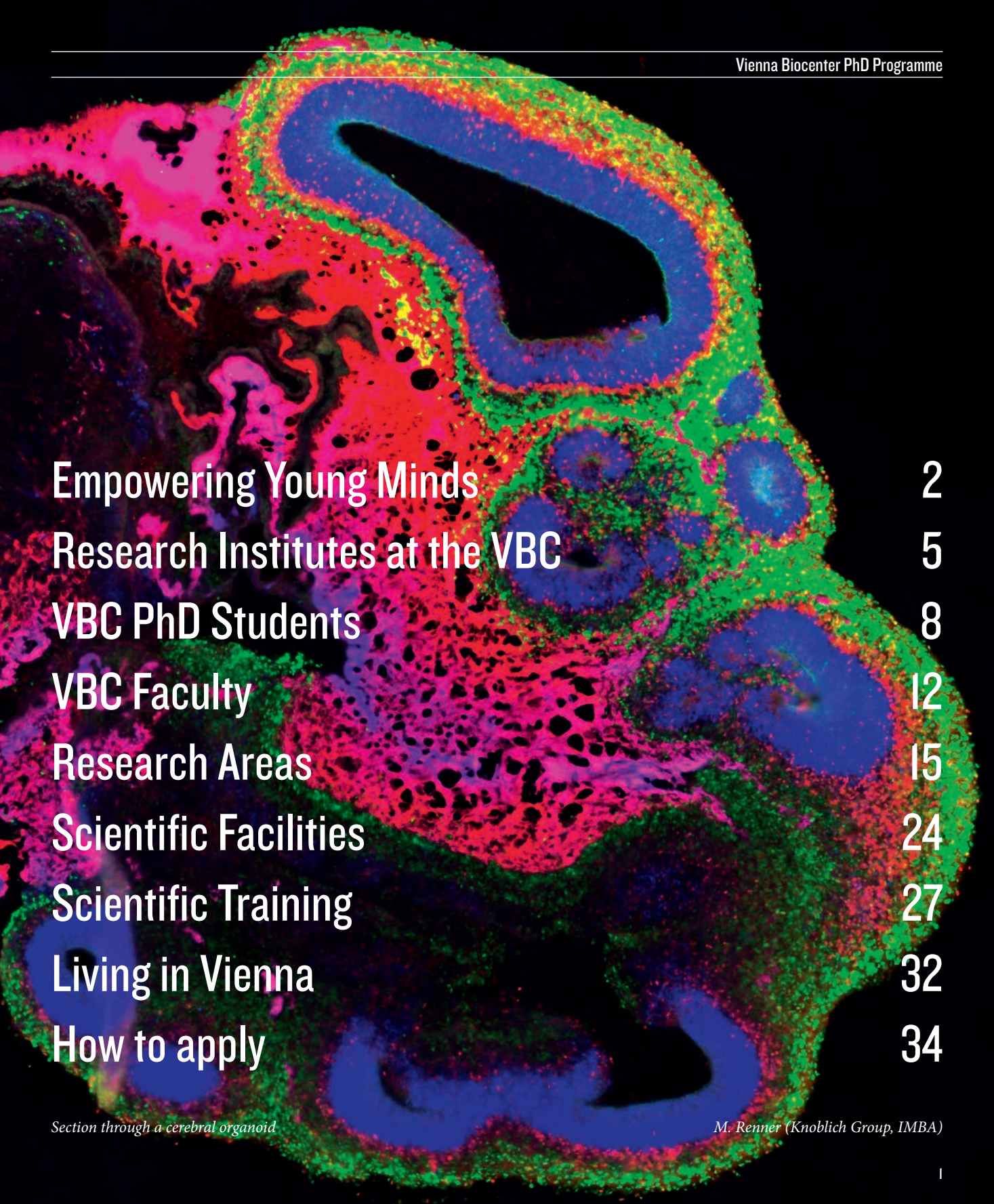
Empowering
Curious Researchers

PhD Programme in Life Sciences
at the Vienna Biocenter

Front cover: Lisa Landskron (Knoblich Group, IMBA), Dhaarsini Koneswarakantha (Martinez Group, IMBA) *R. Gutzat*



Section through a cerebral organoid *M. Renner (Knoblich Group, IMBA)*

Empowering curious minds to become scientists

"For me, science is one of the last remaining true adventures: a journey into the unknown, with unclear outcomes, and full of surprises. But with the unique satisfaction of discovering something no one else has seen before." Jürgen Knoblich, IMBA

These are certainly extremely exciting and rewarding times to explore the secrets of life: DNA sequencers read the three billion base pairs of a human genome within days for ~1000 Euros; a small RNA-guided defense protein discovered in bacteria enables the editing of any genome with nucleotide precision; thousands of biochemical reactions can be watched simultaneously at the resolution of single molecules; electron microscopes reveal the atomic details of macro-molecular protein machines in action; light microscopes allow the real time monitoring of neuronal activity of entire brains; increasingly complex tissues and organs can be grown from induced pluripotent stem cells in a dish; and this list continues to grow. If you are reading this brochure, you are probably interested in doing a PhD or in the process of applying for PhD positions. Undoubtedly, this is one of the most important decisions in your scientific career. During a PhD, many aspects of a scientist's character are being defined, developed, and strengthened. Given the far-reaching implications and the importance of this decision, we compiled some general thoughts and suggestions that we consider important in choosing a PhD programme.

CHOOSING YOUR RESEARCH ENVIRONMENT

Once you set foot in an institute you typically know if you are in a top scientific environment. It is the blend of "everything is possible" and an open collaborative atmosphere that is behind the most successful research institutions. Infrastructure and resources on one hand, and a stimulating intellectual environment on the other are key issues to consider. Access to state-of-the-art equipment, whether it is a computer cluster, the latest microscopes, or next generation sequencers can make all the difference for your PhD project. Make sure you choose an institution where cutting-edge technologies are available to students, ideally through local facilities run by experts.

