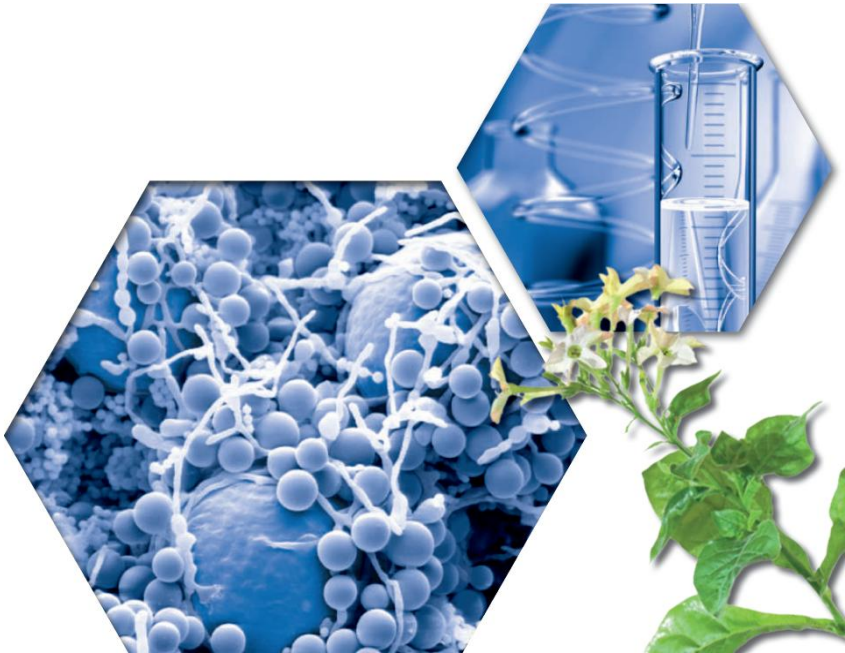
Modules „M.Bio.107/147: Biochemistry and Biophysics“

Claudia Steinem

Ivo Feußner

Andreas Janshoff



Modules „M.Bio.107/147: Biochemistry and Biophysics“

Ivo Feussner, ifeussn@uni-goettingen.de

Lectures/tutorials: Mondays/Thursdays 8:15-9:45

1st half (until 28.05.): Plant Biochemistry

Plants specific metabolism

Cell wall, lipid metabolism, specialized metabolism and plant biotechnology

Targeted and non-targeted analysis of metabolites and metabolic networks

Lecture – 2nd half (from 01.06.)

Analytical methods to study membranes, proteins and beyond

Part 1: Tabea Oswald
Spectroscopy
- Interaction of Matter and Light
- UV/Vis spectroscopy
- Fluorescence spectroscopy

Microscopy (light- and fluorescence microscopy, nanoscopy)

Part 2: Andreas Meyer
NMR- and EPR-spectroscopy of biomolecules

Applications
- Single molecule studies
- Protein-protein interactions
- Membrane structure and dynamics
- Microscopy of biomolecules and cells

Method course „Biochemistry“ (11.05.-29.05.25)

Transgenic plants

- genotyping via PCR
- phenotype characterization
- biochemical characterization
    - of lipid classes via TLC
    - of fatty acid profiles via GC and GC-MS

Metabolome analysis (targeted)

- of central metabolites by GC/MS
- of lipids by ESI-MS/MS
- defense compounds by HPLC-UV/VIS/fluorescence

Metabolome analysis (non-targeted)

- by UPLC/MS-TOF (metabolite fingerprinting)

Heterologous protein expression in Yeast

- biochemical characterization

Methods course „Biophysics“ (11.05.-29.05.25)

Model systems and methods

- Study partitioning of compounds in membranes
- Study transport processes across lipid vesicles
- Analyze protein binding to lipid bilayers
- Investigate the thermal helix-coil transition of DNA

