

Modulbezeichnung „Mobile Systems in Natur und Technik I“
("Mobile Systems in Nature and Technology I")

Module code	1.1
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Semester 1. Semester MSc

Module coordinator Prof. Dr. Eize J. Stamhuis

Qualification objectives Widening and deepening of knowledge of animal functional morphology. Ability to interpret structures towards proposed functions and formulate of Hypotheses. Skills in Abstraction of 'design' towards applications. Essence derivation of book chapters or other literature sources. Ability to prepare and deliverance of presentation in English. Understanding and discussing basic concepts. Familiarization with theoretical and practical background of appropriate measurement equipment. Deduction of principles from individual examples.

Module Content Animal Locomotion 1:
Overview of locomotion systems in nature, from unicellulars to vertebrate animals, with emphasis on body plan ('bauplan'), skeleton or rigidity tissue, musculature + muscle type, muscles from molecule to functional unit, innervations and control. Scaling. General locomotion types and their characteristics: flagellar and ciliar propulsion, drag, resistive propulsion as in paddling and rowing, reactive propulsion as in jet-propulsion, lift-based propulsion as in hydrofoil swimming of penguins, dolphins and tuna's. Terrestrial locomotion types based on leg nr and gait: no legs and crawling types (peristaltic, 2- or 3-anchored, serpentine, concertina, side-winding), multipedes, 6- 4- and 2-legged walking, stance and swing phases, ground reaction forces, inertia as a limiting factor, eigen-frequency, leg motion patterns vs speed, gaits (walk, trot, gallop, pace), bipedal walking and running. In particular on Motion and Control per animal group or locomotion type, links are made to formalisation and simplification for Biomimetic applications.

Biomechanics 1:

Scaling, drag and the Reynolds' number; What is a fluid; Streamlines; Pressure and momentum; Drag of simple shapes; Velocity gradients and Boundary layers; Life in velocity gradients; Flow in pipes and Internal flow; Low Reynolds' nr flow; Streamlining; Studying and Measuring flow phenomena; Flow tanks, Flow visualisation, DPIV, Derivation forces & moments from PIV data, measure fluid forces, mass-flux models, momentum calculations, vortex-ring model. Forces and Moments; Measuring Ground-reaction-forces; Interpreting GRF-curves; Weight-equilibrium and Moment-equilibrium; Load-cells and Force-platform-design.

Type of module Compulsory Module

Teaching and learning methods Seminar instruction, self-study based on literature, presentation (in English) based on literature, Class

	discussions.
Assessment	Written examination 90 mins (Short presentation: 15 mins)*
Pre-requisites	Recommended: Basic knowledge of Biology and Mechanics
Usability	Advanced choice-module for e.g. Biology, Science or Engineering, Adv. BSc or MSc (depending on background)
Student workload	60 + 120 h
Contact hours	60 h
Independent study	120 h
ECTS points	6
Duration and frequency	One time per academic year in Winter-semester 15 scheduled lecture
Language	English
Reading list	Will be announced at the semester start.

Lecturer	Subject	SWS
Prof. Dr. Stamhuis	Biomechanics I	2
Prof. Dr. Stamhuis	Animal Locomotion I	2

*: Studienleistung, unbenotet