

Welcome to Introductory Biology Laboratory! BILD 4 aims to develop an understanding for research in the biological sciences through discovery-based laboratory experiments. We will work in teams to collect, analyze, and present original research data while learning foundational biological concepts and laboratory skills. Data collected in this course will contribute to an on-going research project on soil microbiomes at the Scripps Coastal Reserve on campus.

#### Learning goals

- Collaborate with one another to learn foundation biological concepts and laboratory skills
- Engage in research and learn to draw conclusions based on evidence and reasoning
- Connect with resources on campus, such as faculty research groups, library, and writing center

#### Components of the course

- Class: Learn biological concepts related to the laboratory research project
- Laboratory: Engage in a collaborative research project on soil microbiomes on campus
- Project: Develop and present research proposals on hypothetical projects

#### Learning in this course

BILD 4 is designed to be a collaborative environment for everyone to learn together and construct a shared understanding of the material. Active participation and contribution in classes and in the laboratory are essential because many ideas and laboratory methods that will be developed in these activities cannot be easily captured otherwise. Being able to communicate understanding, articulate confusion, and defend scientific arguments based on evidence and reasoning is both useful for learning<sup>1</sup> and critical to success in any discipline. To encourage collaboration and community building, many class and laboratory activities and assignments will be done in teams, and grades will not be assigned on a curve.

Instead of memorization, we will focus on developing an understanding of fundamental concepts and laboratory skills as they apply to different examples and learn to draw conclusions based on evidence and reasoning. We will utilize class and laboratory time to construct and apply our knowledge, troubleshoot challenging topics, practice problem solving, and develop skills in critical thinking. Laboratory reports and the research proposal will challenge us to think critically about data and experiments.

<sup>1</sup> Smith et al (2009) Science 323: 122–124. <http://science.sciencemag.org/content/323/5910/122.short>

#### Course logistics

The core learning components in this course are comprised of collaborative activities in class meetings and laboratory sections, in addition to independent and group work on studying and completing assignments. Course materials, announcements, and other important details will be available on the TritonEd (<https://triton.ucsd.edu>). Please check the course website and your @ucsd email regularly for updates and relevant information.

Class	Time	Location	Instructor
A00	Tuesday 6:00 pm to 7:20 pm	Solis 107	Stanley Lo

Laboratory	Time	Location	Instructional assistants
A01	Monday 8:00 am to 10:50 am	York 4124	Clifford Liu, Alexandra Vargas
A02	Monday 11:30 am to 2:20 pm	York 4124	Clifford Liu, Natalie Toothacre
A03	Monday 3:00 pm to 5:50 pm	York 4124	Liza Brusman, Angelica Luis
A04	Tuesday 8:00 am to 10:50 am	York 4124	Liza Brusman, Vivian Deng
A05	Tuesday 11:30 am to 2:20 pm	York 4124	Kendall Higgins, Randy Tsai
A06	Tuesday 3:00 pm to 5:50 pm	York 4124	Kendall Higgins, Liangdao Li

Instructor	Email	Office	Phone	Office hours
Stanley Lo	<a href="mailto:smlo@ucsd.edu">smlo@ucsd.edu</a>	York 4070B	858-246-1087	See schedule on TritonEd

Instructional assistant	Email	Instructional assistant	Email
Alexandra Vargas	<a href="mailto:amv010@ucsd.edu">amv010@ucsd.edu</a>	Liza Brusman	<a href="mailto:lbrusman@ucsd.edu">lbrusman@ucsd.edu</a>
Angelica Luis	<a href="mailto:arluis@ucsd.edu">arluis@ucsd.edu</a>	Natalie Toothacre	<a href="mailto:ntoothac@ucsd.edu">ntoothac@ucsd.edu</a>
Clifford Liu	<a href="mailto:czliu@ucsd.edu">czliu@ucsd.edu</a>	Randy Tsai	<a href="mailto:r1tsai@ucsd.edu">r1tsai@ucsd.edu</a>
Kendall Higgins	<a href="mailto:kthiggin@ucsd.edu">kthiggin@ucsd.edu</a>	Vivian Dang	<a href="mailto:v7dang@ucsd.edu">v7dang@ucsd.edu</a>
Liangdao Li	<a href="mailto:lil041@ucsd.edu">lil041@ucsd.edu</a>		

**Course materials:** Assigned readings for this course will be from various sources including primary literature papers and will be posted on TritonEd. Laboratory activities are detailed in the BILD 4 Laboratory Manual, available at the bookstore. For the laboratory, knee-length laboratory coat and UV-blocking safety glasses or goggles are required, and they are also available at the bookstore. iClicker2 is required for lectures and should be registered on TritonEd.

