MAX PERUTZ LABS VIENNA

The Max Perutz Labs

Catalyzing discovery in mechanistic biomedicine

A joint venture of universität wien MEDIZINISCHE UNIVERSITÄT WIEN

Part of Vienna BioCenter

Mission Statement

The Max Perutz Labs are dedicated to a mechanistic understanding of important biological processes.

We have the potential to catalyze groundbreaking discoveries in mechanistic biomedicine.

We combine world-class research facilities with modern teaching methods to educate, inspire, and empower the next generation of 21st century scientists.

The **Max Perutz Labs** are a joint venture between the **University of Vienna** and the **Medical University of Vienna** that builds on the unique opportunities that arise from being embedded in the Vienna BioCenter Campus while having one of the largest hospitals in Europe, the Vienna General Hospital, on our doorstep. In visualizing haemoglobin, Max Perutz paved the way towards the era of precision medicine. To realize its full potential, precision medicine necessitates a molecular mechanistic approach.

2005

Founding

The Max Perutz Labs were founded in 2005 as a joint venture of the University of Vienna and the Medical University of Vienna.

Part of the Vienna BioCenter

The Max Perutz Labs are part of the Vienna BioCenter, one of Europe's hotspots for life sciences.

52/48

Female and Male Staff

Shaping the Future of the Max Perutz Labs

Highlights 2017—2019

Facts & Figures

Max Perutz Labs at a Glance

Data as of May 2019

366

Research Grants, Prizes and Awards

Including 12 ERC Grants and 8 START Awards

1 Australia
282 Austria
1 Belarus
1 Belgium
2 Brazil
9 Bulgaria
1 Canada
3 China
5 Croatia
1 Czech Republic
1 Estonia
5 France
31 Germany
2 Greece
4 Hungary
7 India
1 Indonesia
27 Italy
2 Japan
2 Latvia
1 Lithuania

40+
Nationalities

1 Mexico
1 New Zealand
1 Pakistan
5 Poland
2 Portugal
3 Russia
5 Serbia
5 Slovakia
2 Slovenia
1 Somalia
6 Spain
1 Switzerland
1 Thailand
1 The Netherlands
1 Tunesia
2 Turkey
3 U.S.A.
5 Ukraine
7 United Kingdom
1 Venezuela

Research Groups and their relation to Research Areas

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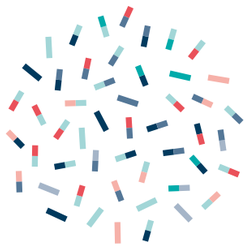
Research Areas



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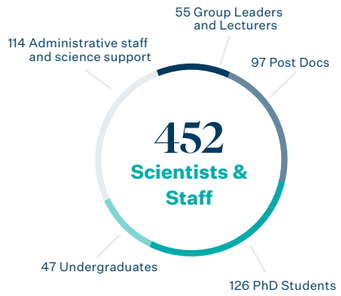
Research Groups

- Cell Biology & Signalling
- Chromatin, RNA & Chromosome Biology
- Computational Modelling of Biological Systems
- Developmental Dynamics
- Immunity & Infection
- Mechanisms of Human Disease
- Structure & Function of Macromolecular Assemblies



The last two years have seen a period of significant change that will shape the future of the Max Perutz Labs.

With the Seeding Success in Science Symposium in 2017 we said farewell to scientific director Graham Warren. Arndt von Haeseler was elected as Graham's successor and continues to lead the Max Perutz Labs today. He is supported by a team of co-directors: Alwin Köhler, Peter Schlögelhofer and Kristin Tessmar-Raible, as well as Fabien Martins as administrative director.

The Catalyzing Change project was kicked off in 2018 and has initiated an internal change process. It has brought together all group leaders of the Max Perutz Labs in a series of workshops to redefine the mission of the institute, finding common ground in the pursuit of mechanistic biomedicine. The new 'Think Tank', a meeting space designed to encourage exchange and communication was opened in November 2018. A new logo and visual appearance of the institute were introduced in May 2019 as a symbolic milestone, kicking off a new era.

With the implementation of a new name — Max Perutz Labs Vienna — we aim to strengthen the identity of the institute and reinforce our connection with an outstanding scientist, leader and educator. The first Max Perutz Day in May 2019 brought together our stakeholders, scientists and students to celebrate the 105th birthday and legacy of Max Perutz.

Researchers at the Max Perutz Labs continue to deliver internationally recognized research in fundamental biological processes. Our group leaders successfully secured multiple high-profile grants, among them five highly competitive ERC grants.

2017—2019 also saw five Max Perutz Labs group leaders promoted to full professor and three promoted to associate professors, demonstrating the success of the tenure track system. Finally, in July 2019 we celebrated the 95th birthday of Professor Hans Tuppy, who was honoured for his outstanding scientific achievements.

At the Max Perutz Labs Vienna we draw inspiration from the legacy of Max Perutz, are home to the talented scientists of today, and educate an aspiring young generation of scientists. Over the next few years our institute will continue to focus on our mission to push forward the frontiers of mechanistic biomedicine as we see more of the Catalyzing Change process coming to life.

ERC Grants

1 ERC Starting Grant
3 ERC Consolidator Grants
1 ERC Proof of Concept Grant

Academic Achievements

Full Professorship:
Andreas Bachmair, Verena Jantsch, Alwin Köhler, Sascha Martens, Isabella Moll, Kristin Tessmar-Raible, Bojan Zagrovic