The free flow of ideas is the key in science. Make sure your research environment fosters communication through flat hierarchies and limited bureaucracy. Look for a place where your colleagues emphasize and expect high quality research, where everyone has the drive to be among the best and to help their colleagues

Steering Committee: Julius Brennecke, Alexander Stark, Inês Crisóstomo, Kristin Teßmar-Raible, Wolfgang Busch *R. Gutzat*

> "You want to be able to do exciting and ambitious experiments, limited only by your imagination."

be there too. Finally, check out the social atmosphere: there is no better environment for your PhD than a place where people work hard but also play hard.

CHOOSING YOUR SUPERVISOR

What is true in sports, art, and music, also applies to science: If you want to be among the best, you have to learn from the best. Your supervisor will help you select the important questions, teach you how to tackle them, mentor your development as a scientist, and introduce you to others at meetings and conferences. Your PI (principal investigator) will be key to your success.

When looking for a group, ask whether the PI is an international leader in her/his respective field. Did they receive training at top institutes? Do they publish landmark papers in renowned journals? Do they speak at international conferences and receive awards and research funding? Do you think you can build a trusted relationship with them in which you are seen as a 'colleague-to-be'? In addition, judge the level of supervision you will need and choose accordingly: more established PIs are usually not at the bench, while a young PI will probably work alongside you. Some of us were a PI's first PhD student while others worked with well-established senior PIs – and we all made it!

Certainly, choosing a supervisor is a hard decision to make. Why not contact PIs that work on topics that interest you in order to find out more? We also recommend speaking to current and previous PhD students or postdocs from labs whose work inspires you.

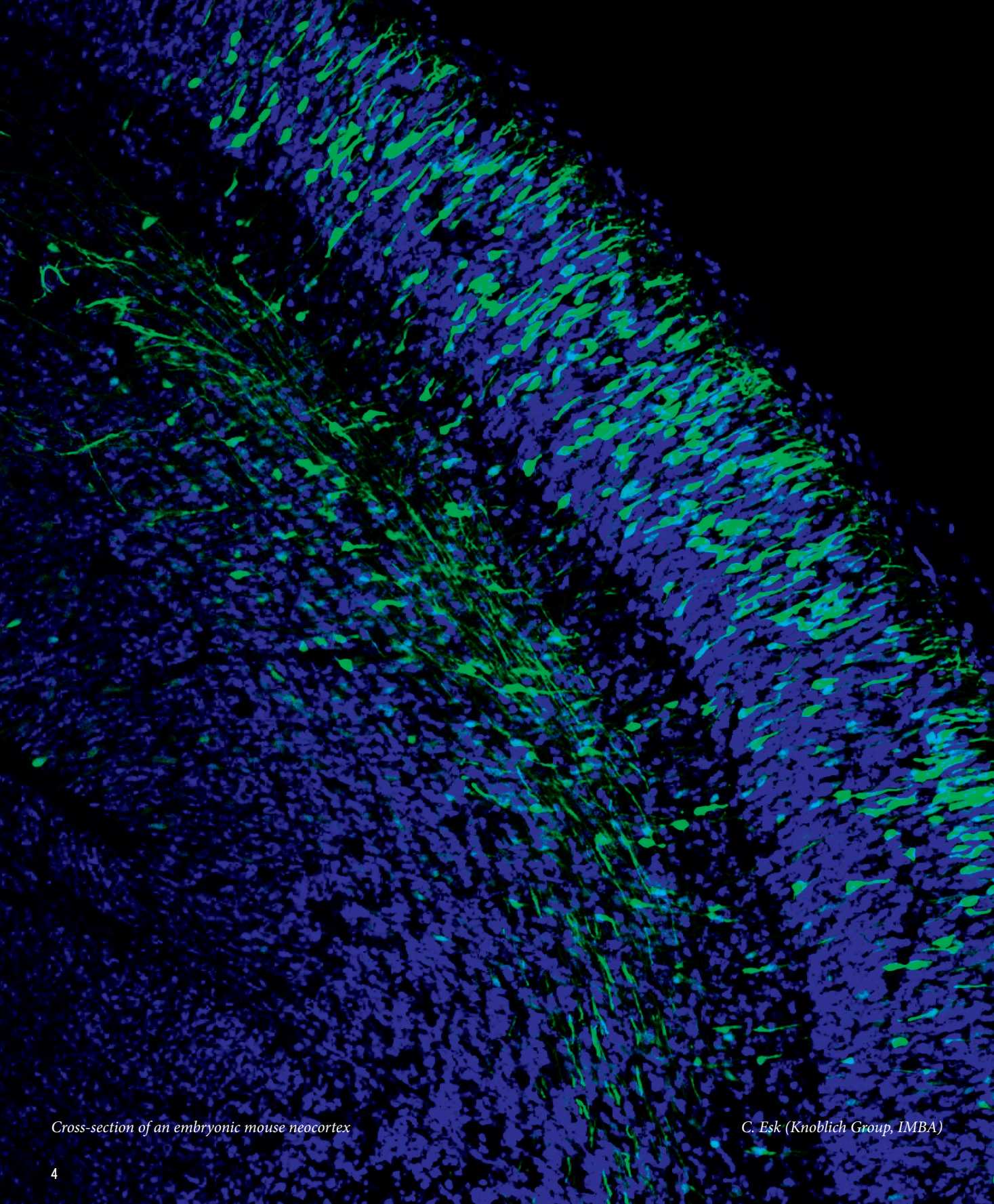
CHOOSING YOUR PHD PROGRAMME

Apart from your supervisor, the other students in your PhD programme will surely make a difference. Look for an international and stimulating environment that thrives on creativity and energy. Make sure the programme offers diverse training opportunities, and find out how previous students have done. It will give you a good measure of what the programme will enable you to achieve.

Last but not least: do not be afraid to leave your comfort zone. Mobility (a new country, different people, and a new culture) will open up new perspectives and allow you to grow and develop. And keep in mind that your undergraduate training does not determine you or your future work—choose what you are really interested in and don't limit your goals to what you can do today.

