



B CUBE - Center for Molecular Bioengineering

Dr. Veikko Geyer und **Prof. Stefan Diez**

Einweisung F Praktikum, Physik, TU Dresden

WS 2024/25



Lage: TU – Campus Johanstadt Tatzberg





CENTER FOR MOLECULAR AND CELLULAR
BIOENGINEERING (CMCB)

MEHR ERFAHREN

Unsere Institute

Biotechnologie

BIOTEC

Das biotechnologische Zentrum der Technischen Universität Dresden ist ein interdisziplinäres Zentrum, das die Bereiche Biotechnologie, Molekulare Maschinen, Gewebezüchtung und Bioinformatik umfasst.

**Regenerative
Therapien**

RTD

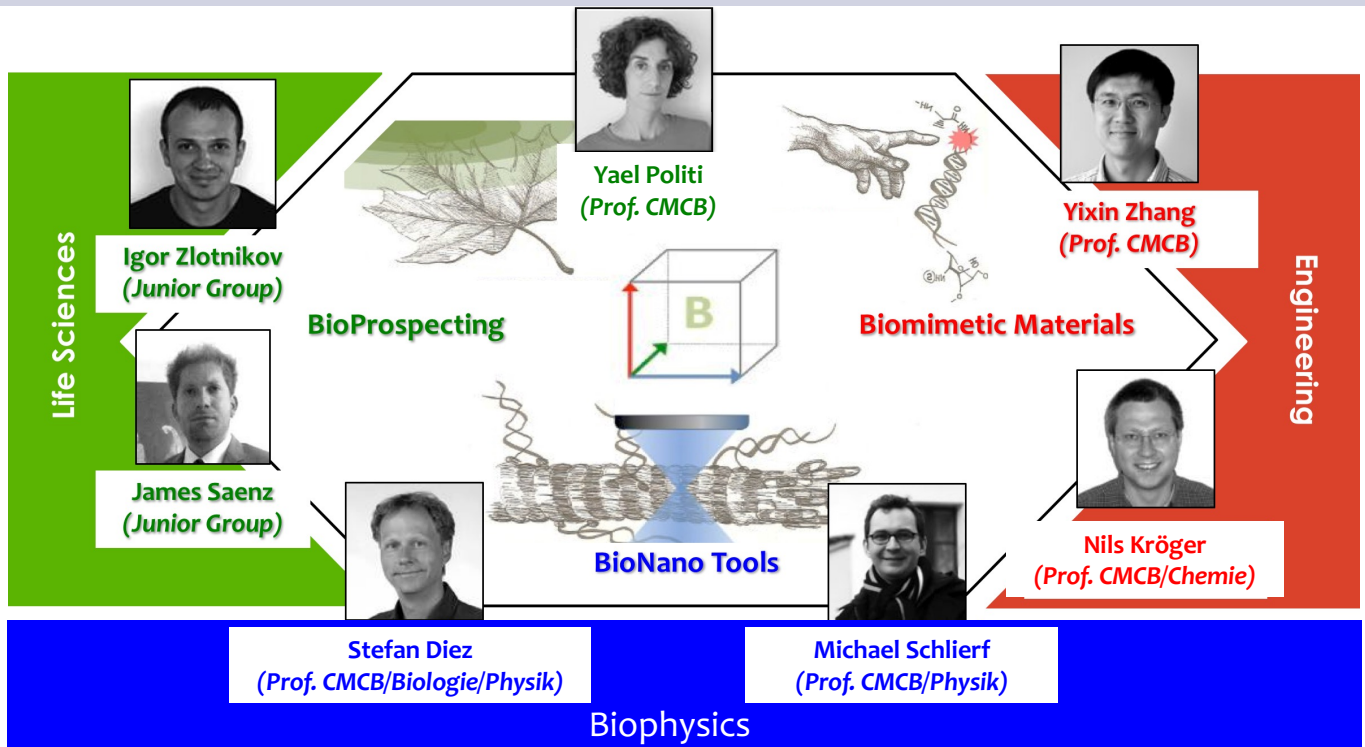
Stammzellen
Regeneration von
Organen
Behandlungen:
- Alzheimer
- Leukemie
- Diabetes