A substantial portion of learning will be from primary research papers. Assignments will be designed to support this more complex level of learning. Each student will need to purchase a copy of the BILD 4 Laboratory Manual with carbonless sheets that will be used for this purpose and will serve as a personal textbook that is constructed from these assignments and in-class activities.

Participation and contribution in class meetings will be mainly through clicker questions and short writing activities. To participate in clicker-based discussions, please have an iClicker2 registered on TritonEd. Short in-class writing activities will be done in the carbonless personal textbooks, so please be sure to bring the Laboratory Manual to class meetings and laboratory sections.

**Podcast:** Whenever possible, class meetings will be recorded and made available online as a resource for learning (<http://podcast.ucsd.edu/>). However, participation and contribution are highly encouraged, as substantial portions of class meetings will be interactive. Many important concepts

and ideas that will be developed collaborative in these activities, which cannot be easily captured on video. Therefore, podcasts are provided as for the purpose of review and should not be used solely to substitute for active engagement in class meetings.

**Technology:** Students are welcome to bring laptop computers, tablets, or similar technology to class meetings and discussion sections for note-taking purposes. Please see this research study, which shows that multi-tasking on computers in class is likely to decrease not only your own grade but also the grades of people around you who can see your screen!<sup>2</sup> For this reason, we ask that you do not flip between relevant course materials and irrelevant activities on the internet. The use of cell phones, computers, or other personal devices is not permitted in the laboratory for safety reasons.

<sup>2</sup> Sana et al (2013) Computers and Education 62: 24–31  
<http://www.sciencedirect.com/science/article/pii/S0360131512002254>

### Grading

BILD 4 has four grading components: contribution (40 points), laboratory reports (81 points), poster presentation (26 points), and professionalism (3 points). These four grading components add up to 150 points, and final grades will be determined based on percentages out of 100%. There are no opportunities for extra credit beyond what is assigned as part of the course.

The general grading scheme is as follows, although it may be adjusted to improve everyone's grades if necessary. Exact boundaries will be determined based on final grade distributions: Because course assessments are not perfectly precise, grade cutoffs will be identified by large gaps in between individual scores. However, BILD 4 is not graded on a curve, i.e. 20% of students getting A, B, C, and such. Thus, the ability to do well in this course is not dependent on others doing poorly.

A+	97–100%	B+	87–90%	C+	77–80%	D+	67–70%	F	0–60%
A	93–97%	B	83–87%	C	73–77%	D	63–67%		
A–	90–93%	B–	80–83%	C–	70–73%	D–	60–63%		

**Contribution:** Active participation both in classes and laboratory sections is essential to learning in this course. There will be many contribution items, including pre-class and pre-laboratory assignments, in-class discussions, in-laboratory activities, and laboratory notebooks and data collection. Contributions will be graded for thoughtful completion. Because individual students may have different competing schedules and life events, completing 40 contribution items will earn the full contribution grade. There will be many contribution items throughout the quarter, and 40 items will be approximately 80%–85% of all contribution items.

**Laboratory reports:** Three reports will be written individually (15 points each), and two reports will be written in teams (18 points each). The reports will focus on generating figures from data collected by all groups in each laboratory section and drawing conclusions that are supported by

evidence and reasoning in scientific arguments. Please see TritonEd throughout the quarter for more details on these assignments.

