Integrative Biology C32 Class Number # 23722
L&S Discovery Course C30Z Number # 23715
3 UNITS
Course may be used to satisfy the Biological Science breadth requirement in Letters and Science
Lower Division

BIOINSPIRED DESIGN

Spring 2023
Website: http://biodesign.berkeley.edu/bioinspired-design-course/

Instructor
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5128 VLSB
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GSIs
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Prerequisites: None. Open to all students.

Textbook: None: On Reserve, Vogel, Steven. *Cats' paws and catapults: Mechanical worlds of nature and people*. WW Norton & Company, 2000.

bCourses Site:
We will use the IB 32 bCourses site for the syllabus, reading assignments, announcements, presentations and lecture material.
You may access the site by going to: https://bcourses.berkeley.edu, login through CalNet and then to Integbi C32 or L&S C30Z/ When viewing Assignments, please be sure to sort by due date. To view a list of assignments with points in chronological order, please see: Tentative Assignment Due Date Checklist

Weekly Landing Pages. Based on student feedback from previous years, we created Weekly Landing Pages as a look ahead, summary guide for the week. Because you will receive many important Announcements, Assignments, and other notes through separate Notifications, Weekly Landing Pages tries to fill in the gaps to smoothen class workflow. Check the Landing Page for the Week periodically. Please note that pages will be updated as the week progresses, so not all links will be immediately accessible. Assignments and Lectures will be published on dates listed. NOTE that Weeks will not be made available in advance, so we can make sure that you have the most up-to-date information. We hope Weekly Landin Pages help. Let us know.

Week 1: 1/16 - 1/22	Week 5: 2/13 - 2/19	Week 9: 3/13 - 3/19	Week 13: 4/10 - 4/16
Week 2: 1/23 - 1/29	Week 6: 2/20 - 2/26	Week 10: 3/20 - 3/26	Week 14: 4/17 - 4/23
Week 3: 1/30 - 2/5	Week 7: 2/27 - 3/5	Week 11: 3/27 - 4/2	Week 15: 4/24 – 4/30
Week 4: 2/6 - 2/12	Week 8: 3/6 - 3/12	Week 12: 4/3 - 4/9	Week 16: 5/1 - Post

Lectures: Monday & Wednesday. In person. 12:00PM - 1:00PM Lectures. We will make every effort to post lecture slide pdfs the day before the scheduled lecture date; they will remain available for the duration of the semester.

iClicker Cloud. We will be using iClicker Cloud to make our class time more engaging. This will help us understand what you know, give everyone a chance to participate, and increase how much you learn in class. This will also provide you with feedback on how well you are comprehending course concepts, and help you master challenging concepts. Participating in iClicker polls will be counted towards your final grade. Attendance/polls/assignments will be worth ~7% of your final grade. You will earn 2 points for each class that you submit responses, not for correct answers. You are required to participate with the iClicker Cloud student app on a smartphone, tablet, or laptop. It is your responsibility to properly get added using the iClicker student app (https://rtl.berkeley.edu/services-programs/student-response-systems/students-getting-started-iclicker-cloud).

Lecture Assignments: Each Lecture Assignment will be accompanied by **three responses**. A **reflection question** will ask you to enter text (<250 words) concerning what you learned in the lecture. We will direct you to a Google form where you will enter your name, discussion section, and any **question that you have about the lecture**. We will answer your questions in subsequent discussion sections. In addition, you will list **one specific *concept*** from this lecture you deemed important for bioinspired design. Identifying concepts for each lecture will help make your Midterm Exam easier.

Discussion Sections:

One hour per week **Friday discussions** will be held in-person. Attendance required.

