

SCIENTIFIC AND METHOD MODULES

Module name	Chemical Biology and Biophysics of Cancer
Number	2023-A2
Aims	This module discusses how physics, chemistry, biochemistry, molecular and materials science can provide a new perspective on oncology. Molecular biology shows the complexity and ambiguity that arises from the variability of tumours. Nevertheless, some biochemical and biophysical changes are universal to solid tumour progression and may provide both, novel diagnostic as well as therapeutic concepts. The state of the art in diagnostics and therapeutics will be discussed to identify the current needs.
Basics	Recommended knowledge: thematic modules T2, T5, T6 Required knowledge: Advanced knowledge in cell biology (cytoskeleton, transcription, translation), chemistry and biochemistry (hybrids of peptides and inorganic molecules) and cell mechanics (polymer physics, rheology)
Contents	<i>Biomechanics:</i> biopolymers, (composite) networks, bundles, rheology, cytoskeleton, cell shape, <i>Models of tumour growth:</i> finite element-based models, differential adhesion hypothesis, glass-like behaviour, <i>Forces, motion, adhesion:</i> cell motility, assembly, molecular motors, <i>Tumour progression:</i> tumour growth and homeostasis, uncontrolled proliferation, invasion and metastasis, tumour induced alterations of the stroma, vascular system and immune system, role of chemical cues as well as active and passive forces in triggering cell division and apoptosis, <i>Diagnostics and screening:</i> imaging [CT, MRI/MRE], tumour markers, histology, tumour staging, <i>Personalised medicine and better tumour staging:</i> single cell analysis, high throughput and content, genetic networks, tumour specific tracers and their application by PET-imaging or fMRI-scanning, tumour cell biomechanics and adhesion, circulating tumour cells <i>Therapy:</i> surgery, radiation, chemotherapy [antineoplastic drugs, cytostatic molecules, protein kinase inhibitors]), <i>Targeted tumour therapy:</i> specific and unspecific shuttles, specific expression of cell surface proteins, internalization of biomolecules into tumour cells, linkers for controlled release, role of the microenvironment, etc. <i>Relapse:</i> selective pressure and resistant tumour cells, dormant cancer cells, cancer stem cells.
Methods	<i>Hybrid molecules as novel or optimised drugs:</i> advanced synthetic methods, combining organic, inorganic and biochemical approaches, <i>Imaging:</i> CT, MRI, PET, fMRI, MRE, Immunohistology <i>Active and passive cell mechanics and adhesion:</i> (cell) rheology, cellhesion, magnetic bead rheology, optical stretcher, <i>Tumour cell migration:</i> wound healing, migration through collagen gels, traction force microscopy, <i>Vital imaging of tumour cells.</i>
Type	Three-day block course/ yearly recurrence with modification

Date	04 - 06 October 2023
Time	All day conference
Work load	15 hours presence/ 45 hours self-study
Examination	2-page report including an introduction, summaries of three different talks from three different sessions, and short discussion. submission to Prof. Käs within 7 days after the conference
Credit points	2
Responsible scientists	Prof. Dr. Josef A. Käs
International guest lecturers	Please consult our webpage https://conference.uni-leipzig.de/poc/2023/ for more information.
Industrial partners	Please see webpage.
Recommendations for literature, e-learning	No recommendations.

Didactic elements:

Lecture, talks, posters and discussions

Expected performance:

Active participation in discussions during conference.