Bioengineering

Eigenschaften der
lebenden Materie auf
molekularer Ebene
Inspiration für Entwicklung
neuer Methoden,
Materialien und
Technologien

<https://tu-dresden.de/cmcb>

Von der Natur Lernen - "Bottom-up" Entwurf von Materialien mit neuen Funktionen

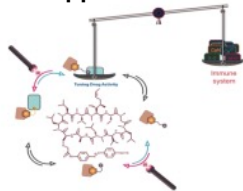


B CUBE Research Areas (1/2)

**Prof.
Yixin
Zhang**



Chemical methods for biological and medical research and application

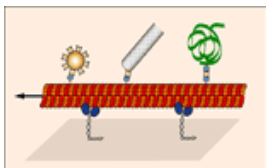


- Development of innovative technologies for high throughput drug discovery
- Increase specificity of compounds

**Prof.
Stefan
Diez**



Biomolecular transport systems in cell biology and nanotechnology

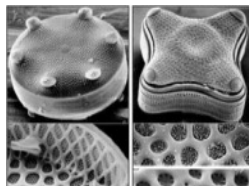


- Understand the functioning principles of biomolecular motors
- Reconstitute cellular transport systems in an artificial environment

**Prof.
Nils
Kröger**



Silica biomineralization and underwater adhesion

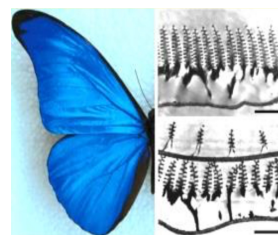


- Model system: species of diatoms
- Understand mechanisms of material biosynthesis and adhesion

**Prof.
Yael
Politi**



Bioprospecting



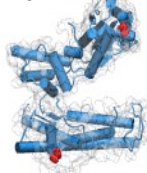
- Basic understanding of the cuticular material of insects at the molecular level
- Mechano-sensing in spiders

B CUBE Research Areas (2/2)

**Prof.
Michael
Schlierf**



Structure and mechanisms of single DNA molecules and proteins



- Understand DNA metabolism and replication on a molecular basis
- Development and application of single-molecule fluorescence techniques

**Dr.
James
Saenz**



From Lipids to Life

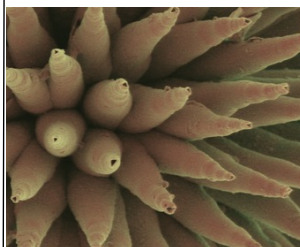


- What role did membranes play in the origin and evolution of the cell?
- What are the minimal features of a membrane that are necessary to support life?

**Dr.
Igor
Zlotnikov**

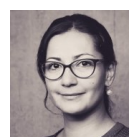


Multi-Scale Analysis

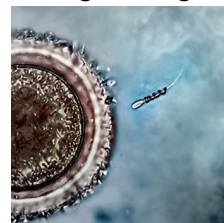


- Thermodynamic and Nanomechanical Aspects of Biomineralized Tissue Formation and Function