INTEGRATIVE BIOLOGY C32 S 101 DIS; 23723; Fr 9-10A, Jacobs Hall 10
INTEGRATIVE BIOLOGY C32 S 102 DIS; 23724; Fr 10-11A, Jacobs Hall 10
INTEGRATIVE BIOLOGY C32 S 103 DIS; 23725; Fr 11-12P, Jacobs Hall 10
INTEGRATIVE BIOLOGY C32 S 104 DIS 23726; Fr 12-1P, Jacobs Hall 10
INTEGRATIVE BIOLOGY C32 S 105 DIS; 23727; Fr 1-2P, Jacobs Hall 10
INTEGRATIVE BIOLOGY C32 S 106 DIS; 23728; Fr 2-3P, Jacobs Hall 10

LETTERS & SCIENCE C30Z S 101 DIS; 23716; Fr 9-10A, Jacobs Hall 10
LETTERS & SCIENCE C30Z S 102 DIS; 23717; Fr 10-11A, Jacobs Hall 10
LETTERS & SCIENCE C30Z S 103 DIS; 23718; Fr 11-12P, Jacobs Hall 10
LETTERS & SCIENCE C30Z S 104 DIS; 23719; Fr 12-1P, Jacobs Hall 10
LETTERS & SCIENCE C30Z S 105 DIS; 23720; Fr 1-2P, Jacobs Hall 10
LETTERS & SCIENCE C30Z S 106 DIS; 23721; Fr 2-3P, Jacobs Hall 10

Location. Our first Discussion Period will be in-person on Jan 20 and held in 10 Jacobs Hall. Attendance required. If you have COVID or Flu symptoms, please do not attend in-person activities.

Rationale: Bioinspired design views the process of how we learn from Nature as an innovation strategy translating principles of function, performance, and aesthetics from biology to human

technology. The creative design process is driven by interdisciplinary exchange among engineering, biology, medicine, art, architecture and business. Diverse teams of students will collaborate on, create, and present original bioinspired design projects learning from our **Design Innovation Institute in Jacobs Hall**. Project teams will have opportunities to learn about team dynamics and how to make a successful team. Lectures will address the biomimicry design process from original scientific breakthroughs to entrepreneurial start-ups using case studies that include gecko-inspired adhesives, robots that run, fly and swim, artificial muscles, computer animation, medical devices and prosthetics while highlighting health, the environment, and safety.

Social Mixer Gallery to Facilitate Effective Teamwork:
We will create Team Slide Galleries containing information about you so that you can get to know your classmates. On one PowerPoint Slide (.pptx), you will introduce yourself to your teammates with a short, one-minute video, pictures, preferences, and your expertise. Of course, your participation is optional. You need not add all the requested information. Practically, we see that this exercise can facilitate future team assignments. It also helps us get to know you.

Team Connections. Each week, design teams will add a Connection Link to share Bioinspired Design connections for classmates to browse, explore, and discuss. These URLs can include relevant design or biology courses on campus; links to campus organizations, clubs, institutes, and competitions interested in design; biological discoveries and bioinspired designs from news and journals, and; global research, centers, institutes, and internships, outreach opportunities, and competitions. Only one team member needs to submit. Each team is responsible to check and make sure their Connection has been registered in the Assignment page. If it is not there, then you will not receive credit. We will select 3 teams to deliver a one minute presentation of their team Connection to the class.

Individual Connections. Each week, we would like you to view the past week's submissions and comment on any you find interesting or helpful. You will not be graded based on the number of comments, questions, or responses you submit, but please do submit at least one each week. Each member of your team should do this individually. Additional information will be provided in the relevant bCourses Discussion.

Midterm Exam. The Midterm Exam will cover material from lectures 1-7. Your exam will NOT be the typical one-hour proctored exam. We have designed a new, far less stressful, and equitable exam. You will be given 14 days to complete the midterm exam. The exam will consist of you selecting a scientific publication, getting it approved, and then telling us how the discovery uses the concepts learned in class. You will decompose the paper, do an analogy check, and create an invention. Given on February 9 and due February 22. It will be 20% of the total grade. It will cover lecture material from January 19 through and including February 9 and discussion section material through February 18. You will have one week to select your research publication and one week submit the midterm exam as a bCourses Quiz Assignment.

Bioinspired Design Projects: Four bioinspired design opportunities will be offered.