In this brochure, we want to give you an impression of the Vienna Biocenter PhD programme, one of the most renowned PhD programmes in Life Sciences in Europe.

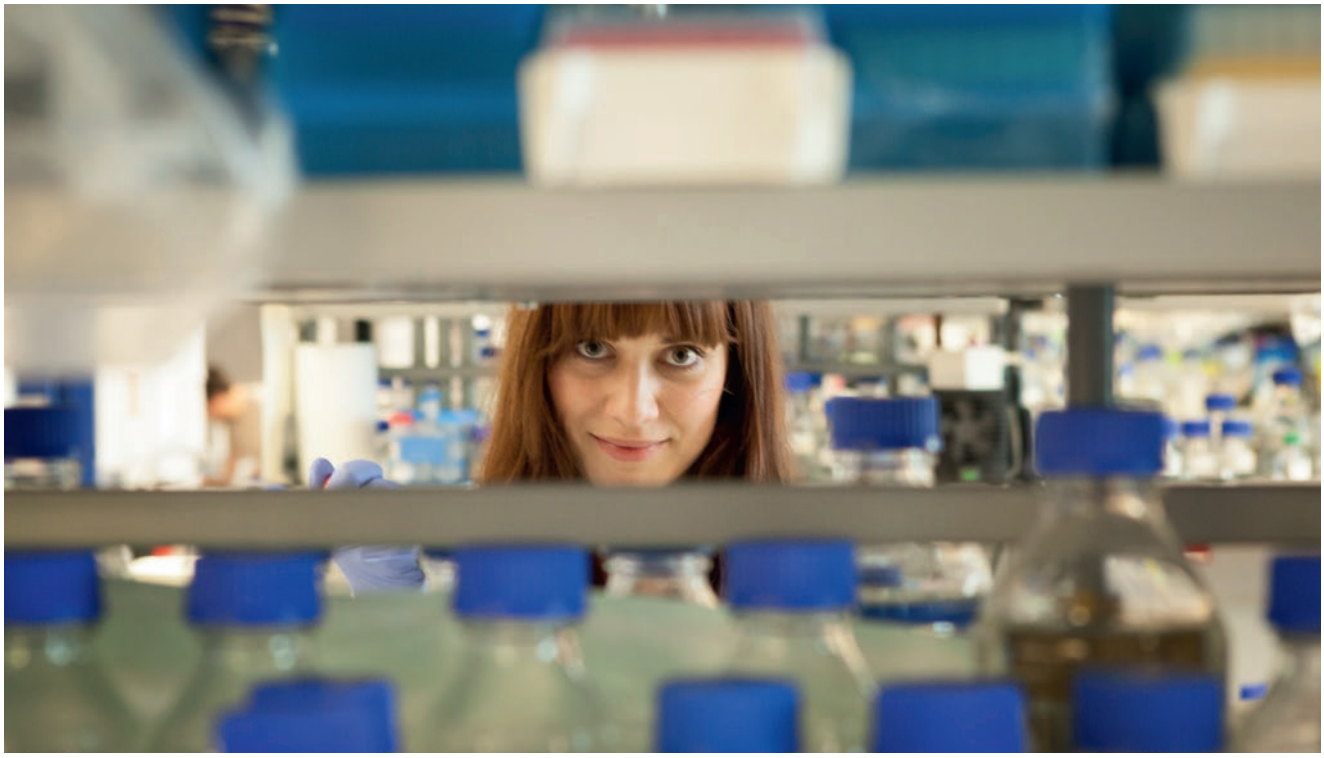
Steering Committee
Julius Brennecke
(IMBA Representative)
Wolfgang Busch *(GMI Representative)*
Inês Crisóstomo
(Scientific Training Coordinator)
Alexander Stark *(IMP Representative)*
Kristin Teßmar-Raible
(MFPL Representative)



Cross-section of an embryonic mouse neocortex *C. Esk (Knoblich Group, IMBA)*

Research Institutes at the VBC

The Vienna Biocenter is a campus of world-class research in Vienna - one of the most livable cities in the world. The VBC hosts four research institutes, three universities and twenty Biotech companies, with around 1400 people from 40 different nations.



Michaela Steiner (Brennecke Group, IMBA) *R. Gutzat*

Four thriving research institutions

A word from the directors

GREGOR MENDEL INSTITUTE (GMI) MAGNUS NORDBORG

The GMI is one of the world's few basic research institutes that focus on plant biology as an integral part of the life sciences. Although plants have a special role as the world's primary producers, they also play a major role as models for understanding how organisms function and evolve. In this respect, GMI research complements the other research institutes at the Vienna Biocenter. However, we also recognise the unique importance of plants, and attempt to maintain a broad research profile that ranges from plant evolutionary ecology to pathogen resistance to mechanisms of DNA replication. Our goal is simple: to do the world's best basic research on plants.

Aerial Representation of the Vienna Biocenter in 2017

INDICATORS (as of 2015) **32 ERC Grants** **14 EMBO Members**

INSTITUTE OF MOLECULAR PATHOLOGY (IMP) JAN MICHAEL PETERS

Research at the IMP is driven by curiosity to understand how life works. Scientists from all over the world come here to achieve this in their particular area. These can be very diverse, ranging from structural biology to circuit neuroscience and cancer research. Yet, what unites us is the belief that life can be understood at the molecular level, and that the knowledge gained by our research will be both fascinating in it, and at the same time useful to improve human health. The conditions that the IMP offers for the scientists who work here are second-to-none and include assets such as our world-class service units and a brilliant environment provided by the Vienna Biocenter. But other research institutes have these things too. What is really special about us is that we work together. The IMP is small enough that we all know each other, and can talk to each other, despite the breadth of our research topics. And this is what we do, every week in the student and postdoc Monday seminars, and almost every day at the coffee bar. This collegiality and open intellectual spirit is a source of great inspiration and one of our secrets, which has enabled great discoveries in the past – from the chromosomal cohesin complex to the neural circuits that guide sexual behavior - and which you can read about in textbooks today. If your heart beats for science and you want to understand how molecules can create life, and how we can use this knowledge to treat human diseases, then join us on our journey into the unknown, learn as a PhD student what it takes to make discoveries, and then make them!

