Center for Molecular Biosciences
Innsbruck

Bernhard Kräutler

previous head (till Dec. 31, 2007):  Klaus Bister

Scientific coordinators:
  Bernhard Kräutler, Professor of Organic Chemistry
  Dirk Meyer, Professor of Molecular Biology
  Jörg Striessnig, M.D., Professor of Pharmacology

Administrative coordinator:
  Gabi Reiter
Mission Statement

– to learn about the molecular basis of life

The Center for Molecular Biosciences (CMBI) at the University of Innsbruck is an integrative and multidisciplinary research and teaching institution, whose mission it is, to advance studies on the structure, function and interaction of biological macromolecules and of low molecular weight compounds relevant for cellular growth, metabolism, and development.
Chemistry
B. Auer, R. Schneider
K. Bister, M. Hartl, T. Valovka
G. Bonn, C. Huck, G. Stecher
K. Breuker
B. Kräutler, M. Oberhuber
R. Micura
biochemistry, molecular genetics
bioanalytics
biomolecular mass spectrometry
structural biology, chemistry of natural products
theoretical chemistry, computer-aided molecular design
chemical biology of nucleic acids

Pharmacy
A. Bernkop-Schnürch, W. Schlocker
H. Schmidhammer, M. Spetea
J. Striessnig, N. Singewald
H. Stuppner
drug delivery, biotechnology
pharmaceutical chemistry, drug design
cell biology, neuropharmacology
pharmaceutical biology, phytochemistry

Biology
R. Dallinger
B. Hobmayer, P. Ladurner
D. Meyer, P. Aanstad
B. Pelster, T. Schwerte
cell physiology, ecotoxicology
cell and developmental biology
vertebrate development
cell biology, cell physiology

Physics
T. Märk, P. Scheier
biophysics, radiation physics
### 16 Research Topics at the CMBI - the Molecular Basis of Life

- Molecular and genetic control of vertebrate development (*Meyer, Aanstad*)
- Stem cell differentiation, regeneration and self organization of basal Metazoa (*Hobmayer, Ladurner*)
- Cell ion and volume homeostasis and metabolic activity (*Pelster, Schwerte*)
- Trace element homeostasis in animal cells (*Dallinger*)
- Voltage-gated calcium channels as new drug targets (*Striessnig, Singewald*)
- Proteomics, metabolomics, phytomics (*Bonn, Huck, Stecher*)
- Bioactive natural products from the plant kingdom (*Stuppner*)
- Development of potential drugs interacting with opioid receptors (*Schmidhammer, Spetea*)
- Non-invasive peptide delivery, controlled and targeted drug delivery (*Bernkop-Schnürch, Schlocker*)
- Mechanisms of DNA sequence recognition and new lead structures from *in silico* work (*Liedl, Langer*)
- Natural products chemistry, chemical & structural biology of pigments of life (*Kräutler, Müller, Oberhuber*)
- Synthesis, structure, and function of chemically modified RNA (*Micura*)
- Oncogenic transcription factors and their cellular targets (*Bister, Hartl, Valovka*)
- Regulation of cell function by protein modification (*Auer, Schneider*)
- Protein structure, stability, and folding in the gas phase (*Breuker*)
- Inelastic interaction of low energy electrons with molecules of biological relevance (*Märk, Scheier*)

At present:
10 Professors, 16 assoc. Professors, 36 (18) postdoral and 55 (24) doctoral students
Selected Recent Publications from the CMBI

Stem cell differentiation, regeneration, and self organization of basal Metazoa

Bert Hobmayer et al.
Institute of Zoology

Unexpected complexity of the Wnt gene family in a sea anemone
Kusserow et al., Nature 433, 156-160 (2005)
C-terminal modulator controls Ca^{2+} -dependent gating of Ca_v 1.4 L-type Ca^{2+} channels

Anamika Singh et al.
Institute of Pharmacy

Singh, Hamedinger, Hoda, Gebhart, Koschak, Romanin, Striessnig.
N(pro) fusion technology to produce proteins with authentic N termini in *E. coli*

Clemens Achmüller *et al.*

*Institute of Biochemistry*

Achmüller, Kaar, Ahrer, Wechner, Hahn, Werther, Schmidinger, Cserjan-Puschmnan, Clementschitsch, Striedner, Bayer, Jungbauer & Auer

Extending Top-down Mass Spectrometry to Proteins with Masses Greater than 200 Kilodaltons

Han, Breuker et al.