**Dr.
Mariana
Sanchez**



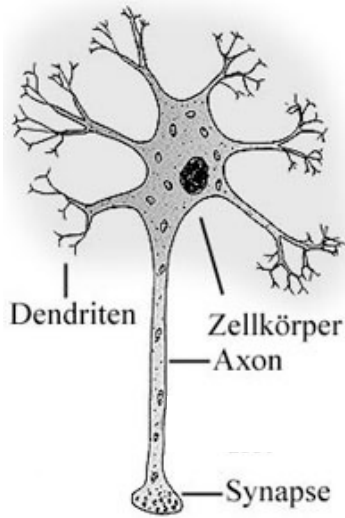
Micro- and Nanobiomedical Engineering



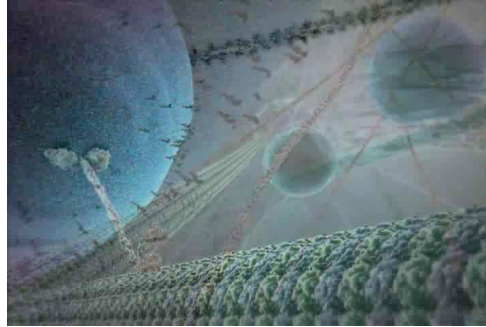
- Medical robots
- Smart Materials

Professur BioNano Tools: Stefan Diez

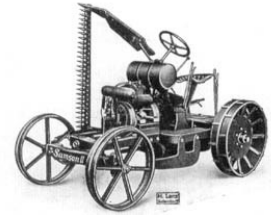
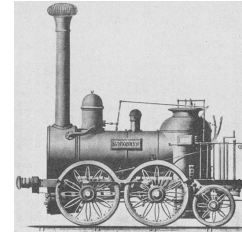
Molekulare Motoren



direct conversion of
chemical energy into
mechanical work

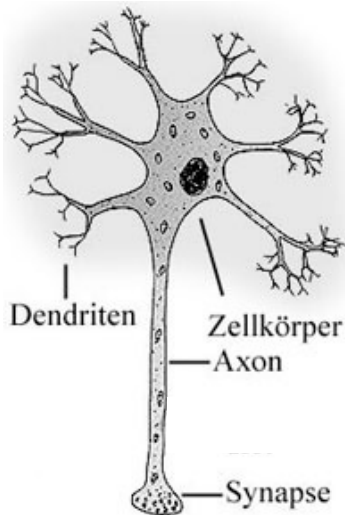


from: "The inner life of a cell"

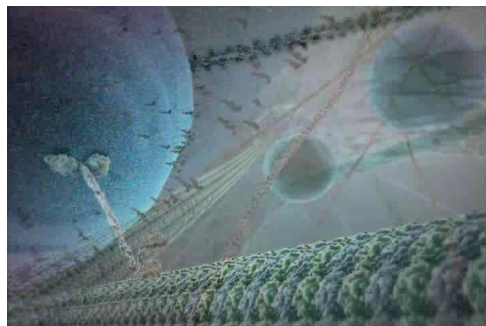


Professur BioNano Tools: Stefan Diez

Molekulare Motoren



direct conversion of
chemical energy into
mechanical work



from: "The inner life of a cell"

Energiequelle
ATP Hydrolyse

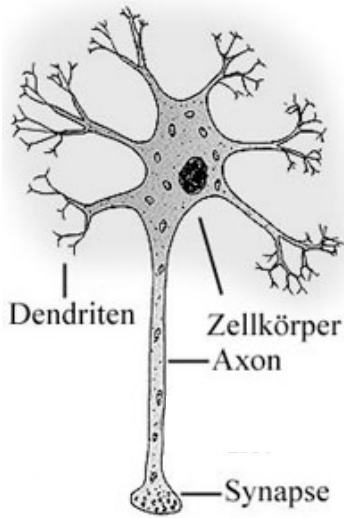
8 nm Schritte

100 Schritte / s

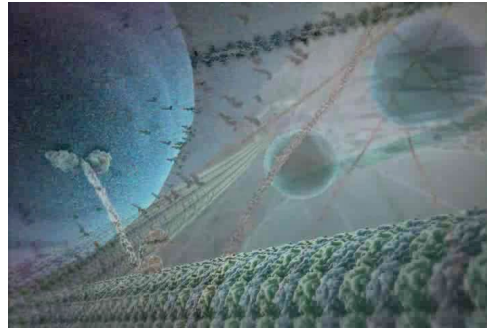
1 ATP / Schritt

Professur BioNano Tools: Stefan Diez

Molekulare Motoren



direct conversion of
chemical energy into
mechanical work



from: "The inner life of a cell"