Associate Professorship:
Boris Görke, Thomas Leonard, Gijs Versteeg

Student Awards and Grants

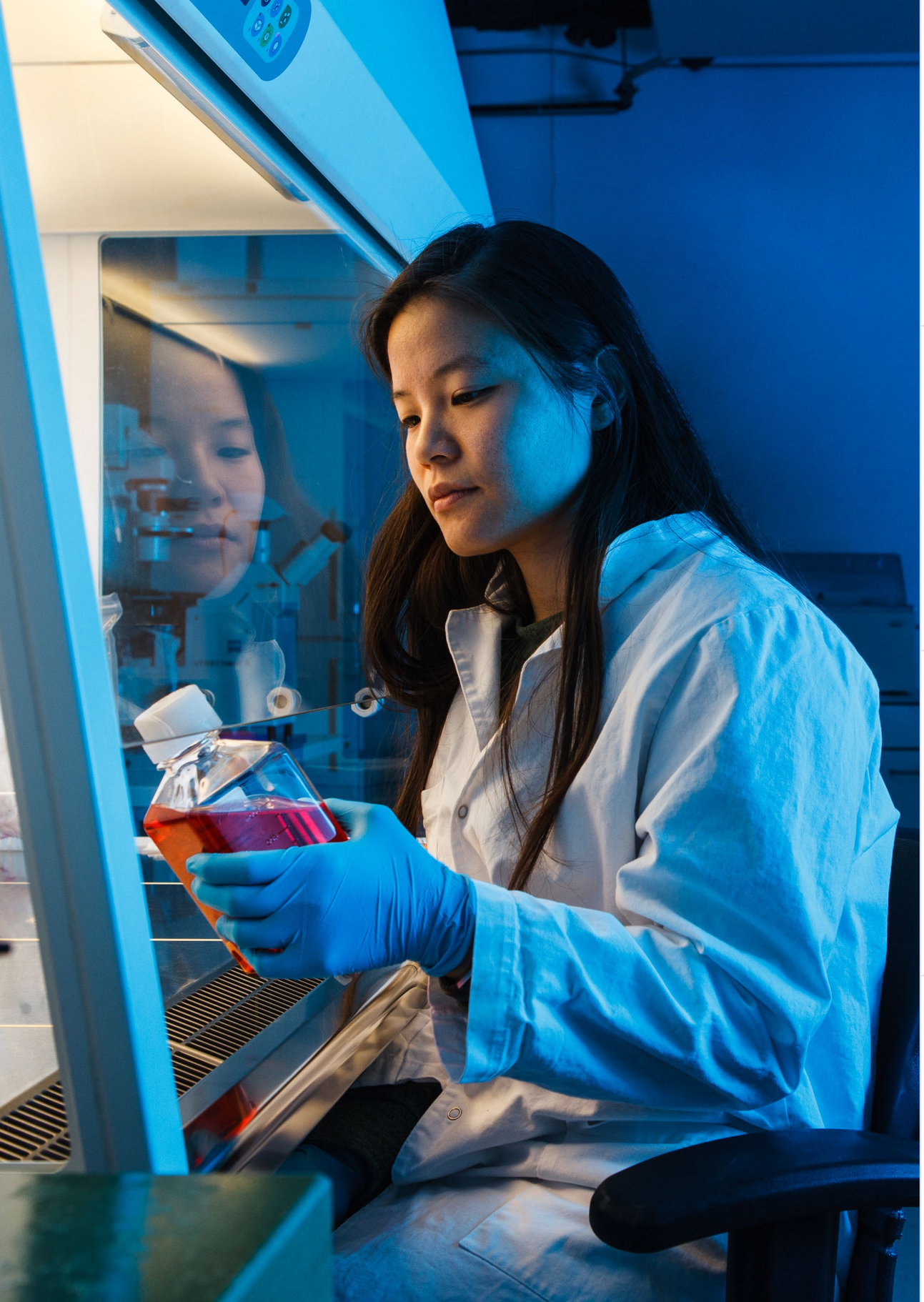
Uni:docs Fellowship:
Martina Borroni, Madhwesh Coimbatore Ravichandran, Merrit Romeike, Adriana Savova, Maria Velkova, Theresa Zekoll

DocAward:
Iva Lučić

VBC PhD Award:
Dorotea Fracchiolla, Laura D. Gallego, Iva Lučić

ÖAW Doc Fellowship:
Tanja Kaufmann, Anete Romanauska, Raffaela Torggler, Georg Vucak, Milica Vunjak

L'Oreal Fellowship:
Laura D. Gallego



Research Areas

Research at the Max Perutz Labs Is Curiosity-Driven and Spans the Fields of Molecular and Cell Biology.

Cell Biology & Signalling

Cells communicate at every level and molecular misunderstandings must be avoided.

Chromatin, RNA & Chromosome Biology

Unravelling nature's genetic and epi-genetic codes.

Computational Modelling of Biological Systems

Making sense of big data to drive hypothesis-based research.

Developmental Dynamics

Elucidating the faithful execution of developmental programmes.

Immunity & Infection

Maintaining an intact armour is essential for human health.

Mechanisms of Human Disease

Cures for human disease start with basic research.

Structure & Function of Macromolecular Assemblies

Visualising the biochemistry of macromolecules in health and disease.

Research Groups

From Mechanism to Medicine

Max Perutz Labs research groups tackle diverse biological questions, promoting cross-fertilization of research fields and broad perspectives.

Manuela Baccarini
Deciphering the MAPK pathway in vivo

Andreas Bachmair
Protein modification in plants

Andrea Barta
Post-transcriptional regulation of gene expression in plants

Dieter Blaas
Early Interactions of Picornaviruses with Host Cells

Udo Bläsi
Molecular Microbiology

Christa Buecker
Transcriptional Regulation during Early Embryonic Development

Christopher Campbell
Mechanisms that ensure chromosome segregation fidelity in mitosis

Alexander Dammermann
Centriole Assembly and Function

Thomas Decker
Interferons: Signals and Immunobiology

Kristina Djinovic-Carugo
Structure and assembly of sarcomeric Z-disc

Gang Dong
Structural biology of ciliogenesis and membrane trafficking

Sebastian Falk
Biogenesis & Action of small RNAs

Roland Foisner
Lamins in nuclear organization and human disease

Peter Fuchs
Intermediate filaments in epithelial stress response

Boris Görke
Signal transduction and post-transcriptional regulation in bacteria

Andreas Hartig
Origin and biogenesis of peroxisomes

Marcela Hermann
LDL-R gene family, apolipoproteins and lipid transfer

Joachim Hermisson
Mathematics and Biosciences Group (MaBS)

Reinhold Hofbauer
L-carnitine as a nutrigenomical metabolite and the use of cytostatic and toxic genes to treat solid tumors

Natale-Erwin Ivessa
Protein and Lipid Homeostasis in Cells and Organisms

Verena Jantsch-Plunger
Meiosis in Caenorhabditis elegans

Thomas Juffmann
Quantum Microscopy and Biophysics

Elif Karagöz
Protein Quality Control in the Endoplasmic Reticulum

Franz Klein
Yeast chromosomes in meiosis

Robert Konrat
Computational Biology and Biomolecular NMR Spectroscopy

Alwin Köhler
Nuclear Envelope Biology – Gates, Chromatin & Lipids

Pavel Kovarik
Signaling and gene expression in inflammation

Heinrich Kowalski
Molecular and structural biology of picornaviruses

Karl Kuchler
Host-Pathogen Interactions & Mechanisms of Drug Resistance & Fungal Pathogenesis