**Poster project:** The project will be a research proposal written and presented in poster format collaboratively in groups (26 points). Each group will identify a topic to study hypothetically and propose experiments to investigate that topic using foundational concepts and laboratory skills learned in the course. The research proposals are presented as posters (25 points) that will be judged by faculty, researchers, and staff from across campus. An individual component (1 point) will involve summaries and critical assessments of other posters. Please see TritonEd throughout the quarter for more details on these assignments.

**Professionalism:** This portion of the course grade is intended to engage students in considering the impact of their actions on their own learning and the learning of others in the course. Unprofessional interactions consume time yet have no meaningful benefits to you, your fellow students, and/or the instructional team. Analogously in the workplace, being unprofessional to your colleagues or supervisors will only discount you. When you are discounted, you may not be invited for new opportunities that you may or may not be aware of.

Professionalism can be demonstrated through individual and community efforts (2 points and 1 point respectively). The individual component is to account for demonstrating maturity and professionalism. By default, every student is assumed to be professionally mature. Hence, this component is awarded to every student at the beginning of the quarter. During the quarter, based on observations by the teaching team, which includes but is not limited to one-on-one interactions, electronic communication, and follow-up conversations on grades, your professionalism credit may be deducted in steps of 1 point.

Example interactions with meaningful benefits that result in:

- Deeper insight into course material, course concepts, biology, and/or society in general
- Clarification of course materials that facilitates deeper learning
- Improvement in skill building and future opportunities
- Learning conceptually and meaningfully why full credit was not awarded for an assignment
- Reporting errors or problems in class or laboratory, assignments, or other course material

Example interactions that have no meaningful benefits that should be avoided:

- Disputes about point deductions claiming they are too severe for mistake or oversight
- Questions asked electronically or in person without checking the syllabus or other information
- Asking questions when the information is already available or will eventually be known
- Ignoring the directions or requests from the instructional team
- Harassing and/or bullying the instructional team either in person or online

For the community professionalism component, the 1 point can be earned by completing course evaluations and related surveys that can aimed to improve the course and the educational experiences of your future peers. If 90% or more of all students complete CAPEs, instructional assistant evaluations, and other course-based evaluation surveys in a mature and professional fashion, i.e. taking them seriously and providing timely and constructive feedback, 1 point will be awarded to everyone in the course.

**Late or missing assignments:** No late contribution items will be accepted, as completing 80%–85% of all the contribution item will earn the full contribution grade. No late assignments will be accepted for the laboratory reports or the poster project, except in the case of a documented short-term illness or serious family emergency. In this case, please contact Dr. Lo as soon as possible or reasonable to do so.

**Regrades:** If a grading error has been made, please submit a regrade request to Dr. Lo at the end of a class meeting within one week of the assignments being returned. Attach a separate piece of paper to your assignment as a cover sheet. If you think your work deserves more points, i.e. it is not an arithmetic error, please write on the cover sheet a concise description of how your answer compares to the rubric and why you think it should have earned more points.

Students who submit for regrades understand that we may: (1) regrade the entire assignment, and (2) compare the submitted paper to a copy of the original assignment. As a result, the overall grade may go up or down or remain the same after the regrade.

**Group work:** A major goal of the course is to learn to collaborate with others. Unfortunately, despite best efforts and intentions, groups do not always functional optimally. Dealing with these challenges is a natural part of the learning experience. Everyone is expected to contribute fully and equitably to group work as part of the university learning community.

If significant disputes occur over the relative contribution of individual members of the group, students can submit an appeal. In such cases, the group grade will be multiplied by the number of people in the group, and the points can be divide among individuals based on what each group member thinks they deserve based on their effort. To submit an appeal, all members of the group need to get together and provide the following information in a document: clear and detailed descriptions of each member's contribution, calculations for how the points should be divided among the members, and signatures from each member with a statement attesting to the fact that everyone in the group has agreed to all information in the appeal document. Please submit the appeal to Dr. Lo at the end of a class meeting within one week of the assignments being returned.

#### Laboratory safety

Safety precautions are crucial in the laboratory setting. Biology lab safety training and assessment (<https://biology.ucsd.edu/education/undergrad/course/ug-labs.html>) must be completed by the

beginning of the first laboratory meeting. Students will not be allowed to participate in any laboratory section without completing this online training and assessment.