1. **Print a Prosthetic Hand for Children.** Early Makerspace experience.
2. **Create a Gecko-inspired adhesive.** In the first session, teams will manufacture a gecko inspired adhesive and analyze the adhesive. In the second design session, teams will use their gecko-inspired adhesive as a design tool to propose a new product.
3. **Build and Analyze a Legged Robot.** In the first session, teams will construct a legged robot provided by DASH Robotics. In the second design session, teams will use their robot as a design platform to propose a new product.
4. **Novel Bioinspired Design.** The final exam will be a 5 min video and poster of a bioinspired design of your team’s choice. Teams will select a journal publication with a

biological discovery and extract the principle. Teams will then create a mock-up, prototype, and/or computer simulation/animation in combination with the setting in which your design is to be used. Designs should include possible societal impacts (health, fitness, environment, safety, security, education, connections to others or community, assisting underserved, disabled populations or underdeveloped countries, sports and entertainment). Your final project must be uploaded to the assignment page in bCourses by 6PM on April 21st for your poster and April 28th for your video. You will NOT have a written exam during the May 10 slot. Your poster should be printed as early as possible before the Showcase on May 2 or 3rd. Both your poster and video will also be posted online using Adobe Behance.

Jacobs Maker Pass. All students will be required to get a Maker Pass for Jacobs Hall. To get your Maker Pass you must pass an online General Workshop Safety training and pay a $125 semester access fee to activate your Maker Pass (fee waivers are available for students with financial need). Detailed instructions can be found at makerpass.jacobshall.org. Check out all the resources at Jacobs! Maker Pass & Jacobs Project Support (JPS) Registration opens: Jan 10; JPS Service begins: Jan 17; Makerspace access begins: Jan 17; Hands-on trainings begin: Jan 23.

Grading (700 points)
Your grade will be determined by:
- 20 pts (~3%): Team *Connection* links (Points for web surfing!)
- 20 pts (~3%): Individual *Connection* tracking (Points for LIKING content!)
- 50 pts (~7%): Lecture Assignments (reflection and lecture questions)
- 50 pts (~7%): iClicker Cloud in-class responses
- 30 pts (~4%): Individual Makerspace Activity (prosthetic finger)
- 135 pts (~20%): Midterm (relating a paper to lectures)
- 15 pts (~2%): Individual Design Assignment (Decompose papers)
- 90 pts (~13%): Team Design Project #1 Gecko-inspired adhesive
- 90 pts (~13%): Team Design Project #2 Legged robot
- 180 pts (~26%): Team Final Design Project #3 (5 min team video and poster)
- 15 pts (~2%): Points for Questionnaires if response rates are greater than 75% for each.

Tentative Assignment Due Date Check List. We have created a check list to help you track each point. https://bcourses.berkeley.edu/courses/1510305/pages/tentative-assignment-due-date-checklist/

Support Passes. We recognize that we all have circumstances that challenge us and can be beyond our control. Therefore, we will show our support by granting “no questions asked” passes where no assignment need be submitted, and no points will be deducted. We offer everyone 6 Support Passes: 3 for *Lecture Reflection and Question Assignments* and 3 for *Individual Connections*. We will leave these unsubmitted assignments blank in bCourses. If you exceed the number of Support Passes, we will contact you to see if we can help.

Final Grades are based both on an absolute scale along with potential positive effort adjustments. Our absolute percentage scale is 100-90 A; 90-80 B; 80-70 C; 70-60 D; <60 F. In the unlikely event that assignments or grading show that the absolute scale is too high, we will lower the curve (e.g., 100-85 A; 85-75 B; etc; We will not raise it to make it more difficult to get a grade). At the end of the semester, we will all meet to discuss any student who is in the gray zone between grades. If you have shown high effort, engagement, and improvement, you will receive the next higher grade. We will not reduce a student’s grade to a lower grade.

