Functional Morphology and Biomechanics, Kiel University

Module biol-252
Biomechancs and Biomimetics: with the Focus on Surfaces

Prof. Dr. Stanislav N. Gorb

ENGLISH !

- Block course: **18-29.05.2020**
  - 8 days: 2 h/day lectures
    2 h/day practical part
  - 2 Tage: 7 h/day seminar
- Englisch
- oral exam 60%, seminar 40%, protocol: „yes“ or „no“

Content

Organisms: Arthropoda, Invertebrata, Vertebrata, plants

Content: Morphology of organs, adaptations to the environment, diversity of functional solutions, physical background of surface structures, evolutionary aspects

Goals: To learn about structure-function relationships in biological surfaces and about the potential to transfer biological solutions into technical/engineering applications. To explore the variety of methods in the surface science. One topic from very recent biology research or biomimetics developments will be suggested as seminar topic. The presentation ability will be tested.

Subdisciplines: Morphology, ultrastructure, evolution, biomechanics, preparation methods, microscopy

Equipment and Techniques: Binoculars, light microcopy, scanning electron microscopy (SEM), laser scanning microscopy (CLSM), 3D analysis of surfaces, friction and adhesion tests

Surfaces and Interfaces

- sensorics
- attachment
- drag reduction
- optics (anti-reflection)
- grinding
- anti-friction
- sound generation
- respiration
- thermoregulation
- coloration pattern
- self-cleaning

etc., etc....

Lectures

18-29.05.2020, Seminar room, 10. floor, Biocenter

1	**18.05,** 10:15-12:00	Functions of biological surfaces and interfaces
2	**19.05,** 8:15-10:00	Frictional and anti-frictional surfaces
3	**20.05,** 8:15-10:00	Nature's attachment technologies
4	**22.05,** 8:15-10:00	Anti-adhesive and «self-cleaning» surfaces
5	**25.05,** 10:15-12:00	Thermoregulation and prevention of drying, Sound generation, Optics
6	**26.05,** 10:15-12:00	Defence, grooming, sampling, filtrating, grinding and other functions
7	**27.05,** 8:15-10:00	Biomimetics of surfaces
8	**28.05,** 8:15-10:00	Methods of studies of biological surfaces and interfaces Guided tour in the department

Practical part

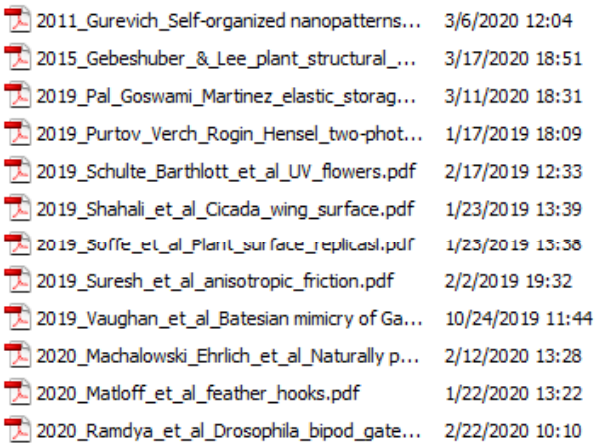
18-29.05.2020, 10. floor, Biocenter

Group 1 **Group 2**

Datum	Zeit	Thema	Objekt	Leiter
18.05	10:30-12:30, 13:30-15:30	Micro and nanostructures (SEM)	Animals and plants	E. Appel, A. Kovalev
19.05	10:30-12:30, 13:30-15:30	Surface analysis with CLSM (Confocal Laser Scanning Microscope)	Insects	J. Michels
20.05	10:30-12:30, 13:30-15:30	Contact Angle Measurements	Animals and plants	E. Gorb
22.05	10:30-12:30, 13:30-15:30	Force measurements (friction and adhesion)	Insects	D. Petersen
25.05 **26.05**	10:30-12:30, 13:30-15:30	Preparation to the seminar		
27.05	8:15 ->	Seminar		
28.05	8:15 ->	Praparation to the oral exam		
29.05	8:15 ->	Oral exam		

Seminar topics

27.05.2020, 8:15 ->
Seminar room, 10. floor, Biocenter



Protocol

Volume: min. 5 text pages

+ Images, diagrams, tables

Language: Englisch (Deutsch exceptionally, f.e. for non-MAMBE students)

Deadline: day of the oral exam

1 protocol for one topic of the practical part

Literature

- S. Vogel, Comparative Biomechanics: Life's Physical World
- W. Nachtigall, Biomechanik. Grundlagen - Beispiele - Übungen
- S.A. Wainwright, Mechanical Design in Organisms
- K. Kendall, Molecular Adhesion and its Applications
- E. Rabinowicz, Friction and Wear of Materials
- V.L. Popov, Kontaktmechanik und Reibung: Ein Lehr- und Anwendungensbuch von der Nanotribologie bis zur numerischen Simulation
- M. Scherge, S. Gorb, Biological Micro- and Nanaotribology: Nature's Solutions (Nanoscience and Technology)
- W. Nachtigall, Bionik. Grundlagen und Beispiele für Ingenieure und Naturwissenschaftler

Oral exam

Three questions:

1. From the lecture (theory)
2. From the practilar part
3. Image interpretation (Imagefrom the lecture or seminar)

WHEN?

29.05.2019, 8:15 ?

Questions
Suggestions
Expectations
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