Energiequelle
ATP Hydrolyse

8 nm Schritte

100 Schritte / s

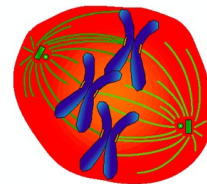
1 ATP / Schritt



muscle



sperm



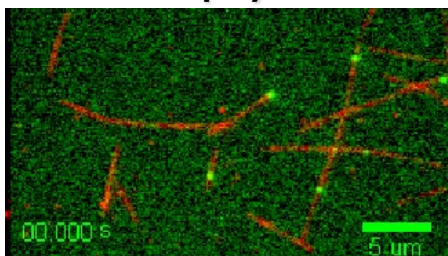
mitosis

Professur BioNano Tools: Stefan Diez

Molekulare Motoren

Molekularer Transport in Zellbiologie und Nanotechnologie

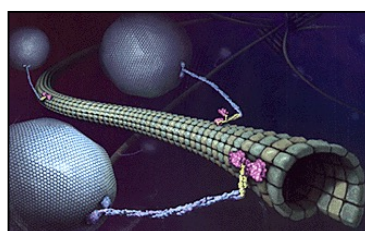
Biophysik



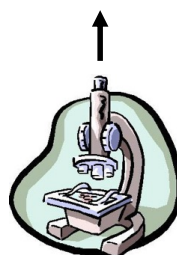
Einzelmolekülmikroskopie



**Molekulares Verständnis
zellulärer Transportprozesse**

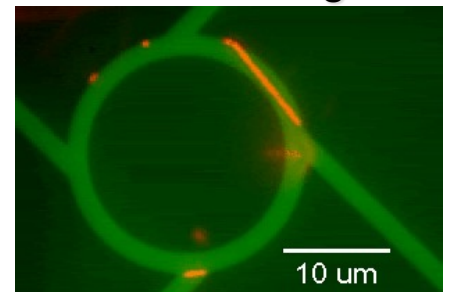


Molekulare Motoren



**Optische
Methoden**

Nanotechnologie



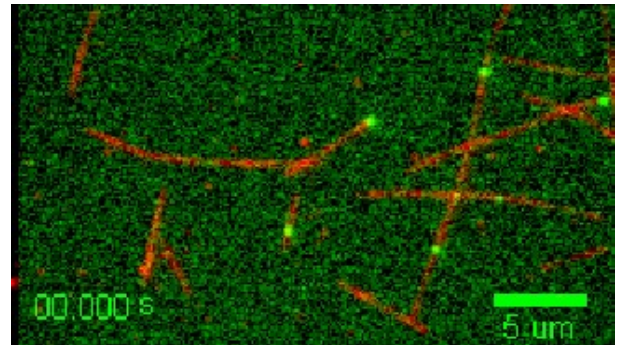
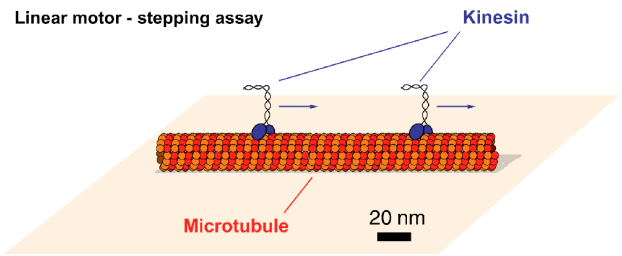
Biomolekül-gesteuerte
Transportsysteme