From the beginning of the first lab, appropriate laboratory attire and personal protective equipment (PPE) are required. Appropriate laboratory attire includes long pants or equivalent, long socks or equivalent, and closed-toe and closed-heel shoes. No skin should be exposed from the waist down at all times. PPE includes laboratory coats that cover to the knees and UV-blocking safety glasses or goggles, both of which are available at the bookstore.

#### Laboratory participation

Attendance in laboratory is required. Missing one laboratory sessions, except in the case of a documented short-term illness or serious family emergency, will automatically result in an F grade. Please be on time for laboratory sessions as responsible conduct for being in a learning community with your peers. Instructional assistants go also over the experiments at the beginning of each session. Two late attendances will be automatically counted as one absence. Additional policies are available online (<https://biology.ucsd.edu/education/undergrad/course/waitlist.html>).

#### Library guide

<http://ucsd.libguides.com/bild4>

A specific library guide has been designed for BILD 4. This website serves as the starting point for navigating campus library resources that support our needs in completing major assignments, such as the research proposal. Please feel free to schedule a consultation with Bethany Harris ([bethany@ucsd.edu](mailto:bethany@ucsd.edu)), our biomedical librarian, for further assistance.

#### Writing and Critical Expression Hub

<http://commons.ucsd.edu/students/writing/index.html>

The Writing and Critical Expression Hub provides support for undergraduates working on course papers, i.e. laboratory reports and the research proposal, as well as other independent writing projects. Writing mentors can help at any stage of the writing process, from brainstorming to final polishing. The Writing and Critical Expression Hub offers: one-on-one writing tutoring by appointment; supportive and in-depth conversations about writing, the writing process, and writing skills; help with every stage in the writing process, walk-in tutoring; and workshops on writing.

#### Accessibility and inclusion

<http://disabilities.ucsd.edu> | [osd@ucsd.edu](mailto:osd@ucsd.edu) | 858-534-4382

Any student with a disability is welcome to contact us early in the quarter to work out reasonable accommodations to support their success in this course. Students requesting accommodations for this course due to a disability must provide a current Authorization for Accommodation (AFA) letter issued by the Office for Students with Disabilities (OSD). Students are required to present their AFA letters to faculty and to the OSD Liaison in the Division of Biological Sciences in advance so that accommodations may be arranged.

Whenever possible, we will use universal designs that are inclusive. For example, colors used in this syllabus are distinguishable by most colorblind and non-colorblind people, and this font is designed to be dyslexic friendly. If you have feedback on how to make the class more accessible and inclusive, please get in touch!

**Discrimination and harassment:** The Office for the Prevention of Harassment & Discrimination (OPHD) provides assistance to students, faculty, and staff regarding reports of bias, harassment, and discrimination. OPHD is the UC San Diego Title IX office. Title IX of the Education Amendments of 1972 is the federal law that prohibits sex discrimination in educational institutions that are recipients of federal funds. Students have the right to an educational environment that is free from harassment and discrimination.

Students have options for reporting incidents of sexual violence and sexual harassment. Sexual violence includes sexual assault, dating violence, domestic violence, and stalking. Information about reporting options may be obtained at OPHD at 858-534-8298, [ophd@ucsd.edu](mailto:ophd@ucsd.edu), or <http://ophd.ucsd.edu>. Students may receive confidential assistance at CARE at the Sexual Assault Resource Center at 858-534-5793, [sarc@ucsd.edu](mailto:sarc@ucsd.edu), or <http://care.ucsd.edu>, or Counseling and Psychological Services (CAPS) at 858-534-3755 or <http://caps.ucsd.edu>.

Students may feel more comfortable discussing their particular concern with a trusted employee. This may be a student affairs staff member, a faculty member, a department chair, or other university official. These individuals have an obligation to report incidents of sexual violence and sexual harassment to OPHD. This does not necessarily mean that a formal complaint will be filed.

If you find yourself in an uncomfortable situation, ask for help. The university is committed to upholding policies regarding nondiscrimination, sexual violence, and sexual harassment.

