Integrative Biology C32

L&S Discovery Course C30Z

3 UNITS
Course may be used to satisfy the Biological Science breadth requirement in Letters and Science

Lower Division

BIOINSPIRED DESIGN

Website: http://polypedal.berkeley.edu/?page_id=691

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

Meeting time and place: Monday & Wednesday. 245 Li Ka Shing. 12:00PM - 1:00PM

Discussion sections:
One hour per week
INTEGRATIVE BIOLOGY C32 S 101 DIS; 32667; Fr 9-10A, 220 Jacobs Hall
INTEGRATIVE BIOLOGY C32 S 102 DIS; 32676; Fr 10-11A, 220 Jacobs Hall
INTEGRATIVE BIOLOGY C32 S 103 DIS; 32677; Fr 11-12P, 220 Jacobs Hall
INTEGRATIVE BIOLOGY C32 S 104 DIS; 32678; Fr 12-1P, 220 Jacobs Hall
INTEGRATIVE BIOLOGY C32 S 105 DIS; 32679; Fr 1-2P, 220 Jacobs Hall
INTEGRATIVE BIOLOGY C32 S 106 DIS; 32680; Fr 2-3P, 220 Jacobs Hall

LETTERS & SCIENCE C30Z S 101 DIS; 32656; Fr 9-10A, 220 Jacobs Hall
LETTERS & SCIENCE C30Z S 102 DIS; 32657; Fr 10-11A, 220 Jacobs Hall
LETTERS & SCIENCE C30Z S 103 DIS; 32658; Fr 11-12P, 220 Jacobs Hall
LETTERS & SCIENCE C30Z S 104 DIS; 32659; Fr 12-1P, 220 Jacobs Hall
LETTERS & SCIENCE C30Z S 105 DIS; 32660; Fr 1-2P, 220 Jacobs Hall
LETTERS & SCIENCE C30Z S 106 DIS; 32661; Fr 2-3P, 220 Jacobs Hall

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 in 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.

Connections: Before every Monday class, design teams will add a *Connection link* via forms provided within bCourses Assignments to share Bioinspired Design connections. 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, and institutes.

Bioinspired Design Projects: Three bioinspired design opportunities will be offered.
  1. 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.
  2. Build 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 tool to propose a new product.
  3. Novel Bioinspired Design. The final exam will be a 5 min video 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). Resources from Jacobs Hall will be available. The video must be posted to the assignment page in bCourses by midnight on April 28th. (You will NOT have a written exam during the May 9 slot.) Design Showcase Presentation and Awards for Top Designs, May 2 11:45-1:30 Jacobs Hall.

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 $75 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.

iClickers. The iClicker is a fun and effective tool for promoting engagement and interaction in the classroom. iClicker is a personal response system that allows you to respond to questions that are posed during class, and you will be graded on that feedback and class participation. iClicker questions will be given every lecture, so if you miss the lecture, your grade will be lowered. We grant 3 unexcused absences from lecture with respect to iClicker questions before points are lost. You are required to purchase an iClicker remote for in-class participation. iClickers will be used during every lecture, so you are responsible for bringing your remote to each class, beginning with the first design lecture (Jan 22). It is recommended to bring two spare AAA batteries. You will need to register your iClicker remote online. If you bought your iClicker used or borrowed it, it will probably have been registered to the previous owner. You need to re-register it in your

name. iClicker registration is found near the bottom of the menu on the left-hand side of the main bCourses page, just above "Settings".

The remote ID is the series of numbers and sometimes letters found on the bottom of the back of your iClicker remote. The iClicker frequency used in this class will be "AA", but this may be subject to change. **iClicker technical support**. Do not ask the professor or GSIs for technical assistance or for repairs as they do not have the expertise. If your iClicker is defective, it is your responsibility to have it repaired or replace it. The UCB student iClicker information page is at https://www.ets.berkeley.edu/services-facilities/clickers/students-getting-started.

Conversing with others about iClicker questions is not only permitted, it is encouraged. However, you must submit your own answer with your own registered iClicker. Using someone else's iClicker is considered cheating by both the user and the owner of the iClicker. GSIs will monitor for multiple iClicker use.

Grading
Your grade will be determined by:
  5%: *Connection* links submitted by teams (Points for web surfing!)
  5%: Class participation (iClicker responses)
25%: Midterm (In-class multiple choice based on lecture and readings)
  5%: Discussion Section Assignments (Decompose two research papers)
15%: Design Project #1 Gecko-inspired adhesive design
15%: Design Project #2 Design legged robot (DASH)
30%: Final Project (5 min team video)
Final grades are based both on an absolute scale, as well as a curve, along with potential positive effort adjustments. Our absolute scale is 100-90 A; 90-80 B; 80-70 C; 70-60 D; <60 F. Curve – 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 effort, engagement, and improvement, you will receive the next higher grade. We will not pull down a student to a lower grade.

Communication
Piazza **- Online Discussion Forum**
We will use *Piazza* as our online forum. Please sign up.
Piazza is your main venue to ask questions, discuss problems, and help each other out.
Social Media
Facebook
a. Join our private Bioinspired Design SP18 class group and feel free to post questions or comments and initiate class-related discussions:
https://www.facebook.com/groups/1669903953059631
b. Please feel free to like and follow our HHMI Bioinspired Design page for program updates:
https://www.facebook.com/bioinspireddesign/
Instagram
a. When posting Bioinspired Design course or related images and video, please tag @hhmi_bioinspired_design and add #BioinspiredDesignSP18
b. Please feel free to follow us @hhmi_bioinspired_design so that we can follow you in return.
Twitter
a. When tweeting a Bioinspired Design course or related post, please mention @HHMIBioDesign and add #BioinspiredDesignSP18
b. Please feel free to follow us at @HHMIBioDesign so that we can follow you in return.
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.