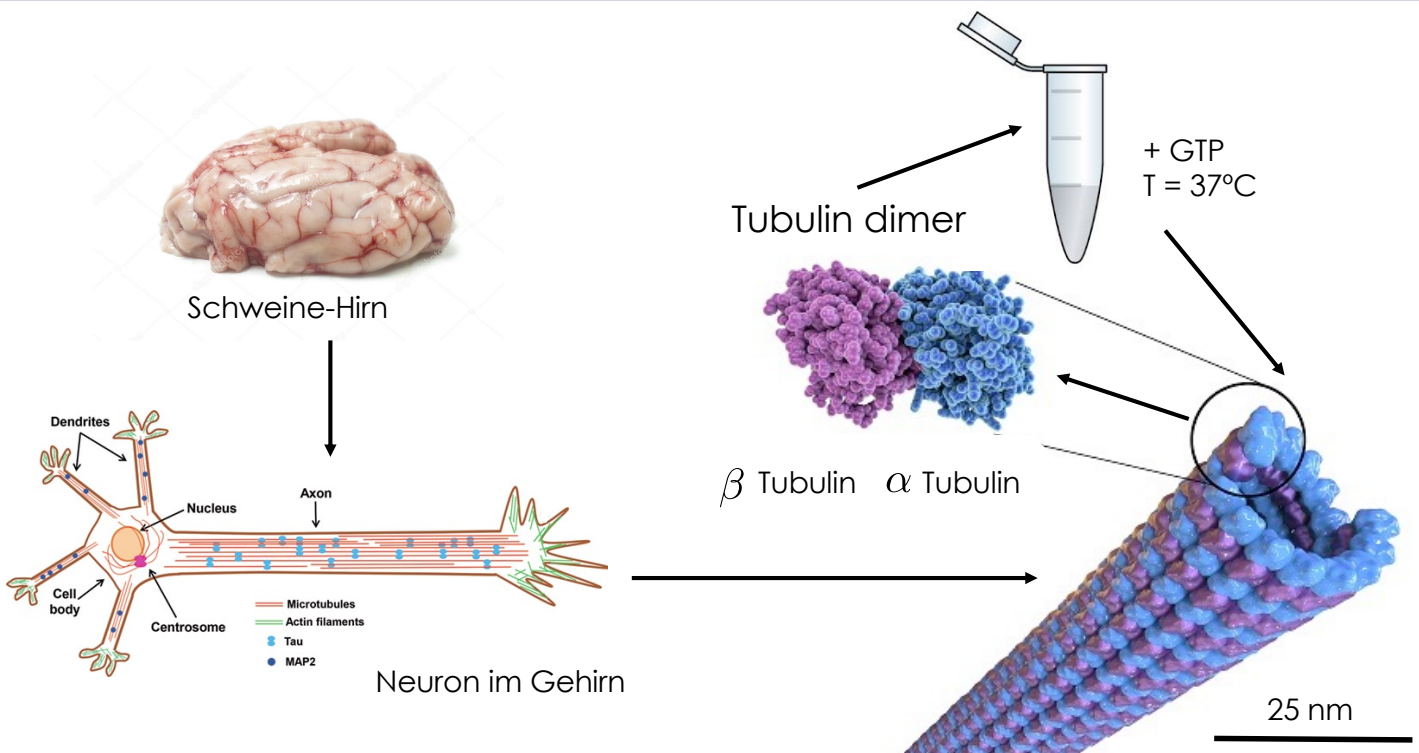
**Miniaturisierte
Detektionsmethoden**

Versuch MMC: Molekulare Motoren und (C)Zellskelett

Fluoreszenzmikroskopie

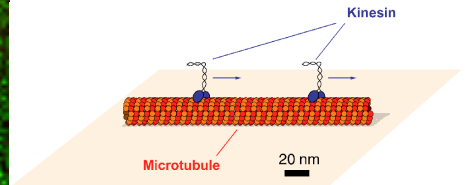
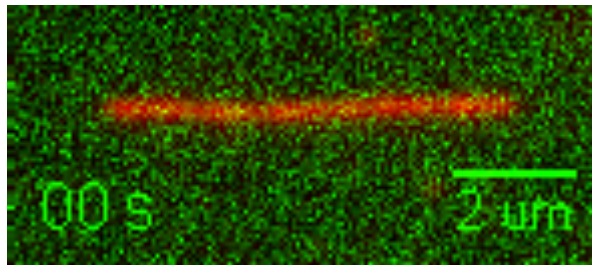