IMP/IMBA Graphics Dept.

INSTITUTE OF MOLECULAR BIOTECHNOLOGY (IMBA) JOSEF PENNINGER

The IMBA is the largest institute of the Austrian Academy of Sciences. Its thirteen research groups are dedicated to explore how life processes function at the molecular level and how their interplay builds up multicellular organisms. While the research directions and approaches are diverse, four main topics characterise IMBA: Stem Cell Biology, Molecular Disease Models & Genetics, RNA Biology & Chromatin Dynamics, and Cell Biology. A central vision at IMBA is that understanding the molecular details of cellular processes will be the key to developing targeted therapies or to harness biological systems for new technologies or research. Being supported by an array of outstanding scientific facilities - shared by the institutes at the Vienna Biocenter - scientists at IMBA employ the most recent technologies, or develop their own. Our PhD students come from all over the world. Since the beginning they have been the drivers of many scientific breakthroughs. During their 4-year scholar time, PhD students receive both, individual guidance as well as the freedom to follow their imagination and their passion for discovery.

≈ 350 publications / year **> 200 invited speakers / year**

> "The number and quality of external speakers is amazing."

MAX F. PERUTZ LABORATORIES (MFPL) GRAHAM WARREN

The Max F. Perutz Laboratories (MFPL) are a center established by the University of Vienna and the Medical University of Vienna, set up to pursue basic research in the Molecular Life Sciences, integrating research with teaching at all levels. MFPL hosts around 60 research groups, involving more than 500 people from 40 nations, and provides an intense and interactive environment in which students can develop their skills and potential, as individuals and as part of a team. We hire the best, and give them the freedom to pursue their interests, using the skills they learn as part of their education, within the supportive framework provided by an adventurous faculty. Currently, our research focuses on several areas: Immunology and Infection Biology, RNA biology, Cell Signalling, Integrative Structural Biology, Computational Biology and Bioinformatics, Chromosome Dynamics, and Molecular Mechanisms of Disease. Our students are part of the vibrant scientific community, as well as part of an international network through lectures, seminars and meetings. We encourage you to join us.

VBC PhD Students

PhD students have driven many of the most important scientific discoveries at the VBC. Their stories are internationally recognised and have a strong impact in their field. You could be part of this!

Hagar Moussa (Bell Group, IMBA) *S. Lutzmayer*

MADALENA REIMÃO-PINTO (PORTUGAL; AMERES GROUP, IMBA)

Going to work feels like going home, where I am received by a family of scientists who perceive me as an individual with "wants and needs" and who work together to make my PhD as fruitful - and enjoyable - as possible. At the VBC I am able to ask the scientific questions I am interested in, while having continuous guidance on how to navigate through the inherent hurdles of a research project; to come up with ideas and try them out, rather than worrying about how much it will cost to actually do them; invest my time in doing experiments that truly excite me, while leaving the standard "must do's" to the amazing in house science support facilities; to learn outside the box by attending seminars from a large variety of research fields (and at journal clubs, and at the PhD symposium, and at the PhD retreat, and at the lab retreat, and so on…); to celebrate the end of each week with everyone at the happy-hour. My experience as a VBC PhD student has exceeded my expectations, and every single day I realise how privileged I am to be here. Why not come and find out for yourself?

MARCIN SUSKIEWICZ (POLAND; CLAUSEN GROUP, IMP)

Coming to Vienna has easily been one of the best decisions of my life. Rarely does one find oneself in the midst of a scientific community as vibrant as that of the VBC. And also Vienna is hard to match in most categories you can think of - especially in classical music. At the VBC there is a very strong sense of community, with frequent activities such as sport events (I am a member of a dragon boat team), happy-hours, trips, or parties bringing together all groups of employees, from administrative staff to students to group leaders. What I love about the VBC are the almost unlimited possibilities of conducting experiments and then discussing the results, both with colleagues, who tend to be very clever here, and with distinguished guests who often come by. I will be looking back to my PhD days with gratitude and would advise anyone to apply.

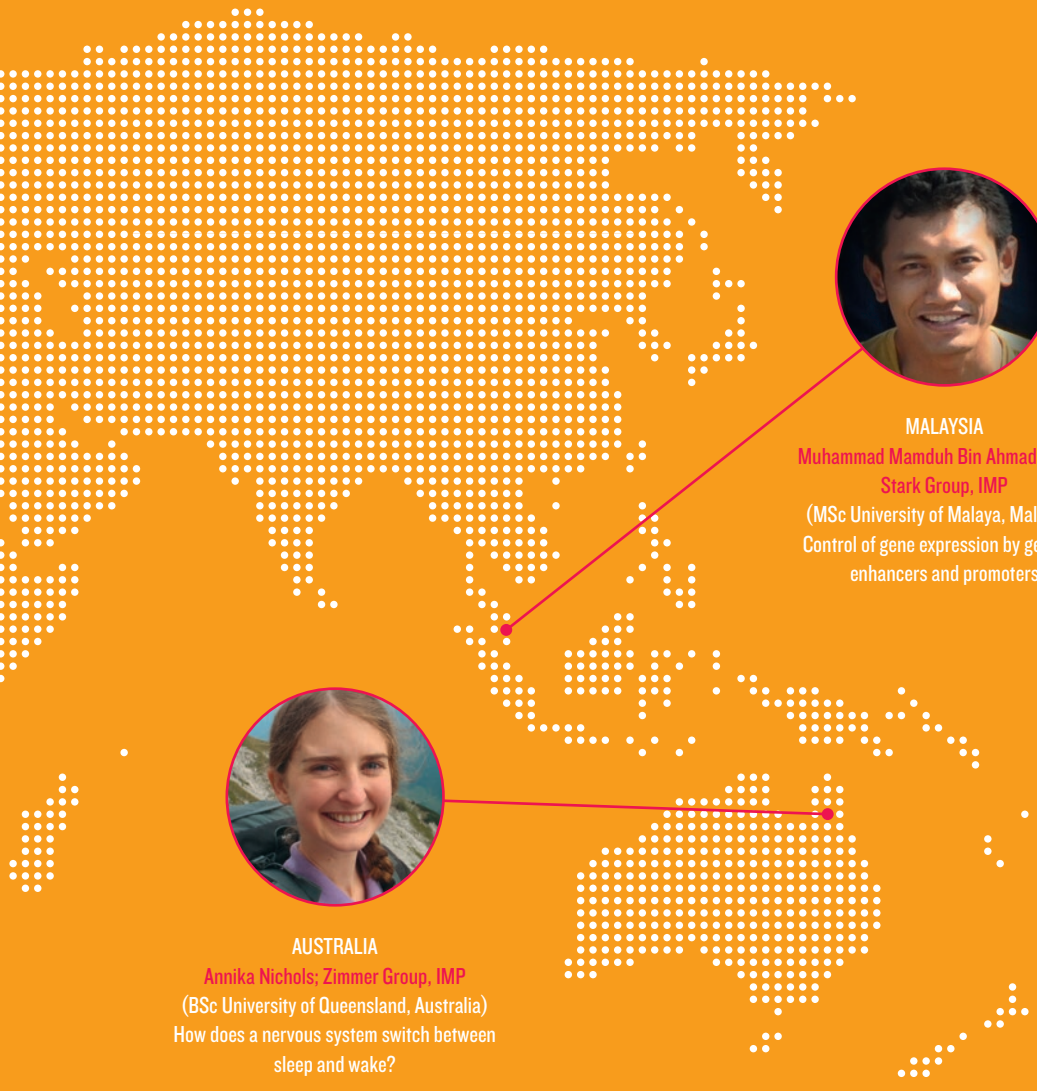
> 100 PhD students from all over the world