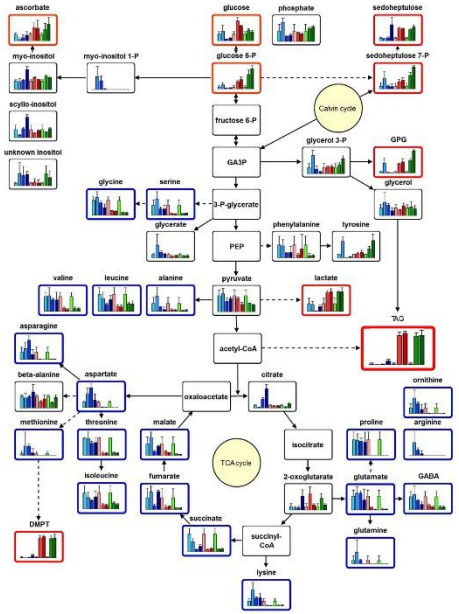
Cell experiments

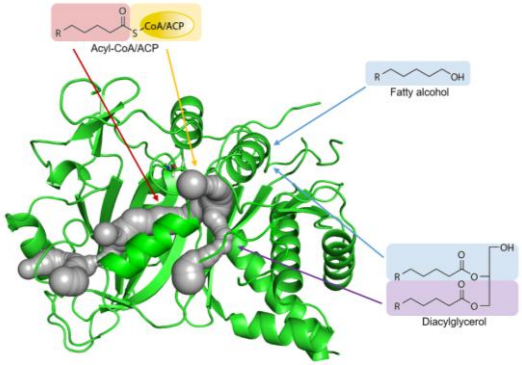
- Label cytoskeletal and membrane components of cells
- Perform confocal fluorescence microscopy of stained cells
- Inhibit actin polymerization and study its impact on cell structure

Department of Plant Biochemistry

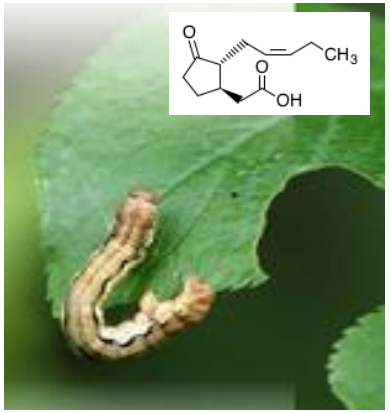
Research at the Department of Plant Biochemistry

Analyze/Identify Lipid Pathways : Triglycerols, Wax Esters and Sphingolipids

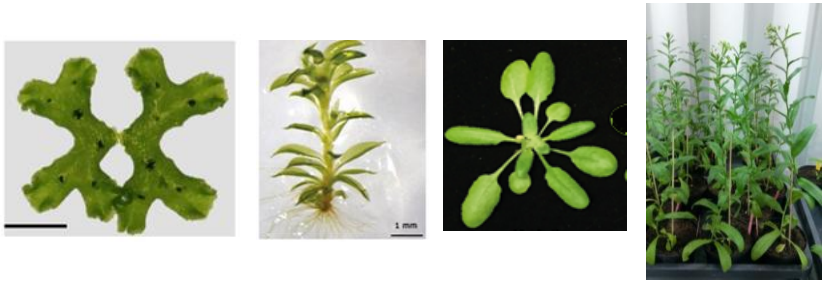




Analyze/Identify Metabolism of Phytohormones: Jasmonic Acid, Salicylic Acid and *N*-Hydroxy Pipecolic Acid



Plants for Analyzing Lipid Pathways: Marchantia, Physcomitrium, Arabidopsis, Camelina



Developing and applying tools for metabolomics

Metabolome – all metabolites of a given sample

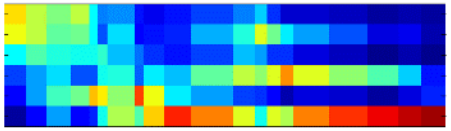
Two different strategies for metabolome analysis

