

Engineering Tripos Part IIB, 4G4: Biomimetics, 2019-20

Module Leader

[Dr F. Iida](#) [1]

Lecturers

[Dr F. Iida](#), [Dr W. Federle](#), [Prof H. Babinsky](#), [Dr T. Stone](#), [Dr S. Vignolini](#) [2]

Timing and Structure

Lent term. 14 lectures (Week 1-7) + 2 lecture slots for group project presentations (Week 8). Assessment: 100% coursework

Aims

The aims of the course are to:

- Engineering means to adopt and adapt ideas from nature and make new engineering entities.
- Interdisciplinary communication between engineers and biologists
- Plan and conduct of biomimetic research projects
- Professional presentation of research proposals and reports

Objectives

As specific objectives, by the end of the course students should be able to:

- Examples of biomimetics research from lectures
- Effective means to conduct literature search
- How to select and structure innovative research projects
- How to conduct a biomimetics project in groups
- Practicing professional presentations

Content

This module aims to introduce methods of conducting interdisciplinary research of biomimetics. We provide lectures about various biomimetics projects, and the students will apply knowledge and techniques to their own group projects.

Introduction and Project assignment (F. Iida, W. Federle, CUED) (2L)

- Introduction of the module;
- Introduction of biomimetics research (concepts and methods)
- Methods of writing research proposals and reports

Bioinspired legged locomotion (F. Iida, CUED) (2L)

- Foundation of biological locomotion
- Models of legged locomotion

- Analysis, experiments, and applications

Biomimetic adhesion and adhesives (W. Federle, Zoology) (4L)

- Foundation of biological adhesion
- Models of biological adhesion
- Analysis, experiments and application

Orthotic design and assessment (T. Stone, Addenbrooks) (2L)

- Fundamentals of orthotic designs
- Methods of manufacturing and assessment
- Challenges and perspectives

Biomimetic flight dynamics (H. Babinsky, CUED, 2L)

- Foundation of biological flight locomotion
- Models of flapping flight
- Analysis, experiments and applications

Bio-mimetic materials (S. Vignolini, Chemistry, 2L)

- Foundation of bio-mimetic materials for mechanical support
- Foundation of bio-mimetic materials for visual appearance
- Bio-materials for biomimetics
- Models, methods, and applications

Project Presentations (2L)**Coursework**

100% coursework assessment consisting of:

- Written report 1 (30%): Group project proposal due on Friday (4pm) Week 5. Maximum 10 pages. Assessment criteria are the detailed descriptions about problem statement, literature review, hypotheses (model), and methods.
- Group presentation (20%): Oral presentations of group projects in Week 8. 10-minute presentation + 5 minute discussion. Assessment criteria are structure, clarity, completeness of the presentations as well as handling of questions and discussions.
- Written report 2 (50%): Individual report of group projects due on Friday 4pm Week 15. Maximum 10 pages. Assessment criteria are: quality of abstract, introduction, methods, results, discussions and conclusions.

Each project group will attend 2 group supervision sessions (compulsory, time-tabled for one hour each in Week 3 and 6), supervised by F Iida and W Federle (2-6 sessions each depending on the number of students). In these supervisions, project groups should report and discuss the contents of the project proposal (Week3), and that of the final presentations and reports (Week6). One demonstrator will also be available in Week 6-8, who assists further group projects.

| Coursework | Format | Due date & marks |
|---|-------------------|---------------------|
| Coursework activity #1: Written report 1 (30%): Group project proposal. Maximum 10 pages. Assessment criteria are the detailed descriptions about problem statement, literature review, hypotheses (model), and methods. | Group report | Anonymously marked |
| Coursework activity #2: Written report 2 (50%): Individual report of group projects. Maximum 10 pages. Assessment criteria are: quality of abstract, introduction, methods, results, discussions and conclusions. | Individual report | Anonymously marked |

Booklists

Please see the [Booklist for Group G Courses](#) [3] for references for this module.

Examination Guidelines

Please refer to [Form & conduct of the examinations](#) [4].

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Links

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[2] <mailto:fi224@cam.ac.uk>, wf222@cam.ac.uk, hb209@cam.ac.uk, sv319@cam.ac.uk

[3] <https://www.vle.cam.ac.uk/mod/book/view.php?id=364101&chapterid=56091>

[4] <https://teaching.eng.cam.ac.uk/content/form-conduct-examinations>