GERMANY
Friederike Schlumm; Vaziri Group, IMP-MFPL
(MSc Ruprecht-Karls-University, Heidelberg, Germany)
Whole-brain neuronal dynamics during behavior

USA
Michael Schon; Nodine Group, GMI
(BSc University of Iowa, USA)
How small RNAs control
plant embryo development

ALGERIA
Younes Redouane; Ikeda Group, IMBA
(MSc University of Aix Marseille University, France)
Shedding light on the role of linear
ubiquitin in inflammation and cancer

On average 15 new students per semester



MALAYSIA
Muhammad Mamduh Bin Ahmad Zabidi; Stark Group, IMP
(MSc University of Malaya, Malaysia)
Control of gene expression by genomic enhancers and promoters

AUSTRALIA
Annika Nichols; Zimmer Group, IMP
(BSc University of Queensland, Australia)
How does a nervous system switch between sleep and wake?

They come from over 30 nations, including:

Algeria
Australia
Austria
Brazil
Bulgaria
Canada
China
Croatia
Czech Republic
Egypt
Estonia
France
Germany
Greece
India
Ireland
Italy
Malaysia
Mexico
Nepal
Netherlands
Poland
Portugal
Russia
Slovakia
Spain
South Africa
Sweden
Switzerland
Taiwan
Turkey
Uruguay
United Kingdom
United States

We asked some of our alumni at different career stages what they think about their time at the VBC

PhD theses on display in library *R. Gutzat*

"My PhD gave me the experience to identify and perform science at a competitive level; the reputation of the institute made me an attractive candidate for various positions. The high quality, curiosity-driven research with great resources, where the goal was the right experiment and not the experiment you could afford to do."

Ciaran Morrison
Professor, National University of Ireland Galway, Ireland
PhD Student @ IMP, Wagner/Wang Groups
(PhD Awarded in 1997)

"What I enjoyed most at the VBC is the freedom to pursue my own ideas in a creative environment."

Grzegorz Sienski
Postdoc, Whitehead Institute for Biomedical Research, Cambridge, MA, USA
PhD Student @ IMBA, Brennecke Group
(PhD Awarded in 2014)

> During my PhD at the VBC I learned how to be independent, think "outside the box", not being afraid of asking questions. It was the best scientific training one can have. Plus the "network" with other students and postdocs (many of us are still friends).
>
> Izabela Sumara
> Group Leader, IGBMC Strasbourg, France
> PhD Student @ IMP, Peters Group
> (PhD Awarded in 2001)

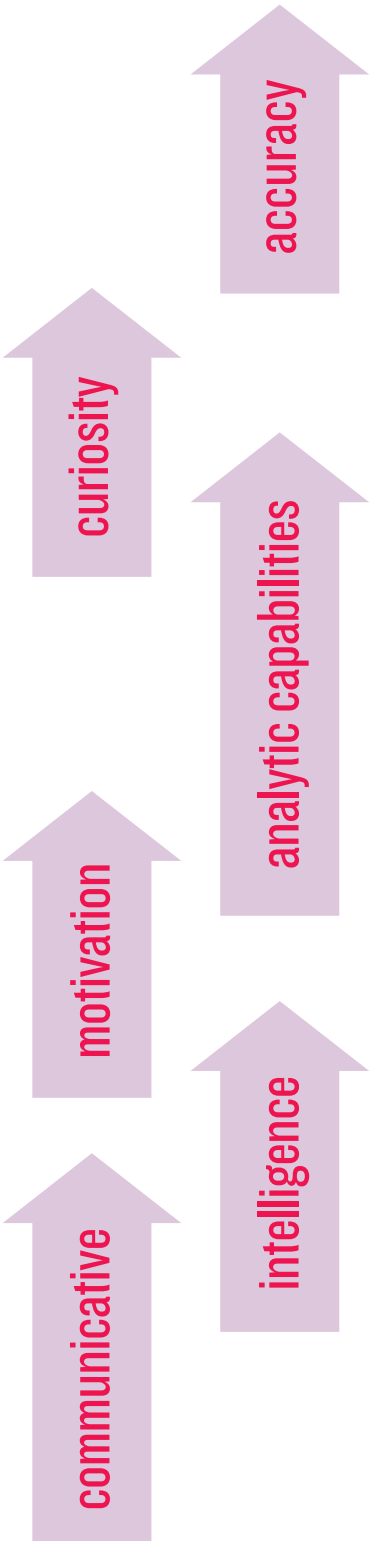
> The amazing scientific community helped me to become an independent thinker and always challenge my ideas. The quality of science and the international character of the institute was the most inspiring atmosphere I've ever experienced.
>
> Mario Richter
> Group Leader, AbbVie DMPK-BA, Germany
> PhD Student @ IMP, Jenuwein Group
> (PhD Awarded in 2009)