Institute of Organic Chemistry

Selected Recent Publications from the CMBI

Chemical Biology of Nucleic Acids

Ronald Micura et al.
Institute of Organic Chemistry

Structural basis for Diels-Alder ribozyme-catalyzed carbon-carbon bond formation
Decomposition of Thymidine by Low-Energy Electrons: Implications for the Molecular Mechanisms of Single-Strand Breaks in DNA

Ptasinska et al.
Institute of Ion Physics and Applied Physics

Ptasinska, Denifl, Gohlke, Scheier, Illenberger, Märk.

The 16 complementary research topics can be grouped in 5 wider and mutually interacting research areas:

- Development of whole organisms
- Cellular function and cell-to-cell communication
- Metabolites, natural and synthetic compounds that modulate important biological processes
- Molecular basis of physiological and patho-physiological processes
- Structure, dynamics and interactions of biologically important molecules
Two interacting, project driven research & teaching networks are developing at the CMBI

Biomolecular interactions & drug discovery
Current research consortium
DK-plus
Molecular and molecularbiological aspects of gene-regulation (in preparation)
Total **annual** amount for the 16 CMBI member labs at present:

~ 4.7 Mio. €

Funding agencies:

>> 100 active, international research collaborations
In the last three years CMBI research groups have received about 3 Mio. € of special governmental funding for research equipment, e.g. for the purchase of a 600 MHz NMR & an FT/ICR-mass spectrometer (2007 FWF-START Prize) that will boost research in structural biology and in biological analysis at the CMBI.
Publications: Since 2005 CMBI members published **ca. 406** articles in peer reviewed journals, among them **24** papers in the top journals:

- *Nature* (4<sup>a-c</sup>, <sup>a</sup>Biochemistry, <sup>b</sup>Organic Chemistry, <sup>c</sup>Pharmacology, Zoology)
- *Science* (2, Organic Chemistry, Zoology)
- *Phys. Rev. Lett.* (2, Ion-Physics)

<sup>a</sup>*Nature Genet.*, <sup>b</sup>*Nature Struct. Mol. Biol.*, <sup>c</sup>*Nature Neuroscience*.

Graduates: CMBI members helped **216 students to graduate** since 2005, among them **55 PhD graduates & 161 diploma graduates** (many from abroad, (75% -diploma- and 35% -PhDs- are female graduates).
Awards (Selection from 2006/2007)

Kathrin Breuker, Institute of Organic Chemistry, recipient of the Novartis Award for Chemistry (2006) and of the Start-Award of the FWF (2007)

Clemens Achmüller, Institute of Biochemistry recipient of the Austria Life Science Award (ALSA, 2007)


Stefan Denifl, Institute of Ion-physics, recipient of an Apart-award of the Austrian Academy of Sciences (2007)

Andreas Bernkop-Schnürch, Institute of Pharmacy, Pharmaceutical Technology, recipient of the Houska Preis Wien 2007

Honorary Memberships (2006/2007)

Bernhard Kräutler, Institute of Organic Chemistry
elected Member of the German Academy of Sciences, Leopoldina

Jörg Striessnig, Institute of Pharmacy, Pharmacology & Toxicology
elected Member of the German Academy of Sciences, Leopoldina

Faculty appointments (2006/2007)

Dirk Meyer, Department of Biology, University of Freiburg (Brsg.)
appointed as Professor of Molecular Biology. Research interests: vertebrate development.

Ronald Micura, Institute of Organic Chemistry
tenured as Professor of Organic Chemistry. Research interests: chemical biology of RNA.
Ulf Rapp, Institute for Medical Radiation & Cell Research
Univ. of Würzburg, Germany

Gregory Kaczorowski, Merck Research Laboratories,
Rahway, New Jersey, USA

Thomas W. Holstein, Institute of Zoology, University of
Heidelberg, Germany

Naweed Syed, Departments of Anatomy and Physiology, University of Calgary, Canada

Erwin Wagner, Research Institute of Molecular Pathology, Vienna, Austria

Walter Schaffner, Institute of Molecular Biology, University of Zurich, Switzerland

Wolfram Saenger, Institute of Chemistry & Crystallography, Free University Berlin, Germany

Peter Herrlich, Institute of Molecular Biotechnology, Jena, Germany

Elisabeth Knust, Institute of Genetics, University of Düsseldorf, Germany

Robert Huber, Nobel Laureate in Chemistry, MPI of Biochemistry, Martinsried, Germany