Martin Leeb
Molecular Control of Cell Identity

Thomas Leonard
Structural Biology of Lipid-Activated Signal Transduction

Josef Loidl
Meiotic Chromosome Pairing and Recombination

Sascha Martens
Molecular Mechanisms of Autophagy

Javier Martinez
RNA processing machineries in mammalian cells

Isabella Moll
Ribosome Heterogeneity in Bacteria

Johannes Nimpf
ApoER2 and VLDL Receptor

Egon Ogris
Protein Phosphatase 2A Biogenesis and Monoclonal Antibodies

Shotaro Otsuka
Intra-cellular Communication between the ER and the Nucleus

Florian Raible
Stem Cells, Regeneration and Developmental Plasticity

Johann Rotheneder
Cell cycle regulation and DNA damage response

Peter Schlögelhofer
Molecular mechanisms of meiotic recombination

Tim Skern
Virus-host interactions

Dea Slade
DNA Damage Response and Transcription Regulation

Kelly Swarts
Tree-ring genomics

Kristin Teßmar-Raible
Biological Timers set by sun and moon

Gijs Versteeg
Cellular control mechanisms of protein degradation

Arndt von Haeseler
Center for Integrative Bioinformatics Vienna (CIBIV)

Georg Weitzer
Molecular aspects of cardiomyogenesis

Gerhard Wiche
The cytolinker protein plectin and its role in disease

Angela Witte
Virus φCh1 as a model system

Bojan Zagrovic
Laboratory of Molecular Biophysics

Hans Tuppy
Honorary Faculty Member

Hans Tuppy, Professor Emeritus at the Institute of Biochemistry at the University of Vienna, was instrumental in establishing research in Biochemistry and Molecular Biology in Austria.
He has served as the President of the Austrian Science Fund, Rector of the University of Vienna, President of the Austrian Academy of Sciences and Minister for Science and Research.

New Group Leaders

Welcome to the Max Perutz Labs

Sebastian Falk
Biogenesis & Action of small RNAs

Sebastian Falk is interested in the mechanisms of gene silencing and the regulation of gene expression by small RNAs. A biochemist and structural biologist by training, he received his PhD from Heidelberg University, where he worked on the targeting of membrane proteins. During his Postdoc at the Max Planck Institute of Biochemistry in Munich he studied eukaryotic RNA degradation. He joined the Max Perutz Labs as a junior group leader in March 2019.

Thomas Juffmann
Quantum Microscopy and Biophysics

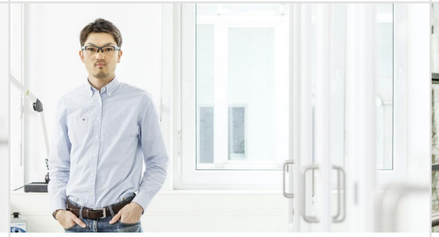
How can the sensitivity of microscopes be improved, so that the information extracted from each probe particle is maximized?

Physicist Thomas Juffmann works at the interface of quantum physics and biology to answer this question. He did his PhD on molecular quantum optics at the University of Vienna and then moved to Stanford as a postdoc. He then joined the ENS Paris as an HFSP fellow. In 2018, he came back to Vienna to start his shared, interdisciplinary group at the Faculty of Physics and the Max Perutz Labs.

Elif Karagöz
Protein Quality Control in the Endoplasmic Reticulum

Most proteins need to fold into distinct structures to fulfill their function. How cells deal with protein folding defects is a fundamental biological question.

Elif Karagöz investigates how cells sense and adapt to the conditions that challenge their protein folding capacity. She studied in Turkey before doing her Master's degree at the Max Planck Research School in Göttingen. After completing her PhD at Utrecht University, she did a postdoc at the University of California San Francisco. She joined the Max Perutz Labs in January 2019.



Shotaro Otsuka
Intra-cellular Communication between the ER and the Nucleus

Shotaro Otsuka joined the Max Perutz Labs in April 2019 to investigate inter-organelle communication, and is especially interested in the connection between the endoplasmic reticulum and the nucleus. As a postdoc at the EMBL, he has developed a novel 'dynamic' nano-scale imaging approach.

Before that he investigated nucleocytoplasmic transport by single-molecule measurements using atomic force microscopy during his PhD research at Kyoto University.

Kelly Swarts
Tree-ring genomics

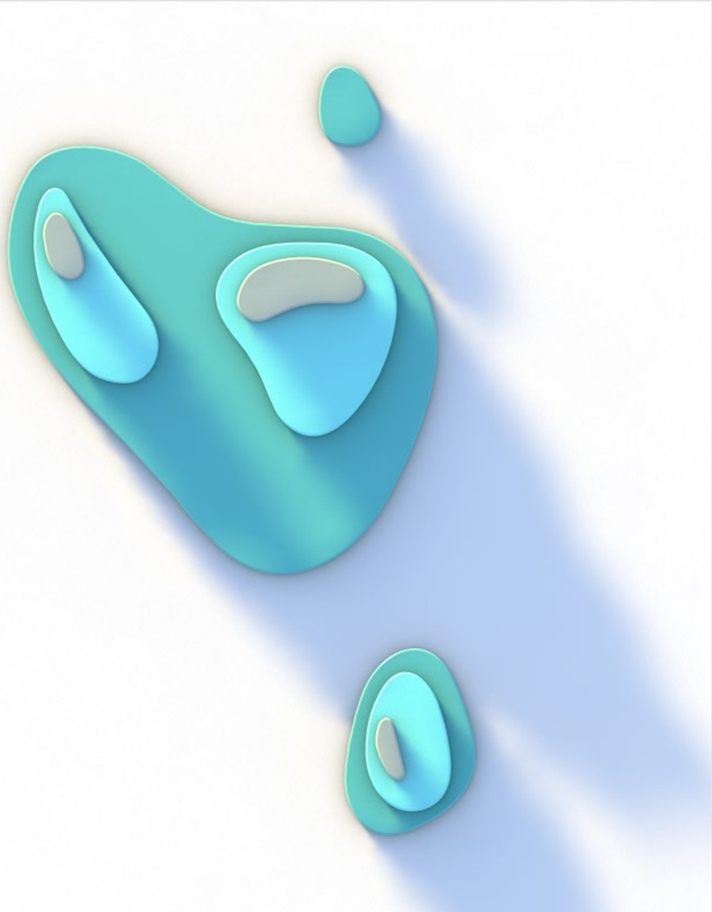
Using quantitative, computational and population genetic approaches, Kelly Swarts' group seeks to understand the biological basis of climate adaptation in conifers.