Versuch MMC: In vitro Polymerisation von Mikrotubuli



Versuch MMC: Molekulare Motoren im Stepping Assay

Einzelmolekül - TIRF Mikroskopie



GFP
Grün fluoreszierendes Protein

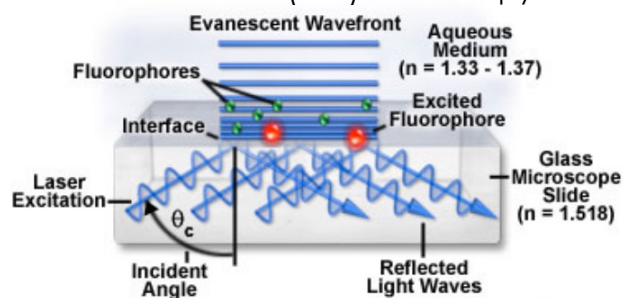


Kinesin 1

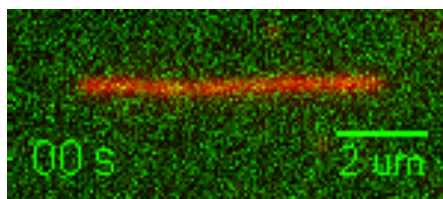
25 nm

(Kinesin grün, Microtubule rot)

Prinzip der Total-Internal Fluorescence (TIRF) Microscopy

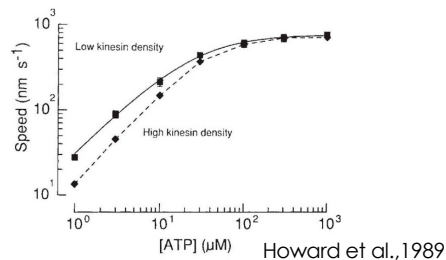


Versuch MMC: Analyse der Molekülbewegung

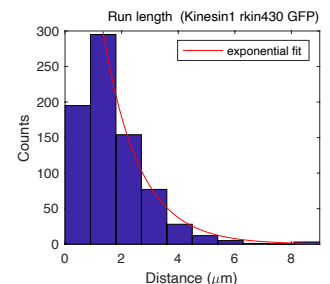


Einzelmolekül - TIRF Mikroskopie
(Kinesin grün, Microtubule rot)

Geschwindigkeit als Funktion der ATP-Konzentration

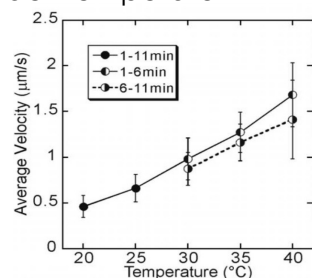


Molekül 'run length'

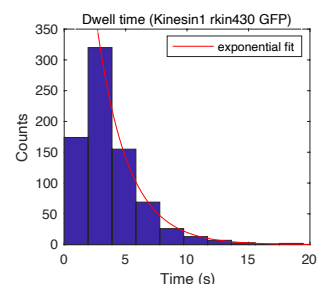


Kymograph der Molekülbewegung

Geschwindigkeit als Funktion der Temperatur



Molekül 'dwell time'





Versuch MMC: Inhalte des Praktikums

- Aufbau und Durchführung eines **Einzelmolekülexperimentes** am TIRF Mikroskop
- **Bildanalyse** (Kymograph-Analyse / Einzelmolekül-Tracking)
- **Datenauswertung**
(theoretische Beschreibung der Datenverteilungen)
- **Vergleich unterschiedlicher Versuchsbedingungen**
(mittels statistischer Testverfahren)
- **Interpretation der Ergebnisse** in Bezug auf mechanischen Zyklus und Schrittmechanismus der Motoren