> I think the VBC is really a place where you can shape your PhD. Many different scientific areas are represented, which is not only mind-opening but also lowers the barrier to follow unfamiliar experimental avenues. Furthermore, our VBC PhD class was really great! We had a lot of fun outside the lab. We even had a VBC band at some point. And already at that time the happy hours were always a great occasion to meet up, have fun and discuss science.
>
> Stefan Ameres
> Group Leader, IMBA/VBC Vienna, Austria
> PhD Student @ MFPL, Schröder Group
> (PhD Awarded in 2006)

VBC Faculty

Around 40 Group Leaders participate in the VBC PhD Programme.
All are committed to foster and promote the development of the PhD Students.

Kikue Tachibana-Konwalski, Johanna Gassler (Tachibana-Konwalski Group, IMBA) *M. Sazel (IMBA)*



We asked our faculty why should a student join the VBC PhD Programme, here is what they had to say:

FUMIYO IKEDA (BIOCHEMISTRY & INFLAMMATION, IMBA)

Opportunities to work on great projects and to take advantage of state-of-art scientific facilities. As a student you will have terrific training and very high chances of getting your work published in respected journals. And a great community: welcoming and collaborative - I wish I had known such a programme when I was a student!

JOHANNES ZUBER (CANCER GENETICS, IMP)

For PhD students, the broad spectrum of research areas represented at the VBC offers an ideal environment for exploring new research fields and finding their favourite one. Simply put, the VBC has everything needed to do excellent science and launch a career in biological research.

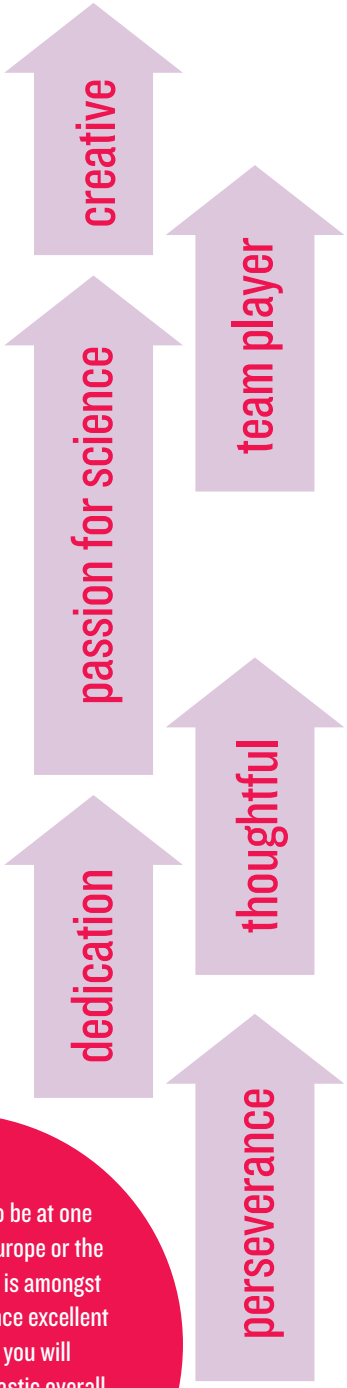
ARMIN DJAMEI (HOST-PATHOGEN INTERACTION, GMI)

A PhD at the Vienna Biocenter offers the possibility to study a broad range of biological topics and to join excellent laboratories at the forefront of their fields. The VBC programme is a well-organised framework that supports the students throughout their studies, and opens many career opportunities. I was once a VBC student and I am now back as a Group Leader!

ALWIN KOEHLER (BIOCHEMISTRY & GENE REGULATION, MFPL)

We have a group of smart, creative and energetic scientists at our campus. That's a key ingredient for making important discoveries. I think that the Vienna Biocenter provides a very positive atmosphere, which can facilitate great science and enrich your perspectives in many ways.

What do I look for in a PhD applicant?



JULIUS BRENNECKE (piRNAs & GENETICS, IMBA)

At the basis of most scientific breakthroughs is an experiment that yields the unexpected. I look for students who are driven by curiosity, who like to puzzle and - equally important - who like to challenge themselves and their surroundings with questions.
I think the most successful students are those for whom science is like a hobby. For one's dreams no hurdle seems too high, no effort seems too big.

LUISA COCHELLA (microRNAs & DEVELOPMENT, IMP)

Above all, motivation and passion for science. This usually comes together with additional qualities, such as care and attention for carrying out experiments carefully and rigorously, the drive to learn and expand knowledge and skills, willingness to discuss and share results and ideas, and perseverance even during times when things don't work as expected. Of course this alone is not sufficient without a minimal knowledge and skill set and so previous experience and background are also something that I take into account.

MAGNUS NORDBORG (POPULATION GENETICS, GMI)

Intelligence, creativity,
and a burning interest in science.