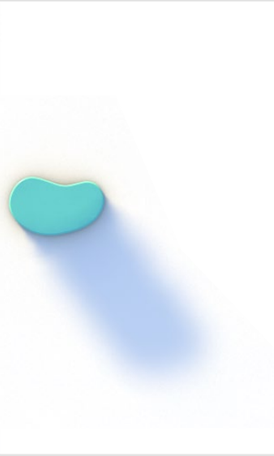
She studied at the University of Michigan and holds a M.A. in archaeology and archaeobotany from Northern Arizona University. During her PhD studies at Cornell University she focused on quantitative genetics in maize and computational biology. After a short postdoc in Germany she moved to the Vienna BioCenter as a joint GMI / Max Perutz Labs group leader.

Research Highlights 2017 — 2019

Catalyzing Discovery in Mechanistic Biomedicine

Our scientists strive to answer fundamental questions in biology with the potential to catalyze discovery in mechanistic biomedicine. Research at the Max Perutz Labs spans the fields of molecular and cell biology. Recent research highlights cover basic research questions, but also more applied fields of biology.



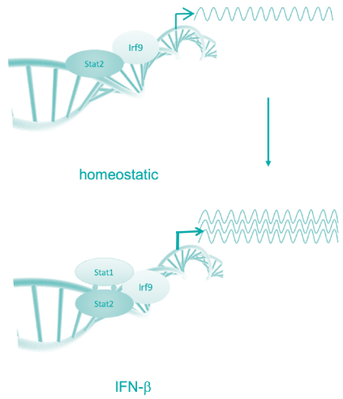


Max Perutz's major contribution to protein crystallography was to solve the so-called 'phase problem' by introducing heavy atoms into proteins. The changes in the intensities of the reflections allowed the positions of the heavy atoms to be worked out using the Patterson synthesis. Today, the **Patterson map** is still widely used for the interpretation of the heavy atom sub-structure and initial experimental phasing.

Research Highlight

How Cells Quickly Activate Innate Immunity

Ekaterini Platanitis, Duygu Demiroz, Anja Schneller, Katrin Fischer, Christophe Capelle, Markus Hartl, Thomas Gossenreiter, Mathias Müller, Maria Novatchkova & Thomas Decker: A molecular switch from STAT2-IRF9 to ISGF3 underlies interferon-induced gene transcription. Nature Communications, 2019 Jul 2;10(1):2921.



© Thomas Decker

Upon infection cells quickly switch from normal operation to immune reaction in a matter of minutes. This requires a cellular signal cascade that activates antimicrobial or antiviral gene expression. Thomas Decker's group has discovered that a molecular switch between an alternative and the regular version of the transcription factor ISGF3 enables the rapid onset of the innate immune response.

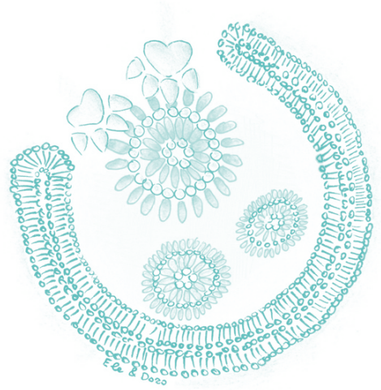
Interferons dock on cell surface receptors to initiate a signaling process that causes the cell to produce the protein complex ISGF3, responsible for activating antimicrobial gene expression. The researchers found out that two of the three proteins forming this complex are constantly bound to DNA, independently of the signals caused by interferons.

This 'light' version of ISGF3 maintains a low expression of antimicrobial genes, similar to an engine running in low gear. When activated by interferons, the complete version of ISGF3 assembles in the nucleus, thus revving up the genetic machine of innate immunity. The proximity of the proteins to the DNA and the rapid exchange of 'light' and complete versions explains how the innate immune system produces high levels of effector proteins in such a quick manner.

Research Highlight

A Molecular "Claw" Is a Long Sought Missing Link in Selective Autophagy

Eleonora Turco, Marie Witt, Christine Abert, Tobias Bock-Bierbaum, Ming-Yuan Su, Riccardo Trapannone, Martin Sztacho, Alberto Danieli, Xiaoshan Shi, Gabriele Zaffagnini, Annamaria Gamper, Martina Schuschnig, Dorotea Fracchiolla, Daniel Bernklau, Julia Romanov, Markus Hartl, James H. Hurley, Oliver Daumke, Sascha Martens: FIP200 Claw Domain Binding to p62 Promotes Autophagosome Formation at Ubiquitin Condensates. Molecular Cell, 2019 Apr 18;74(2):330-346.e11.

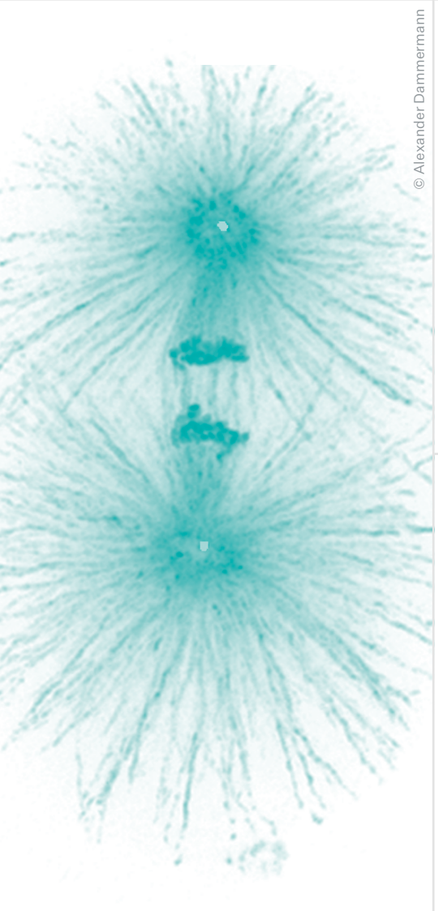


© Dorotea Fracchiolla, Eleonora Turco

In autophagy, cells get rid of potentially dangerous material. This ensures that the organism stays healthy. The process requires perfect communication between the different actors. Scientists led by Sascha Martens have identified how the protein FIP200, a key player in autophagy, is recruited to the material destined for degradation by selective autophagy.

FIP200 is an important factor in the formation of autophagosomes, wherein harmful cellular substances are sequestered and finally degraded. Another protein, p62, collects this cargo material, so that autophagosomes can form around it. How the appearance of the cargo is coupled to the autophagy machinery was unclear. The scientists discovered that the p62 and FIP200 proteins directly bind to each other. Structural analysis of FIP200 also revealed that a part of it is shaped like a claw.

The team identified a pocket in the FIP200 claw that binds a small motif of p62, revealing a long-sought link between cargo collection and autophagic degradation. Mutations in p62 cause a number of diseases including neurodegeneration. A better understanding of the mechanism of autophagy could therefore open new avenues of research into human diseases.