Communication

Ed Discussion (EdD) - Online Discussion Forum: We will use Ed Discussion (EdD) as our online forum. EdD is a venue to ask questions, discuss problems, and help each other out. EdD is a question-and-answer system designed to streamline class discussion outside of the classroom. It should always be your first recourse for seeking answers to your questions about the course, lecture or reading material, or the assignments. You are encouraged to post any questions you might have about the course material, logistics, and assignments. Please post questions about the material or the administration of the course to the discussion board - but before posting a question, read the discussion board and the syllabus and other course materials in case the question has already been answered. If you know the answer to a question, you are encouraged to post it. By default, your posts are visible to the course staff and other students, and you should prefer this mode so that others can benefit from your question and the answer. We will monitor the discussion board, endorse answers, and reply. You can post privately so that only the course staff can see your question. If you post privately, we reserve the right to make your question public if we think the class will benefit. You can also post anonymously if you wish. Do not post your SID on EdD. Please avoid email if EdD will do. Posts may be anonymous to the class, but not to the instructor. We expect that posts will be pertinent and respectful. Don't use EdD as a place to complain about, insult or harass anyone. Please do send us email if you have a real emergency or need to discuss something privately.

Social Media
Facebook
Follow our HHMI Bioinspired Design page for program updates:
https://www.facebook.com/bioinspireddesign/
Get Involved with the Bio-Inspired Design @ Berkeley RSO:
https://www.biodesign.community/

Instagram
a. When posting Bioinspired Design course or related images and video, please tag @hhmi_bioinspired_design and add #HHMIBioinspiredDesign
b. Please feel free to follow us @hhmi_bioinspired_design

Twitter
a. When tweeting a Bioinspired Design course or related post, please mention @HHMIBioDesign and add #HHMIBioinspiredDesign
b. Please feel free to follow us at @HHMIBioDesign

Box
We will be using Box for collaborative storage and workspaces. Once you are assigned to a Design Team, you will be notified of a shared folder for your team members.

Join Berkeley's BioDesign Community RSO. Belong to a fun and exciting club to explore your interests, participate in events, and meet others. All are welcome. There are opportunities to be an officer in the future.
https://biodesign.berkeley.edu/biod/

Assistance, Policies & Conduct
A Perspective on Course Redesign for the Times
We can't imagine all the challenges and inequities you might have been and still be experiencing. It is your course and we are here to help. Please do not hesitate to alert us to any issues beyond the course that you have with housing or food security, physical and mental health, connectivity, or safety. Do not feel embarrassed to ask for help. Remember that seeking help is a courageous thing to do—for yourself and for those who care about you. See our General Support Availability Announcement below.

Our goal for this course is to preserve and enhance all the features and experiences that students have told us in the past are most valuable. We are now adding new solutions to enhance the course that we developed and tested during remote delivery the last 2 years. Based on the experimentation and feedback we received from students, we have created new approaches that directly deal with existing inequities that were exacerbated by the pandemic and racial trauma. We always welcome new ideas.

Coronavirus Classroom (https://coronavirus.berkeley.edu/) and Campus Access (https://coronavirus.berkeley.edu/campus-access/)

1. Comply with current face-covering requirements. EH&S is providing free masks in Eshleman Hall. Face coverings are no longer required, but strongly recommended indoors.
2. Activate CA Notify
3. Comply with all posted signage and requirement to not enter facilities if experiencing symptoms of COVID-19.
4. Mitigation for Fall 2022 (https://sa.berkeley.edu/covid19/messages/2022/8/4/covid-19-mitigation-measures-fall-2022) and Testing (https://uhs.berkeley.edu/coronavirus/testing-covid-19).
5. Comply with University of California COVID-19 Vaccine Policy (full vaccination with booster)
6. Comply with University of California Flu Vaccine Policy
7. Campus has transitioned to a vending machine option to get free at-home PCR tests.

Monkeypox information. Transmission and vaccines.

General Support Availability Announcement
We pledge to make your experience this semester worth your effort.

Inclusion: We are committed to creating an environment welcoming of all students where everyone can fulfill their potential for learning. To do so, we intend to support a diversity of perspectives and experiences and respect each other's identities and backgrounds (including race/ethnicity, nationality, gender identity, socioeconomic class, sexual orientation, language, religion, ability, etc.). If you need accommodations that provide equitable access, (e.g., religious observance, physical or mental health concerns, insufficient resources, etc.) please check https://diversity.berkeley.edu/. If you have a name and/or pronouns that differ from your legal name, designate a preferred name for use in the classroom at: https://registrar.berkeley.edu/academic-records/your-name-records-rosters. As a participant in this class, please recognize that you can be proactive about making other students feel included and respected.

