting in a course for another student
- paying someone else to write a paper and submitting it as one's own work
- giving or receiving answers by use of signals during an exam
- copying with or without the other person's knowledge during an exam
- doing class assignments for someone else
- plagiarizing published material, class assignments, or lab reports
- use of AI without attribution
- turning in a paper that has been purchased from a commercial research firm or obtained from the internet
- padding items of a bibliography
- obtaining an unauthorized copy of a test in advance of its scheduled administration
- using unauthorized notes during an exam

- collaborating with other students on assignments when it is not allowed
- obtaining a test from the exam site, completing and submitting it later
- altering answers on a scored test and submitting it for a regrade
- accessing and altering grade records
- stealing class assignments from other students and submitting them as one's own
- fabricating data
- destroying or stealing the work of other students

Plagiarism is a special kind of academic dishonesty in which one person steals another person's ideas or words and falsely presents them as the plagiarist's own product. This is most likely to occur in the following ways:

- using the exact language of someone else without the use of quotation marks and without giving proper credit to the author
- presenting the sequence of ideas or arranging the material of someone else even though such is expressed in one's own words, without giving appropriate acknowledgment
- submitting a document written by someone else but representing it as one's own"

ACADEMIC INTEGRITY

Academic integrity is one of the highest values that Purdue University holds. Individuals are encouraged to alert university officials to potential breaches of this value by either emailing integrity@purdue.edu or by calling 765-494-8778. While information may be submitted anonymously, the more information is submitted the greater the opportunity for the university to investigate the concern. More details are available on our course Brightspace under University Policies and Statements.

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NOTICE OF COPYRIGHT PROTECTION OF COURSE MATERIALS

See the University Policies and Statements section of Brightspace for guidance on Use of Copyrighted Materials. Effective learning environments provide opportunities for students to reflect, explore new ideas, post opinions openly, and have the freedom to change those opinions over time. Students and instructors are the authors of the works they create in the learning environment. As authors, they own the copyright in their works subject only to the university's right to use those works for educational purposes. Students may not copy, reproduce, or post to any other outlet (e.g., YouTube, Facebook, or other open media sources or websites) any work in which they are not the sole or joint author or have not obtained the permission of the author(s).

EMERGENCY PREPAREDNESS

In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances beyond the instructor's control. Relevant changes to this course will be posted onto the course website or can be obtained by contacting the instructors or TAs via email or phone. You are expected to read your @purdue.edu email on a frequent basis.

A link to Purdue's Information on [Emergency Preparation and Planning](#) is located on our Brightspace under "University Policies and Statements." This website covers topics such as Severe Weather

Guidance, Emergency Plans, and a place to sign up for the Emergency Warning Notification System. I encourage you to download and review the *Emergency Preparedness for Classrooms document (PDF)* or *(Word)*.

The first day of class, I will review the **Emergency Preparedness plan for our specific classroom**, following Purdue's required [Emergency Preparedness Briefing](#). Please make note of items like:

- The location to where we will proceed after evacuating the building if we hear a fire alarm.
- The location of our Shelter in Place in the event of a tornado warning.
- The location of our Shelter in Place in the event of an active threat such as a shooting.

ON-LINE COURSE EVALUATIONS

During the last two weeks of the semester, you will be provided an opportunity to evaluate this course and your instructor(s). To this end, Purdue has transitioned to online course evaluations. On Monday of the fifteenth week of classes, you will receive an official email from evaluation administrators with a link to the online evaluation site. You will have two weeks to complete this evaluation. Your participation in this evaluation is an integral part of this course. Your feedback is vital to improving education at Purdue University. I strongly urge you to participate in the evaluation system.

NON-DISCRIMINATION POLICY

Purdue University is committed to maintaining a community that recognizes and values the inherent worth and dignity of every person; fosters tolerance, sensitivity, understanding, and mutual respect among its members; and encourages each individual to strive to reach his or her potential. In pursuit of its goal of academic excellence, the University seeks to develop and nurture diversity. The University believes that diversity among its many members strengthens the institution, stimulates creativity, promotes the exchange of ideas, and enriches campus life. A hyperlink to Purdue's full Nondiscrimination Policy Statement is included in our course Brightspace under University Policies and Statements.

MENTAL HEALTH

If you find yourself beginning to feel some stress, anxiety and/or feeling slightly overwhelmed, try [WellTrack](#). Sign in and find information and tools at your fingertips, available to you at any time.

If you need support and information about options and resources, please contact or see the [Office of the Dean of Students](#). Call 765-494-1747. Hours of operation are M-F, 8 a.m.- 5 p.m.

If you find yourself struggling to find a healthy balance between academics, social life, stress, etc., sign up for free one-on-one virtual or in-person sessions with a [Purdue Wellness Coach at RecWell](#). Student coaches can help you navigate through barriers and challenges toward your goals throughout the semester. Sign up is free and can be done on BoilerConnect.

If you're struggling and need mental health services: Purdue University is committed to advancing the mental health and well-being of its students. If you or someone you know is feeling overwhelmed, depressed, and/or in need of mental health support, services are available. For help, such individuals should contact [Counseling and Psychological Services \(CAPS\)](#) at 765-494-6995 during and after hours, on weekends and holidays, on weekends and holidays, or by going to the CAPS offices in [West Lafayette](#) or [Indianapolis](#).

BASIC NEEDS SECURITY

Any student who faces challenges securing their food or housing and believes this may affect their performance in the course is urged to contact the Dean of Students for support. There is no appointment needed and Student Support Services is available to serve students 8 a.m.-5 p.m. Monday through Friday.

ACCESSIBILITY AND ACCOMODATIONS

Purdue University strives to make learning experiences as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, you are welcome to let me know so that we can discuss options. You are also encouraged to contact the Disability Resource Center at: drc@purdue.edu or by phone: 765-494-1247.