© Alexander Dammermann

Research Highlight

A Critical Player at the Centre of Mitosis

Mitosis is the process by which the genetic information encoded on chromosomes is distributed to two daughter cells, a fundamental feature of all life on earth. In animal cells, centriole-organised centrosomes direct the assembly of the mitotic spindle on which chromosomes align and are segregated.

A team led by Alexander Dammermann has been examining how centrioles contribute to centrosome function in mitosis.

Using laser microsurgery, the team was able to remove the centrioles from within the mitotic centrosome without simultaneously eliminating the entire structure. They found that centriole ablation did not lead to an immediate collapse of the surrounding so-called pericentriolar material. However, further growth of this material was strongly impaired, revealing a critical role for centrioles in mitotic spindle assembly.

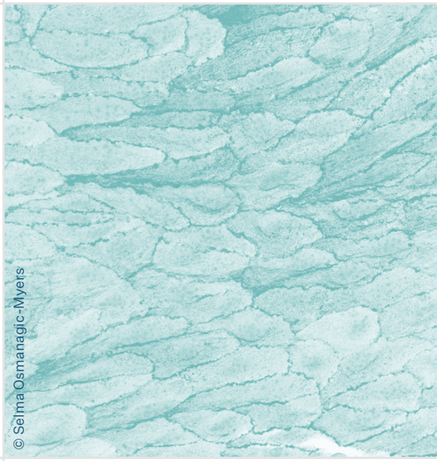
Centrioles were also found to be essential for the structural integrity of centrosomes. This is particularly remarkable given the small size of centrioles compared to the pericentriolar material. How centrioles confer mechanical stability to a structure >30x larger is not immediately clear. The authors propose that centrioles may provide anchor sites for filamentous proteins that impart tensile strength to the pericentriolar material just as rebars do for reinforced concrete.

Gabriela Cabral, Triin Laos, Julien Dumont, Alexander Dammermann: Differential Requirements for Centrioles in Mitotic Centrosome Growth and Maintenance. Developmental Cell, 2019 Aug 5;50(3):355-366.e6

Research Highlight

The Biomechanics of Vascular Ageing

Selma Osmanagic-Myers, Attila Kiss, Christina Manakanatas, Ouafa Hamza, Franziska Sedlmayer, Petra L. Szabo, Irmgard Fischer, Petra Fichtinger, Bruno K. Podesser, Maria Eriksson, and Roland Foisner: Endothelial progerin expression causes cardiovascular pathology through an impaired mechanoresponse. JCI, 2019 Feb 1;129(2):531-545.



© Selma Osmanagic-Myers

Scientists from Roland Foisner's group have unravelled the molecular mechanism behind cardiovascular symptoms in the premature aging disease Hutchinson-Gilford progeria syndrome. In doing so, they also improve our understanding of normal aging processes in the cardiovascular system.

Progeria is caused by mutations in the LMNA gene that lead to the production of a mutant lamin protein, called progerin. The scientists found out that accumulating progerin stiffens the lamina and the cytoskeleton, structures that provide stability to the cell. In endothelial cells this reduces their ability to respond to mechanical forces exerted by blood flow. The affected cells then produce excessive connective tissue, a condition called fibrosis.

Progerin is also often found in normally aged organisms, but at lower levels. The cardiovascular pathologies of 'normally-aged' people resemble those in progeria. Understanding the molecular defects leading to cardiovascular disease in progeria can help to develop new therapeutic strategies for progeria patients and helps in the understanding of the molecular processes in normal aging.

© Anete Romanauska, Alwin Köhler and Sonja Jacob

Research Highlight

Lipid Storage Metabolism in an Unexpected Place

Our genetic material is safeguarded by two membranes surrounding the cell nucleus. While the outer membrane has long been known to synthesize new lipids for membrane proliferation or fat storage, the inner nuclear membrane has been regarded as a metabolically inactive backwater of a cell's endomembrane system. Alwin Köhler and Anete Romanauska have overturned this idea by discovering active lipid metabolism at the inner nuclear membrane.

Using metabolic perturbations, lipid biosensor probes and electron microscopic analyses, the researchers demonstrated lipid turnover at the inner nuclear membrane, which leads to the formation of specific organelles called nuclear lipid droplets. These droplets store fat, can occupy a huge portion of nuclear space and communicate with the inner nuclear membrane through specialized membrane bridges. The authors also described the genetic circuit for the synthesis of nuclear lipid droplets, and identified a factor that is required for the proper exchange of lipids between the droplets and the inner nuclear membrane. This study assigns a new function to the inner nuclear membrane and raises intriguing questions about how the genome might be influenced by nuclear lipid metabolism in health and disease.

Anete Romanauska, Alwin Köhler: The Inner Nuclear Membrane Is a Metabolically Active Territory that Generates Nuclear Lipid Droplets. Cell, 2018 Jul 26;174(3):700-715.e18.

© Jantsch Lab

Research Highlight

Chromosomes in Motion: What's Lamin Got to Do with It?

Jana Link, Dimitra Paouneskou, Maria Velkova, Anahita Daryabeigi, Triin Laos, Sara Labella, Consuelo Barroso, Sarai Pacheco Piñol, Alex Montoya, Holger Kramer, Alexander Woglar, Antoine Baudrimont, Sebastian Mathias Markert, Christian Stigloher, Enrique Martinez-Perez, Alexander Dammermann, Manfred Alsheimer, Monique Zetka, Verena Jantsch: Transient and Partial Nuclear Lamina Disruption Promotes Chromosome Movement in Early Meiotic Prophase. Developmental Cell, 2018 Apr 23;45(2):212-225.e7.

Meiosis is a form of cell division, which occurs in all sexually reproducing organisms. During this process, homologous chromosomes from the mother and the father exchange parts in an event called 'crossing over', leading to a new mix of parental genomes. Verena Jantsch's group shows that the lamina, the usually stiff and rigid scaffolding of the nucleus acquires flexibility to support those early meiotic events.

A crucial step for successful crossovers is that the chromosomes from the two parents align pairwise next to each other. This is mediated by rapid chromosome movements, where chromosome ends are dragged along the inside membrane of the cell nucleus. Yet under the nuclear membrane, a stiff and rigid lamina network supports the shape and stability of the nucleus, posing a potential obstacle for chromosome movement.

In C. elegans, the researchers discovered that, like slightly opening a knot, the lamina network loosens up during meiosis. This is critical for facilitating the rapid movement of the chromosomes. If the lamina remains stiff during meiosis, chromosome pairing and chromatin reorganization were slower and aberrant chromosome structures were observed. The findings also provide an incentive to examine whether similar mechanisms are operating in mammalian cells.