#### Academic integrity

<https://students.ucsd.edu/academics/academic-integrity/index.html>

Integrity of scholarship is essential for an academic learning community. In this course and at the university, we expect that both students and the instructional team will honor this principle and in so doing protect the validity of university intellectual work. For students, this means that all academic work will be done by the individual to whom it is assigned, without unauthorized aid of any kind. Instructors, for their part, will exercise care in planning and collaborating with students on academic work, so that academic integrity is upheld.

When people collaborate to work toward a common goal, shared values must be established so that everyone understands the acceptable ways for working together. In organizations, these are commonly called codes of conduct or ethics. In this course, we are using a statement of values<sup>4</sup> in support of codes of ethics, like the Policy on Integrity of Scholarship, to state explicitly our values and describe the behaviors for maintaining and protecting those values.

The following values are fundamental to academic integrity and are adapted from the International Center for Academic Integrity. In our course, these values are open to discussions and possible alterations based on mutual agreements among all students and the instructional team. In collaborative work, each group should discuss these values and must articulate the expectations for how they are made manifest within the group's work together.

	As students, we will ...	As the instructional team, we will ...
Honesty	<ul style="list-style-type: none"> <li>Honestly demonstrate your knowledge and abilities according to expectations listed in the syllabus or in relation to specific assignments and exams</li> <li>Communicate openly without using deception, including citing appropriate sources</li> </ul>	<ul style="list-style-type: none"> <li>Give you honest feedback on your demonstration of knowledge and abilities on assignments and exams</li> <li>Communicate openly and honestly about the expectations and standards of the course through the syllabus and in relation to assignments and exams</li> </ul>
Responsibility	<ul style="list-style-type: none"> <li>Complete assignments on time and in full preparation for class</li> <li>Show up to class on time and be mentally physically present</li> <li>Participate fully and contribute to team learning and activities</li> </ul>	<ul style="list-style-type: none"> <li>Give you timely feedback on your assignments and exams</li> <li>Show up to class on time and be mentally and physically present</li> <li>Create relevant assessments and class activities</li> </ul>
Respect	<ul style="list-style-type: none"> <li>Speak openly with one another while respecting diverse viewpoints and perspectives</li> <li>Provide sufficient space for others to voice their ideas</li> </ul>	<ul style="list-style-type: none"> <li>Respect your perspectives even while we challenge you to think more deeply and critically</li> <li>Help facilitate respectful exchange of ideas</li> </ul>
Fairness	<ul style="list-style-type: none"> <li>Contribute fully and equally to collaborative work, so that we are not freeloading off of others on our teams</li> <li>Not seek unfair advantage over fellow students in the course</li> </ul>	<ul style="list-style-type: none"> <li>Create fair assignments and exams and grade them in a fair and timely manner</li> <li>Treat all students and collaborative teams equally</li> </ul>
Trustworthiness	<ul style="list-style-type: none"> <li>Not engage in personal affairs while on class time</li> <li>Be open and transparent about what we are doing in class</li> <li>Not distribute course materials to others in an unauthorized fashion</li> </ul>	<ul style="list-style-type: none"> <li>Be available to all students when we say we will be</li> <li>Follow through on our promises</li> <li>Not modify the expectations or standards without communicating with everyone in the course</li> </ul>
Courage	<ul style="list-style-type: none"> <li>Say or do something when we see actions that undermine any of the above values</li> </ul>	<ul style="list-style-type: none"> <li>Say or do something when we see actions that undermine any of the above values</li> </ul>



	<ul style="list-style-type: none"><li>• Accept a lower or failing grade or other consequences of upholding and protecting the above values</li></ul>	<ul style="list-style-type: none"><li>• Accept the consequences (e.g. lower teaching evaluations) of upholding and protecting the above values</li></ul>
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All course materials are the property of the instructor, the course, and University of California, San Diego and may not be posted online, submitted to private or public repositories, or distributed to unauthorized people outside of the course. Any suspected instances of a breach of academic integrity will be reported to the Academic Integrity Office for review.

<sup>4</sup> This class statement of values is adapted from Tricia Bertram Gallant Ph.D.