Resources & Support for Sexual Harassment and Assault: The University of California is committed to creating and maintaining a community where all individuals who participate in University programs and activities can work and learn together in an environment free of harassment, exploitation, or intimidation. Sexual harassment and violence are prohibited both by law and by University of California policy. Sexual harassment is defined as unwelcome sexual advances; requests for sexual favors; and other verbal, nonverbal or physical contact of a sexual nature. Sexual harassment includes conduct that explicitly or implicitly affects a person's employment or education or interferes with a person's work or educational performance or creates an environment such that a reasonable person would find the conduct intimidating, hostile or offensive. Sexual harassment includes sexual violence. https://sa.berkeley.edu/conduct/sexual-harassment

Disabled Student's Program (DSP 260 César Chávez Student Center #4250; 510-642-0518). DSP serves students with disabilities of all kinds, including temporary disabilities. https://dsp.berkeley.edu/students

COVID-19 resources and support. We care about your health and safety. Please check:

https://coronavirus.berkeley.edu
https://uhs.berkeley.edu
This includes support for mental health issues at Counseling and Psychological Services (CAPS)
https://uhs.berkeley.edu/caps
and **Crisis Counseling for Urgent Concerns**
https://uhs.berkeley.edu/counseling/urgent

The Division of Equity & Inclusion is providing support virtually for**:**
Basic needs – Food and Housing
https://basicneeds.berkeley.edu
https://sa.berkeley.edu/covid19
Disability Access & Compliance
https://dac.berkeley.edu/message-campus-disability-community-re-covid-19
Health and Wellness
https://diversity.berkeley.edu/health-and-wellness
Student Technology Equity Program (STEP)
Resource for connecting laptops, Wi-fi hotspots, and other technology you might need.
https://technology.berkeley.edu/STEP
Academic Accommodations Hub
This site provides support resources and academic accommodations to ensure all students have a fair chance at academic success.
https://evcp.berkeley.edu/programs-resources/academic-accommodations-hub

Grading & Exam Format and Proctoring
We have participated in UC Berkeley's Grading for Equity - Promoting Excellence in All Students Through Equitable Grading and Assessment Workshop Series.
As a result, we have redesigned our course assignments to reduce stress, eliminate proctoring, be as fair as possible, and even enhance your learning experience. Since these are new approaches, we need your immediate feedback if there are issues to be addressed or if you have any ideas to improve these approaches.

The student community at UC Berkeley has adopted the following Honor Code.
"As a member of the UC Berkeley community, I act with honesty, integrity, and respect for others." The expectation is that you will adhere to this code, as your instructors pledge to do as well. For more information, please visit this website: https://teaching.berkeley.edu/berkeley-honor-code

Policy on UC Berkeley's Code of Student Conduct. All students are expected to follow the University of California at Berkeley's Campus Code of Student Conduct, as is published at http://sa.berkeley.edu/uga/codeofconduct. Cheating, plagiarism, or any other form of academic dishonesty will not be tolerated (102.01).

Policy on plagiarism. In academia ideas are our commodity. Taking direct text or ideas or data or results from someone else's work without properly giving credit is essentially stealing. Representing them as your own is unethical and disrespectful. This is unacceptable in a university and we take it very seriously here at UC Berkeley. We will pursue disciplinary action against students who plagiarize in this class.

Policy on accommodation of religious holidays and other scheduling conflicts: In compliance with Education code, Section 92640(a), it is the official policy of the University of California at Berkeley to permit any student to undergo a test or examination, without penalty, at a time when that activity would not violate the student's religious creed, unless administering the examination at an alternative time would impose an undue hardship which could not reasonably have been avoided. All deadlines and the midterm exam date (Feb. 24) are noted on this syllabus. It is your responsibility to note any conflicts with the exam and due dates and let the instructor and GSIs know. If you have other scheduling conflicts, please see the guidelines at: https://teaching.berkeley.edu/academic-calendar-and-student-accommodations-campus-policies-and-guidelines

Policy on exams, lecture, and design assignments due dates. We will have due dates for all assignments. Keeping pace is in your best interest, because material builds on that all comes before. Given the challenging circumstances and the inequities present, we will be as flexible as possible with dues. If you do find yourself facing an unforeseen circumstance, please contact us as soon as possible to let us know.