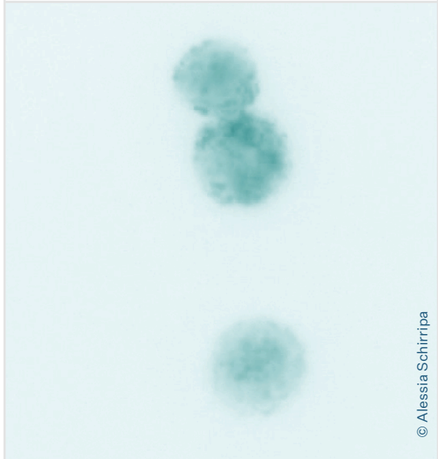
Research Highlight

A System of Checks and Balances in the Blood

Hematopoietic Stem Cells (HSCs) give rise to blood and immune cells of the body, and are therefore essential for survival. Whenever new blood needs to be formed, they must rapidly switch back and forth between their dormant state and activation. The group of Manuela Baccarini has shown how intracellular signalling can safeguard this delicate balance between activation and dormancy.

To compensate for blood loss, HSCs start to actively self-renew and differentiate into all blood cell types. After completing their task, HSCs need to revert back to their dormant state. A small tilt towards either state can have catastrophic consequences for the organism. Manuela Baccarini's group has discovered the mechanism that safeguards this delicate balance. They showed that two pivotal intracellular signalling pathways, almost always activated in parallel, are coordinated by a feedback-loop that maintains HSC homeostasis. Inhibitors of the pathways under study are currently being used in cancer therapy. The results suggest that these compounds could be repurposed to mobilize 'lazy' HSCs, as seen, for instance, in ageing organisms.

Christian Baumgartner, Stefanie Toifl, Matthias Farlik, Florian Halbritter, Ruth Scheicher, Irmgard Fischer, Veronika Sexl, Christoph Bock, and Manuela Baccarini: An ERK-Dependent Feedback Mechanism Prevents Hematopoietic Stem Cell Exhaustion. Cell Stem Cell, 2018 Jun 1;22(6):879-892.e6.



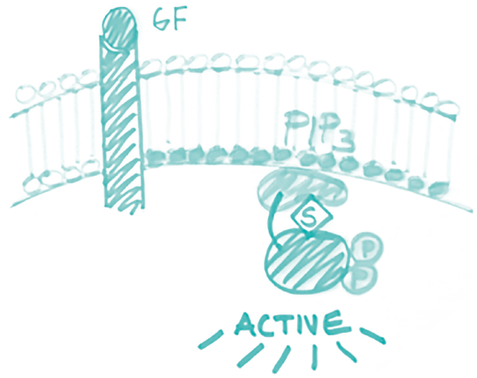
© Alessia Schirripa

Research Highlight

Lipid-dependent Aktivity

Michael Ebner, Iva Lučić, Thomas A. Leonard, Ivan Yudushkin: PI(3,4,5)P3 Engagement Restricts Akt Activity to Cellular Membranes. Molecular Cell, 2017 Feb 2;65(3):416-431.e6.

The growth and proliferation of cells in a multicellular organism must be tightly coordinated. Akt is an essential signal transducer that controls cell growth, proliferation, and survival. Unsurprisingly, uncontrolled Akt activity is observed in overgrowth disorders and more than 50% of all human cancers. Understanding the mechanisms that govern Akt activity is therefore essential for developing and improving cancer therapies.



© Iva Lučić

Two Max Perutz Labs PhD students, led by Thomas Leonard and Ivan Yudushkin, have determined that the signals that activate Akt directly control activity by eliciting a conformational change in Akt that unblocks its active site. By coupling engagement of the signal to Akt activity, the cellular response is maintained proportional to the magnitude of the stimulus. Since these signals are embedded in cellular membranes, this mechanism also restricts activity to discrete locations in the cell.

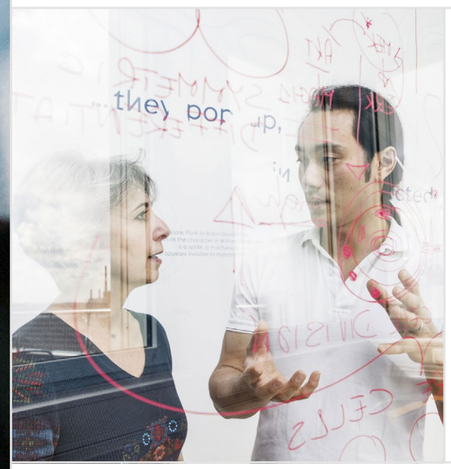
A mutation associated with overgrowth disorders of the brain unlocks Akt such that these signals are bypassed, leading to runaway activity throughout the cell that is independent of the activating signal. These pro-proliferative and pro-survival signals have the potential to drive tissue growth in an unregulated manner.

Education

Inspiring and Enabling the Next Generation

Teaching Mission Statement

The Max Perutz Labs seek to educate students to think critically and analytically, challenge them to set ambitious goals, and instill in them both broad horizons and deep understanding. In doing so, we aspire to furnish them with the necessary knowledge and skills to push forward the frontiers of 21st century biomedical science.



PostDoc

Moving Towards Independence

Postdocs at the Max Perutz Labs benefit from a supportive environment, coaching, and tailored workshops aimed at their career development. More than 50 research labs, excellent research facilities, and the vibrant international atmosphere at the Vienna BioCenter ensure that young researchers find all they need at this important career stage.

PhD Studies

Being Part of an International Community

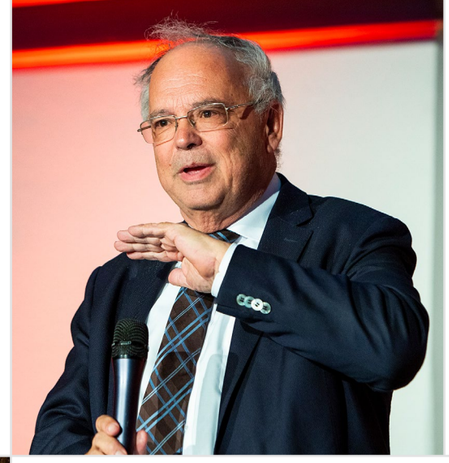
PhD education is a strong priority at the Max Perutz Labs. Over the years, we have been running several strong PhD programs, recruiting and training many excellent young scientists who have strengthened our research. More than 100 PhD students from over 30 countries currently participate in the research activities of the Max Perutz Labs. We support their curiosity and dedicated work by providing excellent facilities, mentoring, and high-quality seminars with renowned international experts from all fields of molecular biology.