KRISTIN TESSMAR (NEUROSCIENCE & MOLECULAR CLOCKS, MFPL)

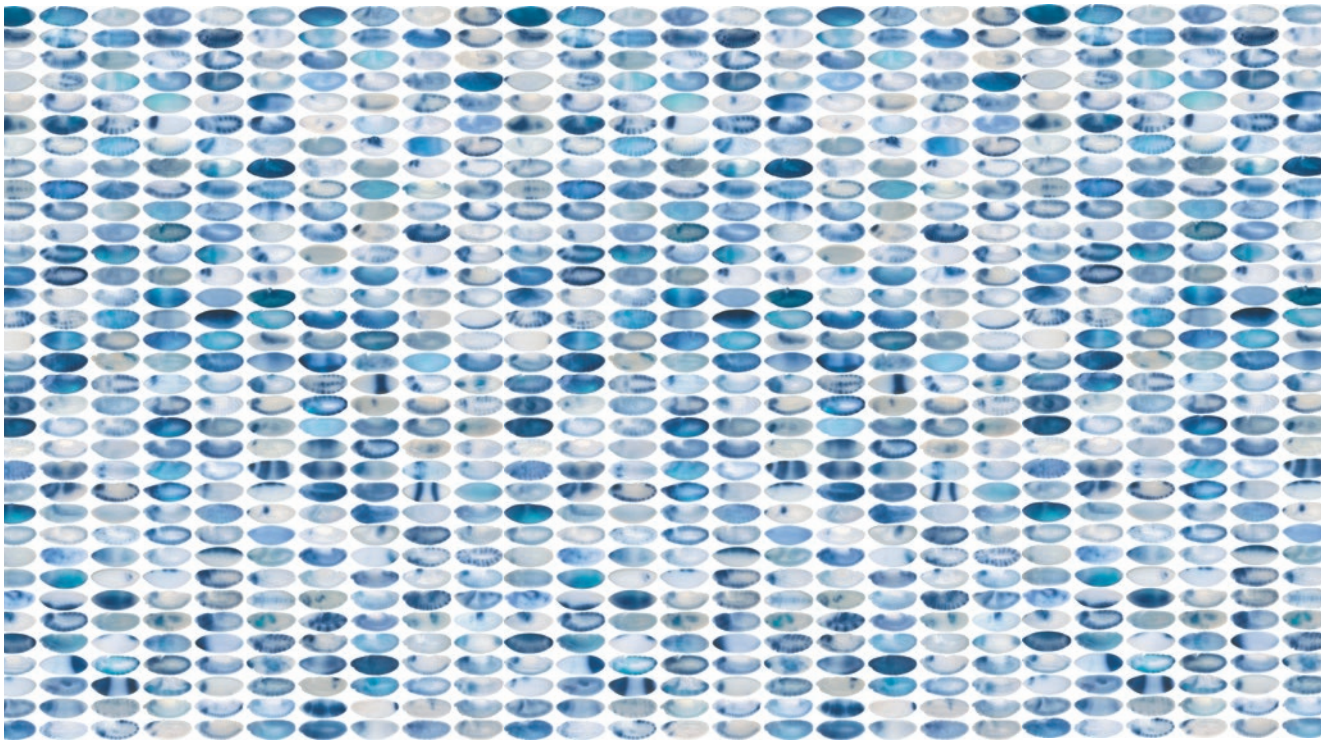
Intrinsic curiosity and energy,
attention to the detail,
perseverance.

"For a PhD you want to be at one of the best places in Europe or the entire world. The VBC is amongst these. You will experience excellent science – to which you will contribute - and a fantastic overall training for your next step."

Javier Martinez, IMBA
(Biochemistry & Small RNAs)

Research Areas

The first and foremost criterion for research at the Vienna Biocenter is scientific excellence. Our research groups focus on a variety of biological questions, using a wide range of model organisms. This creates a multidisciplinary environment where collaborations naturally develop.



Drosophila embryos displaying diverse enhancer activities *E. Kvon, G. Stampfel, A. Stark (IMP)*

Research Groups

On the following pages, we provide an overview of the main research areas within the programme. There is frequent interaction between the areas and most groups are part of more than one area.

- RNA Biology, Gene Regulation and Epigenetics
- Biochemistry, Structural and Cell Biology
- Stem Cells and Developmental Biology
- Molecular Medicine
- Neuroscience
- Plant Biology
- Bioengineering and Computational Biology
- Evolutionary and Population Biology

RNA Biology, Gene Regulation and Epigenetics

Gene expression is at the heart of nearly every cellular process. How genetic information is stored and decoded has always fascinated biologists. A large community of scientists at the VBC works in this vibrant field. They combine diverse approaches and disciplines such as mechanistic biochemistry, genetics, and an increasing number of genome-wide assays, greatly facilitated by modern high throughput sequencing methods. Coupled to bioinformatics data analyses, these systematic genome-wide approaches allow us to address fundamental questions in virtually all areas of gene expression as well as RNA and chromatin biology.

Selected publications from our students

Evgeny Z. Kvon et al.
Genome-scale functional characterization of Drosophila developmental enhancers in vivo. 2014, Nature (Stark Group, IMP)

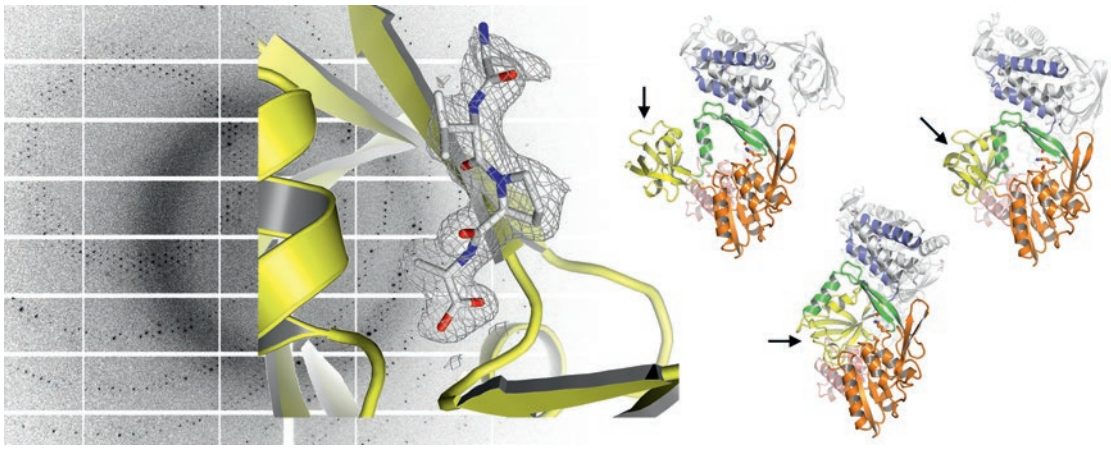
Veronika A. Herzog et al.
A strand-specific switch in noncoding transcription switches the function of a Polycomb/Trithorax response element. 2014, Nature Genetics (Ringrose Group, IMBA)