Policy on students with learning disabilities. Disabled students please make certain that your letter from the Disabled Students Program is sent to us as soon as possible. See http://dsp.berkeley.edu

Policy on recording lectures or selling slides or notes. Posting or selling video recordings are expressly prohibited by University of California policy. Lectures are comprised of copyrighted intellectual material, and the recording and sharing of that material without express permission is a violation of copyright and personal privacy. Additionally, the discussion of sensitive issues in this class requires that students feel safe to express their opinions without fear of future reprisal or exposure. Note, it is a violation of copyright to sell notes, assignments or exams to on-line companies.

Questionnaires and self-reports. You will be asked to take part in a series of questionnaires to help improve the course. These are anonymous and you are not required to answer all questions. You will be given 15 points if all surveys attain over 75% response rates. Surveys have IRB approval.

Integrative Biology C32; L&S Discovery Course C30Z

TENTATIVE COURSE SCHEDULE, Spring 2023

Date	Lecture (245 Li Ka Shing)	Discussion (10 Jacobs Hall)
18 January	1. Introduction	
20 January		1. Introduction & orientation; Literature searching and AI; Pre-Makerspace Activity Intro.; Team Selection Surveys; Get Maker Pass; Assign Gecko Paper Assignment #1
23 January	2. BioDiscovery - How to discover Nature's principles?	Publish Teaming Survey
25 January	3. BioDesign - How do I design from Nature?	
27 January		2. Teams Formed; Assign Gecko Paper #2; Early Maker Space Activity 3D Printing and Demo
30 January	4. BioConstraints-How are Nature's designs compromised?	
1 February	5. BioSelection - How do I select the best inspiration?	
3 February		3. Review Paper Assignment #2. Discovery Decomposition & Analogy Check; Pick up finger & prepare for hand assembly; Teaming Activity (Seed dispersal)
6 February	6. BioScaling - How do I consider size?	
8 February	7. BioComplexity - How to simplify & extract principles?	Begin Midterm, Select Own Publication for Approval
10 February		4. Hand Assembly; Midterm Instructions.
13 February	8. BioAdhesion	
15 February	9. BioAdhesion – Gecko	Midterm Paper Approval Due
17 February		5. Review example for Midterm; Prepare for Gecko Synthesis Project #1
20 February	Holiday	
22 February	**10. Midterm Exam**	Midterm Due
24 February		6. Gecko adhesive Design Project #1 Part 1; Manufacture and Test
27 February	11. BioMotion-Walk	
1 March	12. BioMotion-Running	
3 March		7. Gecko adhesive Design Project #1 Part 2; Data Science & Design
6 March	13. BioControl	
8 March	14. BioSensing	
10 March		8. DASH robot Design Project #2 Part 1; Assemble and Test
13 March	15. BioLearning	
15 March	16. BioPower	
17 March		9. DASH robot Design Project #2 Part 2; Data Science & Design
20 March	17. BioMaterials	
22 March	18. BioMotion-Swim	
24 March		10. Final Design Project #3. Select bio paper for Final Project.
27 March	Spring Recess	
29 March	Spring Recess	
31 March	Spring Recess	
3 April	19. BioMotion-Fly	
5 April	20. BioProsthetics	
7 April		11. Work on final project; Teaming Exercises

10 April	21. BioAnimation	
12 April	22. BioEnginuity Hub – Guest Lecture	
14 April		12. Work on final project; Visit Hub
17 April	23. BioMaterials and Ai – Guest Lecture	
19 April	24. BioEntrepreneurship – Dash Robotics – Guest Lecture	
21 April		13. Work on final project; Poster upload
24 April	25. BioArchitecture – Guest Lecture	
26 April	26. Summary	
28 April		14. Submit final video project