PhD students can choose from specialised PhD tracks within the Vienna Doctoral School Molecules of Life, a joint doctoral programme of the University of Vienna and the Medical University of Vienna. While the curricula of the individual tracks are specifically tailored to the scientific focus, the VDS fosters interdisciplinary and scientific exchange between programmes. Many research groups at the Max Perutz Labs additionally participate in the Vienna BioCenter PhD programme. The four research institutes at the Vienna BioCenter jointly organise the programme. Doctoral training is complemented by a number of more specialised PhD programmes, some of which are third party funded.

Going forward, we plan to harmonize PhD education in molecular biology at the University of Vienna and the Medical University of Vienna, creating a unified School that awards a joint PhD degree of the co-founding Universities and merges the activities of ‘Molecules of Life’ and the VBC PhD program.

Connecting the Past and the Future

Kicking off a New Era — Max Perutz Day 2019



“The Max Perutz Labs are a leading example of an evolving inter-university cooperation.”

– Rector Heinz Engl,
University of Vienna

MAX PERUTZ DAY №1
105th birthday of Max Perutz

“Scientists affiliated with the University of Vienna and the Medical University of Vienna work side by side to investigate the basic mechanisms of life, while at the same time ensuring top quality education for students at all levels. Education at the Max Perutz Labs is a mission and a legacy; today’s students will be tomorrow’s scientists. Research and education in Molecular Biology are among the key strengths of the University of Vienna and we will continue to invest in this area in the future. The Max Perutz Labs are part of our long-term strategy to establish new professorships in Cell and Developmental Biology, Quantitative Modeling of Biological Networks, Advanced Microscopy and Cellular Dynamics, and Molecular Biology.”

– Rector Heinz Engl,
University of Vienna

On the occasion of Max Perutz’s 105th birthday, the science community, students and stakeholders from the University of Vienna and the Medical University gathered to celebrate the first Max Perutz Day on May 23rd 2019 to honour the scientific legacy of the Nobel Prize winner for whom the institute is named. Beyond his intellectual brilliance, Max Perutz was a humanist as well as an ambassador for science, and whose ideas are shaping the future of the Max Perutz Labs.

In her keynote speech, science writer and Max Perutz biographer Georgina Ferry honoured Max Perutz’s life and his passion for research by quoting his famous saying: “In science, truth always wins”. In this spirit the Max Perutz Labs Vienna will seek to uphold the values he stood for: creating an open environment where ideas can be exchanged and international researchers can thrive.

“The future of internationally competitive science is necessarily collaborative, interdisciplinary, and forward thinking.”

– Rector Markus Müller,
Medical University of Vienna

“In the long term, individuals and the recognition they compete for are less important than the collective endeavor of the scientific community.”

– Georgina Ferry, science writer and Max Perutz biographer

From left to right: Arndt von Haeseler, Alwin Köhler, Georgina Ferry, Marion Turnovszky (Max Perutz’ cousin), Rector Heinz Engl, Rector Markus Müller

“Max Perutz was a beacon of scientific curiosity and his legacy is our inspiration. Basic science has always been a strong focus of the Medical University of Vienna, and the Max Perutz Labs, with its emphasis on mechanistic biomedicine, provide an outstanding environment in which to nurture the creativity and intellectual freedom that are the hallmarks of outstanding scientific discovery. The cures of tomorrow are rooted in the discoveries of today. The development of a new 2-year Master’s course in Molecular Precision Medicine, which is being spearheaded by the Max Perutz Labs, is just one example that illustrates these values, as well as our commitment to basic science. I sincerely hope that the education of students in basic, clinical, translational, and medical science will help bridge the gap between the bench and the clinic, strengthen our ties to the University of Vienna and the Vienna BioCenter, and maximize the synergies of our research programmes.”

– Rector Markus Müller,
Medical University of Vienna

1914 — 2002

Max F. Perutz

Max Perutz was one of a handful of pioneers who began something that has become so familiar to us: Molecular Biology.

Born in Vienna, Max Perutz studied in Cambridge, was later deported to Canada, and eventually found his way back to Cambridge to discover the structure of DNA together with Francis Crick.

His own quest to reveal the structure of haemoglobin was rewarded with the Nobel Prize in 1962 and launched a new era of medicine. Beyond intellectual brilliance, Max Perutz stands out as an ambassador for science, a humanist, and as an inspiration for young scientists.

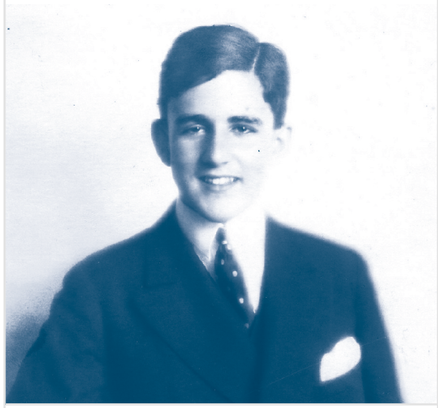
Max F. Perutz with his first high-resolution model of haemoglobin

Growing up in Vienna

Max Ferdinand Perutz was born in Vienna on May 19th, 1914 into a family of textile manufacturers. Max was supposed to study law in preparation for entering the family business. However, a good schoolmaster at the Theresianum grammar school kindled his interest in chemistry, and he made this the subject of his studies at the University of Vienna.

Although largely disappointed with the way in which the subject was taught, he acquired a special interest in organic biochemistry, having heard about the work of the Nobel Prize winner (and discoverer of vitamins) Sir Gowland Hopkins at Cambridge.

His teacher, Herman Mark, visited Cambridge with plans to pave the way for Perutz to join Hopkins' group. But Mark met J. D. Bernal, who said that he would take Perutz as his student. Max left Austria in 1936 to pursue his scientific career in Cambridge.



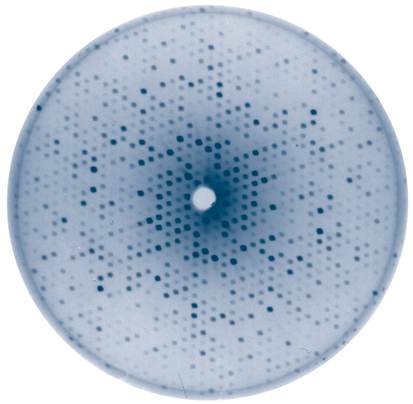
Pupil at the Theresianum, aged fifteen

Mountains and Glaciers

Mountains played an important part in Max Perutz's life. He had a great passion for mountaineering and skiing. Barely a year passed without a visit to Austria or Switzerland. He also led courses in alpine skiing for his friends.

