BIO-INSPIRED DESIGN / 3-0-3 BIOS / ME / MSE / BMED / ISYE 4740 / BIOS 8803 / ID 4843. 3 cr.

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Georgia Institute of Technology
Fall 2025 / Monday Wednesday 11-1215pm; College of Computing 102
TA: Anuradha Lal. Office hours by appointment.

Introduction
The course provides an opportunity for students in Biology, BioMedical Engineering, Industrial and Systems Engineering, Mechanical Engineering, and Material Sciences Engineering and Industrial Design to work together in interdisciplinary teams.

Course Overview This course introduces students to the emerging and exciting field of Biologically Inspired Design (BID) through a scaffolded engagement with biological concepts; different modes and methods of scientific inquiry and design exploration; and current approaches to BID research and practice in engineering, science, design, and art.

Its motivating questions are:
How could science and design engage in a productive dialog?
How could biology inform and inspire design?
How does one translate biological concepts, specimens, and behaviors into design proposals and engineered artifacts?

Learning Goals
Bio Literacy. Ability to observe, understand, analyze biological concepts, phenomena, artifacts, and scientific literature: (evolution, homeostasis, physiology, bio-mechanics, bio-materials, sensory systems);
Design Literacy. Ability to translate scientific knowledge into compelling design proposals and propositions.
Interdisciplinary Literacy. Familiarity with diverse methods, approaches, tools, representations, and data.

Course Requirements
All assignments are posted on Canvas. Please review assignments in advance of their due dates and ask any questions.
All assignments are to be uploaded to Canvas. Completed assignments will be discussed and reviewed in class.
All assignments must be completed to receive a passing grade.
Course requires a completed prototype to be submitted by end of semester. Thus, there is an expectation for time to be committed outside of scheduled course time.

Course Readings and Resources
All readings and resources for the assignments are uploaded to Canvas.

Attendance No unexcused absences. Given the compressed schedule, missing class will affect the quality of the work you produce. Unexcused absences in more than two classes will result in a grade penalty.

Retention of Work
Georgia Tech has the right to retain any student project, whether it is for display, accreditation, documentation, or any other educational or legal purpose.

Grade Scale
The grade scale for all individual components of the course as well as for completion of the final course grade will be as follows:
Points Grade Description
90-100 A Excellent
80-89 B Good
70-79 C Satisfactory
60-69 D Minimally Passing
0-59 F Failing
There will be no incompletes awarded without appropriate reason nor without a prior meeting, in person, of the student and the instructor.

Academic Integrity
Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. For information on Georgia Tech's Academic Honor Code, please see *The Georgia Institute of Technology 2012-2013 Catalog* at http://www.catalog.gatech.edu/. Refer specifically to section XVIII entitled "Academic Honor Code" at http://www.catalog.gatech.edu/rules/1.php for the principles, policies, and procedures governing issues of academic integrity.

Student and Instructor Conduct
All persons in the classroom are expected to behave with courtesy towards others and in a way that does not interfere with the regular conduct of the class. Students are expected to be on time for class. Cell phones are to be turned off when students enter the classroom and should remain off for the duration of class.

Accommodation of Disabilities
Any student with a disability that may require accommodation should contact ADAPTS (Access Disabled Assistance Program for Tech Students) at (404) 894.2564 or http://www.adapts.gatech.edu/ to make an appointment to discuss his or her special needs and obtain an accommodations letter. He or she should also schedule an appointment to speak with the instructor.

Nota Bene
With the exception of grade and attendance policies, parts of this syllabus are subject to change with advance notice, as deemed appropriate by the instructor.

