

**SCIENTIFIC AND METHOD MODULES**

<b>Module name</b>	<b>Chemical Biology and Biophysics of Cancer</b>
<b>Number</b>	2021-A2
<b>Aims</b>	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.
<b>Basics</b>	Recommended knowledge: thematic modules T2, T5, T6 <b>Required knowledge:</b> Advanced knowledge in cell biology (cytoskeleton, transcription, translation), chemistry and biochemistry (hybrids of peptides and inorganic molecules) and cell mechanics (polymer physics, rheology)
<b>Contents</b>	<i>Biomechanics:</i> biopolymers, networks, 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 <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, etc. <i>Relapse:</i> selective pressure and resistant tumour cells, dormant cancer cells, cancer stem cells.
<b>Methods</b>	<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> AFM-based 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>
<b>Type</b>	Three-day block course/ yearly recurrence with modification
<b>Date</b>	30 August-1 September 2021

<b>Time</b>	All day conference
<b>Work load</b>	15 hours presence/ 45 hours self-study
<b>Examination</b>	2-page report about the conference, submission to Prof. Käs approx. 7 days after the conference
<b>Credit points</b>	2
<b>Responsible scientists</b>	Prof. J. Käs
<b>International guest lecturers</b>	Please consult our webpage <a href="https://conference.uni-leipzig.de/poc/2021/">https://conference.uni-leipzig.de/poc/2021/</a> for more information.
<b>Industrial partners</b>	Please see webpage.
<b>Recommendations for literature, e-learning</b>	No recommendations.

**Didactic elements:**

Lecture, discussions

**Expected performance:**

Active participation in discussions during conference.