From his early twenties Perutz had a deep interest in glaciers. How do glaciers flow? Does this occur like honey flowing out of a tilted container, or is there some other mechanism? More or less as a hobby, Perutz, examined this problem and proposed that they behave like a ductile metal such as aluminium when it is rolled into a sheet. The story was published in Nature in 1953. In honour of his contributions to glaciology, a glacier in the Antarctic was named after him.

> "I owe my first step to popularity to scarlet fever which I caught when I was fourteen. To disinfect the classroom, my schoolmates got three days off, for which they thanked me solemnly in a letter signed by the entire class."
>
> – Max F. Perutz



Diffraction photograph of oxyhaemoglobin

Groundbreaking Studies

In 1946 Max Perutz was joined in Cambridge by John Kendrew, who set out to work on myoglobin, the much smaller single-chain cousin of haemoglobin. Both spent several years collecting huge amounts of data and using the intensities of the reflections to calculate contour maps, hoping that these would allow them to determine the haemoglobin structure.

The approach failed. Provoked and inspired by a graduate student, Francis Crick, Perutz decided to attack the so-called phase problem from a different angle.

The breakthrough came in 1953, when Perutz and Kendrew managed to soak a heavy atom (mercury) into their haemoglobin crystal. For being the first to successfully determine the structures of complex proteins, Perutz and Kendrew were awarded the Nobel Prize for Chemistry in 1962.

The Challenge Continued

For Max Perutz the challenge continued. To understand the oxygen-binding function of haemoglobin, he needed atomic models of both the oxygenated and deoxygenated forms of haemoglobin. This required measuring several hundred thousand reflections.

Max Perutz and his collaborators completed it in 1970, about thirty-three years after he had taken the first X-ray picture of the molecule. He proposed a cooperative mechanism with the different parts of the model swinging back and forth between the two forms. It beautifully illustrated, and refined, the mechanism of conformational change (or allostery) postulated by the French biochemist Jacques Monod.

Approaching his eightieth birthday, Max Perutz took an interest in Huntington disease, a neurodegenerative disorder caused by abnormal expansions of glutamine repeats in the mutant protein (later called huntingtin). Max Perutz led by example and carried out his own experiments at the bench well into his eighties.

> "Discoveries cannot be planned, they pop up, like Puck, in unexpected corners."
>
> – Max F. Perutz

Max F. Perutz also had a great passion for mountaineering and skiing. When asked in a BBC radio interview what luxury he would take on a remote island, 87-year old Max Perutz said:

“A pair of skis.”

One of Max Perutz’s many stunning mountain photographs, taken on a trip to the Swiss Alps.

Imprint

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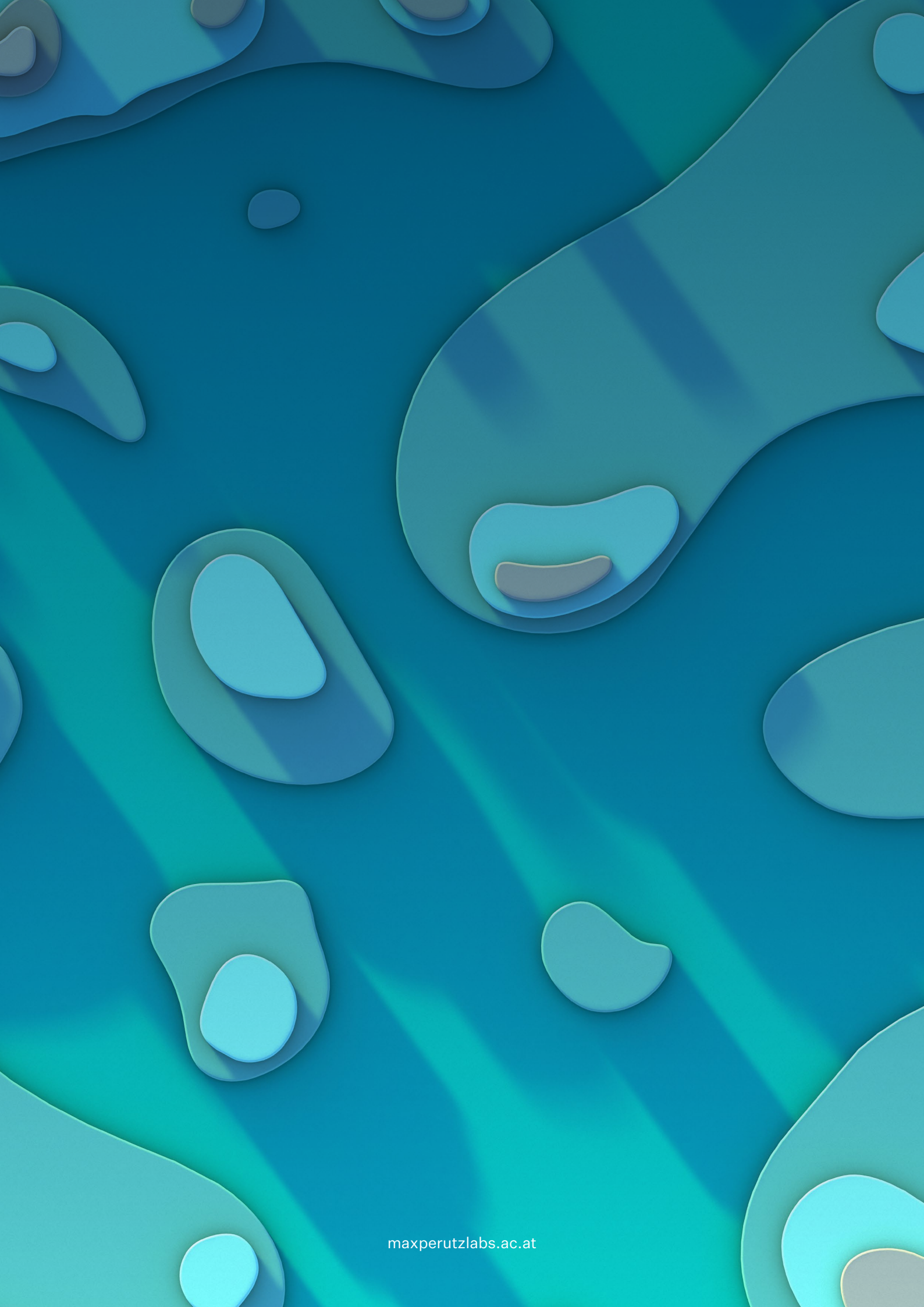
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