### Calendar

A general outline for the course is available below. More specific details for each week, including reading and assignments, will be provided on TritonEd and in class. We may also adjust the schedule as necessary, while still focusing on the foundational concepts and laboratory skills.

Because of Thanksgiving, the weeks for BILD 4 are somewhat staggered from Thursday to Thursday for most of the quarter. For example, week 1 begins with class on Thursday 9/22 at 6:00 pm and ends with laboratory sections on Tuesday 9/27 at 5:50 pm. After Thanksgiving, week 10 is from Monday 11/28 to Thursday 12/1, meaning that class takes place after laboratory that week. Please note that dates are listed in US format of month/day, where for example 9/22 is September 22<sup>nd</sup>.

Week	Dates	Class	Laboratory	Lab manual
1	9/22-9/27	<ul style="list-style-type: none"> <li>• Introduction to BILD 4</li> <li>• Microbiomes</li> </ul>	<ul style="list-style-type: none"> <li>• Introduction to laboartory</li> <li>• Pipetting and statistics</li> <li>• Error analysis</li> </ul>	<ul style="list-style-type: none"> <li>• BB1</li> </ul>
2	9/29-10/4	<ul style="list-style-type: none"> <li>• Forms of biodiversity</li> <li>• Introduction to Ecoplate</li> </ul>	<ul style="list-style-type: none"> <li>• Scripps Coastal Reserve</li> <li>• Soil properties</li> <li>• Functional biodiversity</li> </ul>	<ul style="list-style-type: none"> <li>• SP1, SP2</li> <li>• FB1</li> <li>• GB1</li> </ul>
3	10/6-10/11	<ul style="list-style-type: none"> <li>• Carbon source utilization</li> <li>• Ecoplate analysis</li> </ul>	<ul style="list-style-type: none"> <li>• Functional biodiversity</li> <li>• Ecoplate analysis</li> <li>• Data presentation</li> </ul>	<ul style="list-style-type: none"> <li>• SP2</li> <li>• FB1</li> </ul>
4	10/13-10/18	<ul style="list-style-type: none"> <li>• 16S rDNA sequences</li> <li>• Polymerase chain reaction</li> </ul>	<ul style="list-style-type: none"> <li>• Genomic DNA prep</li> <li>• Polymerase chain reaction</li> </ul>	<ul style="list-style-type: none"> <li>• GB2, GB3</li> </ul>
5	10/20-10/25	<ul style="list-style-type: none"> <li>• Gel electrophoresis</li> </ul>	<ul style="list-style-type: none"> <li>• Gel electrophoresis</li> </ul>	<ul style="list-style-type: none"> <li>• GB3</li> </ul>
6	10/27-11/1	<ul style="list-style-type: none"> <li>• Recombinant DNA</li> <li>• Biotechnology</li> </ul>	<ul style="list-style-type: none"> <li>• Ligation</li> <li>• Transformation</li> </ul>	<ul style="list-style-type: none"> <li>• GB4</li> </ul>
7	11/3-11/8	<ul style="list-style-type: none"> <li>• DNA sequencing</li> </ul>	<ul style="list-style-type: none"> <li>• Transformation data</li> <li>• Designing posters</li> </ul>	<ul style="list-style-type: none"> <li>• GB4</li> </ul>
8	11/10-11/15	<ul style="list-style-type: none"> <li>• Biodiversity calculations</li> </ul>	<ul style="list-style-type: none"> <li>• DNA sequence analysis</li> <li>• Biodiversity calculations</li> </ul>	<ul style="list-style-type: none"> <li>• FB1</li> <li>• GB5</li> </ul>
9	11/17-11/22	Thanksgiving: no class	Thanksgiving: no laboratory	---
10	11/28-12/1	<ul style="list-style-type: none"> <li>• Research opportunities for undergraduates</li> </ul>	<ul style="list-style-type: none"> <li>• Paper 2 peer review</li> </ul>	---
Exam	Thurs 12/8 at 3:00 pm	<ul style="list-style-type: none"> <li>• Poster presentations</li> </ul>	---	---