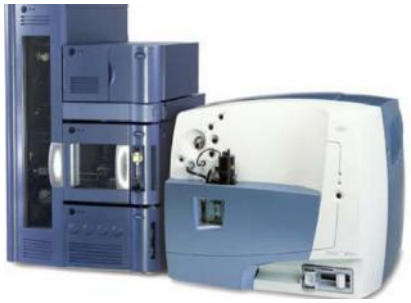
Targeted analysis

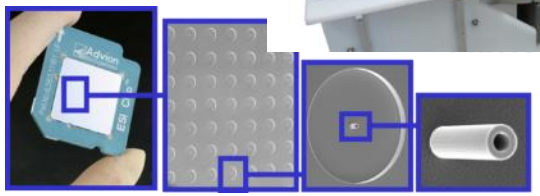
restricted to groups of metabolites
(e.g. central metabolites via GC-MS
lipidomics via LC-MS)

Non-targeted analysis

"detect the unexpected"
identification of all metabolites
which are characteristic for
which change intensity under
a specific experimental setup







LIPID MAPS

METACYC

KEGG
Kyoto Encyclopedia of Genes and Genomes

GöML

Biomolecular Chemistry

at the Institute of Organic and Biomolecular Chemistry
Department of Chemistry

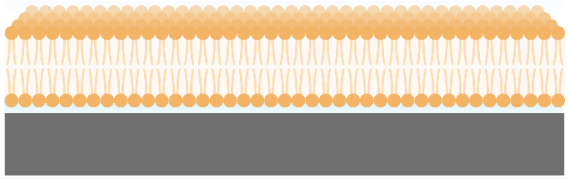
Claudia Steinem

Research in the Steinem group

Understanding membrane-confined processes with a bottom-up approach (model membranes)

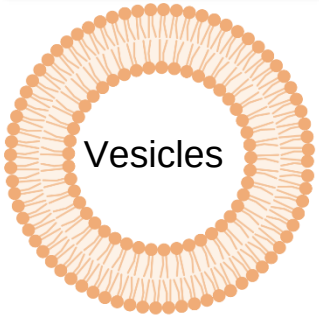
Minimal actin cortices

Supported lipid bilayers



Fluorescence microscopy
Atomic force microscopy
Reflectometric interference spectr.

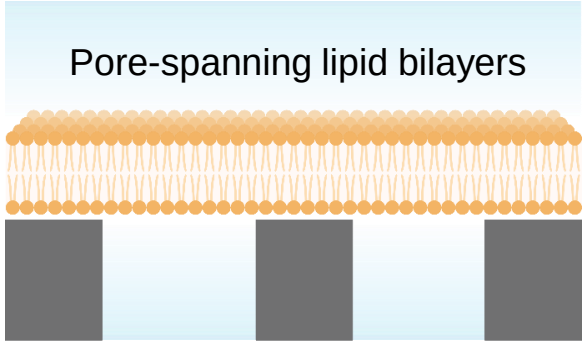
Novel antibiotics
ATP-synthase



Fluorescence spectr.

Asymmetric membranes
Natural membranes
Lipid nanoparticle fusion

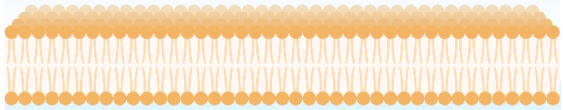
Pore-spanning lipid bilayers



Fluorescence microscopy
Atomic force microscopy
Impedance spectroscopy

Potassium channels

Freestanding lipid bilayers



Ion channel recordings
Fluorescence microscopy

Biophysical Chemistry

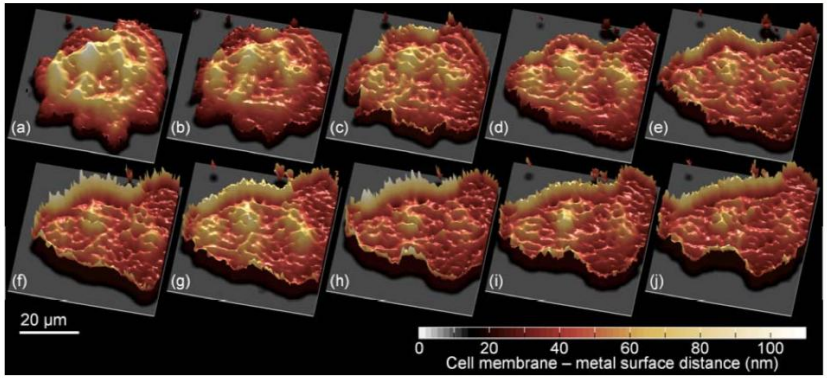
at the Institute of Physical Chemistry
Department of Chemistry