Reinhard Fässler, MPI of Biochemistry, Martinsried, Germany

Daniela Pietrobon, Dept. of Biomedical Sciences, University of Padova, Italy
Directions:

Congresspark Igls
Eugenpromenade 2
6080 Igls

Bus line J runs from Innsbruck to Igls. From the bus stop in Igls, it's a 10 min walk to the Congresspark.
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<tr>
<th>Year</th>
<th>Speaker Name</th>
<th>Institution/Location</th>
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<tbody>
<tr>
<td>2007</td>
<td>Manfred Auer</td>
<td>Innovative Screening Technologies, Novartis GmbH, Vienna</td>
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<td></td>
<td>Wolfgang Driever</td>
<td>Institute of Biology I (Zoology), University of Freiburg, Germany</td>
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<td>Michael Gait</td>
<td>Laboratory of Molecular Biology, MRC, Cambridge, UK</td>
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<td>Regine Kahmann</td>
<td>Max Planck Institute for Terrestrial Microbiology, Marburg, Germany</td>
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<td>Daniel Wilson</td>
<td>LMU Gene Center, University of Munich, Germany</td>
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<td>2006</td>
<td>Norbert Polacek</td>
<td>Biocenter, Medical University Innsbruck, Austria</td>
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<td></td>
<td>Kurt Faber</td>
<td>Department of Chemistry, Division of Organic &amp; Bioorganic Chemistry, University of Graz, Austria</td>
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<td>Thorsten Schwerte</td>
<td>Institute of Zoology, LFU Innsbruck</td>
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<td>Bernd Nilius</td>
<td>Department of Physiology, KU Leuven, Belgium</td>
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<td></td>
<td>Herbert Waldmann</td>
<td>Max Planck Institute of Molecular Physiology, Dortmund, Germany</td>
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<td>2005</td>
<td>Andreas G. Bader</td>
<td>Molecular &amp; Experimental Medicine, The Scripps Research Institute, La Jolla, California, USA</td>
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<td></td>
<td>Roland K. O. Sigel</td>
<td>Institute of Inorganic Chemistry, University of Zurich, Switzerland</td>
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<td>Christoph Stein</td>
<td>Dept. of Anesthesiology &amp; Operative Intensive Care, Charité, Universitätsmedizin Berlin, Germany</td>
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<td>Jorge Mayer</td>
<td>Campus Technologies Freiburg, University of Freiburg, Germany</td>
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<td>Jens Rettig</td>
<td>Dept. of Physiology, Saarland University, Homburg, Germany</td>
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<td></td>
<td>Manfred Sippl</td>
<td>Center of Applied Molecular Engineering (CAME), University of Salzburg, Austria</td>
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<td>Lukas A. Huber</td>
<td>Biocenter, Innsbruck Medical University, Austria</td>
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<td>Alan S. Verkman</td>
<td>Dept. of Medicine &amp; Physiology, University of California, San Francisco, USA</td>
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<td>Knud H. Nierhaus</td>
<td>Max Planck Institute for Molecular Genetics, Berlin, Germany</td>
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<td>Gottfried Baier</td>
<td>Institute for Medical Biology and Human Genetics, Innsbruck Medical University, Austria</td>
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<td>Ulf R. Rapp</td>
<td>Institute of Medical Radiation and Cell Research, University of Würzburg, Germany</td>
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<td>2004</td>
<td>Alexandra Lusser</td>
<td>Dept. of Molecular Biology, Innsbruck Medical University, Austria</td>
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<td></td>
<td>Robert Konrat</td>
<td>Institute of Theoretical Chemistry and Structural Biology, University of Vienna, Austria</td>
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Current & Future Developments of the CMBI

• **Research.** Further development of joint research projects and of joint grant applications (research and excellence networks):
  - application for an FWF-funded DK-plus graduate research program (doctoral program) „Molecular and molecularbiological aspects of gene-regulation“ currently in preparation;
  - research consortium „Biomolecular interactions and drug discovery“.

• **New Building** Chemistry/Pharmacy - next to new Biocenter of the MUI.

• **Teaching.** Important graduate studies at the CMBI need structured and largely similar doctoral programs in the contributing disciplines: Biology, Chemistry, Pharmacy & Physics;
  - realization of (inter-disciplinary) graduate teaching capacities as entry steps and actual contributions to future structured PhD-programs;
  - development of a cross-disciplinary, structured CMBI PhD-program.

• **Young scientists.** Generation of an environment in research and teaching, attractive for excellent young scientists, in order to cultivate, in the molecular biosciences, a capacity at the „cutting edge“.