Policies & Conduct
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 are noted on this syllabus. It is your responsibility to note any conflicts with the exam and due dates and let the instructor or 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 exam. We will not administer a make-up midterm exam. If you have to miss an exam for a valid, unforeseeable and urgent reason, your grade will be pro-rated. If you do find yourself facing an unforeseen emergency, please contact us as soon as possible to let us know. Documentation will be required. Please note: this policy is for valid emergencies. Students are otherwise expected to complete all assignments. While we will remind you about exam logistics, you are responsible for making sure that you complete every question and turn in the exam before you leave the room in which it is administered. We will not accept your exam after you have left the classroom.

Policy on design assignments. Only a documented illness or some other unforeseeable emergency will allow us to grant you a later due date for a design assignment than what is posted on this syllabus or in a bCourses Announcement. Anticipated events do not count as acceptable reasons for turning in your assignment late as you can and should plan ahead and turn your assignment in early. If your assigmnent is late, please still submit as soon as possible. You will lose a pooint for each day late.

Policy on attendance for lecture. We do not enforce attendance. That said, be advised that the midterm exam content will primarily derive from lectures. It is *strongly* recommended that you do not skip lecture. iClicker questions will be given every lecture, so if you miss the lecture, your grade will be lowered. We grant 3 unexcused absenses from lecture with respect to iCliker questions before points are lost.

Policy on attendance for discussion section. Again, we do not enforce attendance, but will periodically take attendance. Design project attendance is mandatory and is part of your grade. It is *strongly* recommended that you do not skip your discussion section.

Policy on cell phones. All cell phones need to be silenced during class. We all understand that there may be occasional situations in which you need to receive or send a text, but keep in mind that excessive texting or other use of your phones is distracting to other people in the class. If your cell phone activity becomes disruptive, you will be asked to leave the class. Cell phones must be turned off and put away during the midterm exam. If

you use your phone (even if it just rings) during an exam you will be asked to leave and you will receive a zero on the exam.

Policy on students with learning disabilities. Disabled students please make certain that your letter from the Disabled Students Program is sent to the instructor at least 2 weeks in advance of the exam so that appropriate accommodations can be made. See http://dsp.berkeley.edu

Policy on recording lectures. Lectures may NOT be recorded using audio or photographic equipment without the prior written permission of Professor Full or by formal recommendation of the Disabled Students' Program. 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. Students caught recording course lectures using cameras, audio, or video equipment without prior notification and permission will be asked to leave the class. In addition, it is a violation of copyright to sell notes, assignments or exams to on-line companies.

Surveys and self-reports. You will be asked to take part in a series of surveys and self-reports to help improve the course. These are anonymous and you are not required to answer all questions.

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TENTATIVE COURSE SCHEDULE,

Date	Lecture (245 Li Ka Shing)	Discussion (220 Jacobs Hall)
17 January	1. Introduction	
19 January		1. Introduction & orientation; Literature searching; Assign Gecko paper #1
22 January	2. BioDiscovery - How to discover Nature's principles?	Publish Teaming Survey
24 January	3. BioDesign - How do I design from Nature?	
26 January		2. Understanding scientific publications; Assign Gecko paper #2; Form Teams
29 January	4. BioConstraints - How are Nature's designs compromised?	
31 January	5. BioSelection - How do I select the best inspiration?	
2 February		3. Review Assignment #2. Discovery Decomposition & Analogy Check.Assignment #3 Select own publication and do Decomposition and Check
5 February	6. BioScaling - How do I consider size?	
7 February	7. BioComplexity - How to simplify &extract principles?	
9 February		4. Assist with Assignment #3. Discuss teaming tools
12 February	8. BioAdhesion	
14 February	9. BioAdhesion - Gecko	
16 February		5. Review Assignment #3; Help for Midterm
19 February	Holiday	
21 February	**10. Midterm Exam**	
23 February		6. Gecko adhesive design project Part 1
26 February	11. BioMotion-Walk	
28 February	12. BioMotion-Running	
2 March		7. Gecko adhesive design project Part 2
5 March	13. BioControl	
7 March	14. BioSensing	
9 March		8. DASH robot design project Part 1
12 March	15. BioPower - Nature	
14 March	16. BioPower - Technology	
16 March		9. DASH robot design project Part 2
19 March	17. BioMaterials	
21 March	18. BioMotion-Swim	
23 March		10. Final Design Project. Suggest bio paper for final project.
26 March	Spring Vacation	
28 March	Spring Vacation	

30 March	Spring Vacation	
2 April	19. BioMotion-Fly 19. BioMotion-Swim	
4 April	20. BioProsthetics	
6 April		Work on final project
9 April	21. BioAnimation	
11 April	22. BioGreenChem	
13 April		Work on final project
16 April	23. BioArchitecture	
18 April	24. BioEntrepreneurship	
20 April		Work on final project
23 April	25. Team Project Preparation	
25 April	26. Summary	
28 April		Submit final video project