Andreas Janshoff

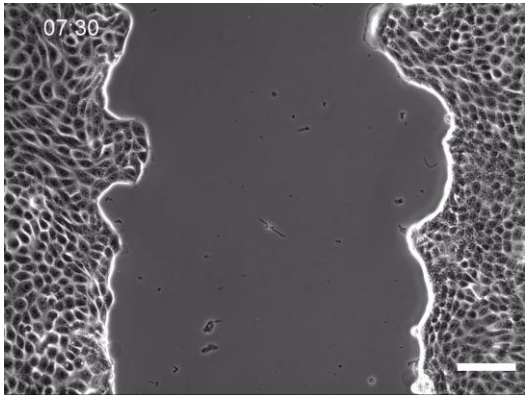
Research in the Janshoff group

Membrane mechanics / cell adhesion

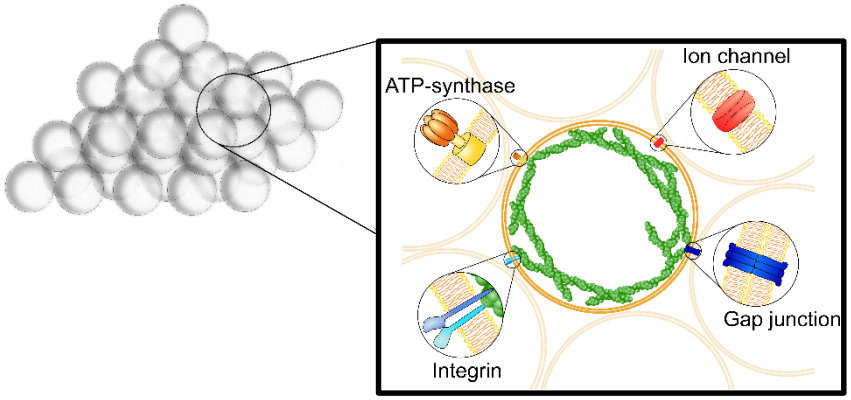
Cell adhesion and mechanics



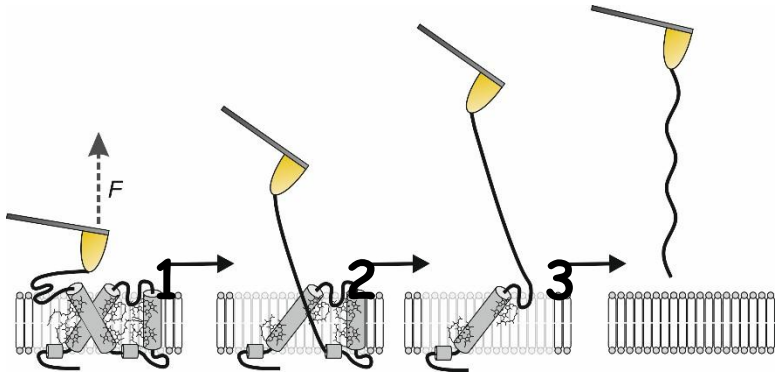
Wound healing



Artificial life



Single molecule mechanics



Electron-Spin Resonance Spectroscopy in Biomolecules

Max Planck Institute for Multidisciplinary Sciences

Andreas Meyer

EPR spectroscopy:

- identifies reaction intermediates in enzymatic catalysis
- characterizes metal centres in biological systems
- structural determination via measurements of distances in the nanometer scale

Ribonucleotide Reductase