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Wk #	Theme	Activity	Assignment [A]
1: Aug 18,20	Wonders of the World: AUCTION BID intro. Web of Science. SBF. Syllabus	**A1**: Superlatives in Nature Readings: Yen et al., Fish, Bhushan	A2: Find key article. Present FD using SBF Aug. 22: last day to register
2: Aug. 25,27	Introduction to Bio Inspired Design: Bhushan, Fish Dunlop Racket BID. Form teams. Concept readings: squid, damselfly, roach, bees.	Phylogenetic relatedness, convergent evolution. Bio inspiration vs deep **A2** due. References by Organism: select 1 article from each group, e.g. 2 articles/person.	A3: FD of theme article. BioTheme selection: biolocomotion, biosensing, physiology, biomaterials.
3: Sep. 3	**Labor Day**	Search strategies, Koans, Gorb chart. Discuss A2. **A3** theme presentation.	A4: Functional Matrix of 25 organisms.
4: Sep. 8,10	**Evolution**: Weissburg Readings: Vogel	Continue discussion of BID process. Scientific method, Problem vs Solution, Compound vs multiple analogies **A4** due.	A5: Found object Note: First presentation of DOSSIER in 2 weeks.
5: Sep. 15,17	**Biomechanics**: Fish [R] Discuss readings: Vogel, Full, Koditschek, Goldman, Fish	Analogical reasoning **A5**: Found Object due.	A6: QA Gecko
6: Sep. 22,24	**BioMaterial**: Alison Sweeney: bio inspired photovoltaics Discuss readings: Mattheck, Vincent, Nadler **BIOSensing**: Rolf Mueller	Bio inspiration: Class dossier Functional Matrix **Dossier presentations.** **A6**: QA gecko	A7: Design Dossiers BioInspired **Materials**: Brooke Flammang and Aimy Wissa.
7: Sep.29, Oct. 1	**Physiology**: Fudge Readings: KleinhenzTAUTZ et al 2003	Design process and design thinking: Li [recording] **A7**: Design dossiers, self study are due	A8: Landscape Analysis Bio Inspired Materials: NikeShoe, Shower Caddy.
8: Oct. 6, [fall break], 8	Fall Break [Oct. 6, 7] Iterate heavily on your sketches!	**A8**: landscape analysis MODA tour [R] Synthesis update.	Design and Sketch A9: Sketches Make Low fidelity models: cardboard, clay, glue, scissors….in class
9: Oct. 13,15	Tour makerspaces: learn ONE tool: Hive/Invention/Kendeda	Share individual SKETCHes. Decide/defend TEAM best sketch. **A9** Sketches are due	A10: Evaluative chart [disc]
10: Oct. 20,22	Helms: biodesign approach, 4 box application space. Creativity	In class work on prototype. Present TOOL. **A10**: Evaluative charts.	A11: Low Fidelity Prototype models Oct. 26: last day to withdraw
11: Oct. 27,29	Hierarchy in Nature: Yen Natural Glues, Bike Helmet	In class work on poster. **A11**: Prototype review due. Submit design for review. Tool use report	A12: Initial design. Define GOALS and needs for your design [materials, tools, etc.]
12: Nov.3,5	High fidelity models. Sam Thurman [Arch] Economy of materials: Vincent, Yen	Teamwork. Open studio **A12**: Poster due.	A13: prototype 2
13: Nov. 10,12	Nov. 11: prepare pitch to **Wayne Li** for his evaluation	Teamwork. Prototype development **A13**: Prototype 2 due	Work on model A14: Final presentations
14: Nov. 17,19	A14: Final presentations: 2 teams	**A14**: Final presentations: 2 teams	A14: Present final models Synthesis discussion [grad students]
15: Nov. 24,26	A14: Final presentations: 2 teams Self Study due Dec. 1	Thanksgiving [Nov. 27]	A14: Final presentations
16: Dec. 1	Value of Nature: Norton, Quitmeyer Last day of class	Rebeccah Pailes-Friedman [Pratt]. The HeroWear Apex Exosuit, a soft goods product design by Interwoven getinterwoven.com;	**A15**: Final report, poster, prototype due **Dec. 8**
Dec. 8	Final Exam [none]	final report, prototype, poster due	Grades: Dec. 15, noon.