Versuch MMC: WS 2021

<https://tu-dresden.de/cmcb/bcube/forschungsgruppen/diez/teaching>

TEACHING

Winter Semester 2024/25

Physik-Fortgeschrittenenpraktikum: Versuch MMC

TUD advanced practical training for students of Physics (Biomolecular Motors: From Cellular Function to Nanotechnology)

TIME: Fridays, start: 8.55 am

PLACE: B CUBE, TU Dresden, Tatzberg 41, 01307 Dresden, [reception](#)

SUPERVISOR: Veikko Geyer

Versuchsanleitung

[References](#)

Fragen im Vorfeld:

Dr. Veikko Geyer

0351 / 463 43013 oder

veikko.geyer@tu-dresden.de

Versuch in Englisch: Anleitung, Testat, Durchführung & Protokoll

Soft Condensed Matter and Biological Physics

Vorlesende:

Prof. S. Diez, Prof. S. Grill, Prof. F. Jülicher
Prof. J.-U. Sommer, Prof. K. Fahmy,
Prof. L. Eng, Prof. A. Fery et al.

u. a.: Vorlesung über **Molekulare Motoren**, Start: 15.10.2024

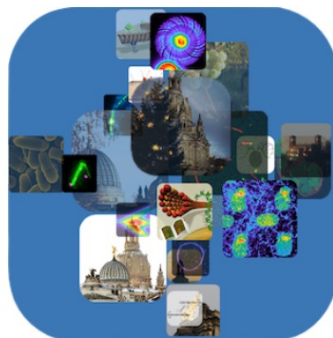
Diez	2/0	>Cellular Mashines II	VWm	Englisch
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<https://tu-dresden.de/cmcb/bcube/forschungsgruppen/diez/teaching>



Biophysics in Dresden

- Home
- Research Groups
- Teaching
- Positions
- Institutes
- Conferences
- Links



DRESDEN is an exciting place for BIOPHYSICS

Driven by the expertise and the enthusiasm of several energetic research groups, Dresden has become an international hub for studying biophysics and for performing high-level biophysical research.

DRESDEN offers a wide spectrum of BIOPHYSICS

Biophysical research in Dresden offers a tremendous width in both, research topics and methods. As such, the dynamics of single molecules, the mechanics of single cells as well as the organisation of tissues are likewise addressed by experimental and theoretical approaches. Among the strong technical expertise are the fields of (nano)optical spectroscopy, optical microscopy,

DRESDEN promotes BIOPHYSICS at several institutions

Biophysics in Dresden is constantly pushed forward at multiple locations, both within several departments of the Technische Universität (TU) Dresden as well as in a number research institutes outside TU Dresden. Interdisciplinary interactions with other fields of research are strongly supported by a unique culture of collegiality as well as by a number initiatives facilitating the setup and maintenance of collaborations. For example, **DRESDEN-concept** runs a number of online platforms towards the synergistic usage of equipment (**Technology Platform**) and knowledge (**Dresden Science Calendar**).

This webpage aims to provide an overview of the BIOPHYSICS activities in DRESDEN.

<http://www.biophysics-dresden.de>



DRESDEN SCIENCE CALENDAR

ANKÜNDIGUNG WISSENSCHAFTLICHER VORTRÄGE IN DRESDEN



B CUBE – Center for Molecular Bioengineering

Technische Universität Dresden

Prof. Stefan Diez

Tatzberg 41, 01307 Dresden

Tel: 0351 - 463 43010

Fax: 0351 - 463 40322

E-mail: stefan.diez@tu-dresden.de
veikko.geyer@tu-dresden.de



Versuch MMC: WS 2024

Bachelor und Master Arbeiten möglich !