Grzegorz Sienski, Derya Dönertas et al.
Transcriptional silencing of transposons by Piwi and maelstrom and its impact on chromatin state and gene expression. 2012, Cell (Brennecke Group, IMBA)

Sasha Waidmann et al.
A DEK domain-containing protein modulates chromatin structure and function in Arabidopsis. 2014, Plant Cell (Jonak Group, GMI)

SASCHA WAIDMANN

The interdisciplinary environment of the VBC allows our students to cross boundaries and venture into the unknown. During his PhD, in the Jonak Group at GMI, Sascha decided to explore the role of the DEK protein in the model plant Arabidopsis thaliana after he found a connection with stress response. His interest was sparked by the fact that the DEK protein was known as an important oncogene in mammals, but its function in plants was unclear. After three years of hard work, he showed that DEK is able to modulate DNA topology in a histone-independent manner, which led to novel perspectives on the role of DEK not only in plant stress response, but also in general plant and animal chromatin biology.



Structural Biology: From diffraction data to structure to mechanism *Clausen Group (IMP)*

Biochemistry, Structural and Cell Biology

How individual molecular components provide biological function and how they assemble into sophisticated higher-order structures in cells remain key questions in modern biology. By resolving the atomic structure of proteins and protein complexes, by biochemical investigation of molecular interactions, and by light- and electron microscopic analysis of intact cells, students of the VBC PhD programme have gained groundbreaking insights into the molecular mechanisms underlying cellular function.

Selected publications from our students

Gabriela Cabral et al.
Multiple mechanisms contribute to centriole separation in C. elegans. 2013, Curr Biology (Dammermann Group, MFPL)

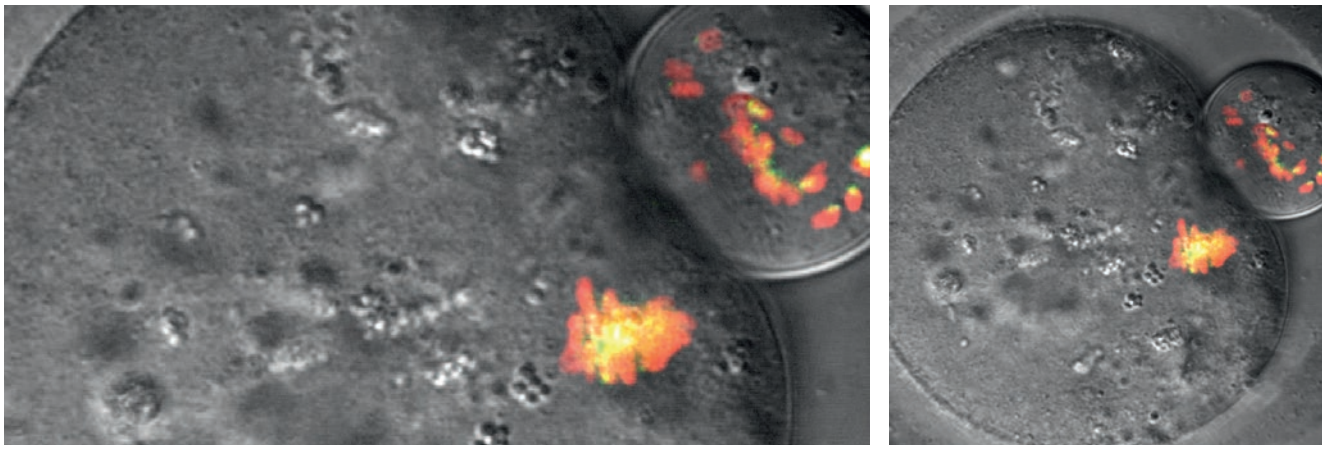
Julia Radics, Lisa Königsmaier et al.
Structure of a pathogenic type 3 secretion system in action. 2014, Nat Struct Mol Biol (Marlovits Group, IMP-IMBA)

Linn Gazda, Doris Hellerschmied et al.
The myosin chaperone UNC-45 is organized in tandem modules to support myofilament formation in C. elegans. 2013, Cell (Clausen Group, IMP)

Pim J. Huis in 't Veld et al.
Characterization of a DNA exit gate in the human cohesin ring. 2014, Science (Peters Group, IMP)

PIM J. HUIS IN 'T VELD

During his PhD in the Peters lab at the IMP, Pim wanted to test if open forms of the cohesin ring exist. By reconstituting the wild type as well as mutated forms of the complex "in vitro", he managed to visualise it in its open and closed form by electron microscopy. Pim also used these tools to show that within the ring structure there seems to be a specialised gate for DNA exit. One can imagine the cohesin complex like a pair of cherries, the paper shows that the "cherries", although they look alike, are actually different, and one of them is the key to opening the ring, and hence the release of DNA.



Mouse metaphase II oocyte *S. Burkhardt (Tachibana-Konwalski Group, IMBA)*

Stem Cells and Developmental Biology

How multicellular organisms arise from a single totipotent cell has fascinated mankind for centuries. During development, stem cells, along with their chromatin and gene expression go through remarkable changes to specify the many cell types in an organism. New technologies, such as advanced microscopy and next generation sequencing allow an unprecedented insight into these changes, making for exciting times in the field. Finding out how stem cells give rise to different structures in development will, in addition, allow us to harness their potential to revolutionize medicine. Soon, they might be used to create organs in a dish, model diseases, and test drugs for a cure. At the VBC, several labs use a variety of model systems, such as plants, worms, insects, mice, and humans to uncover basic principles of this central question in biology.

Selected publications from our students

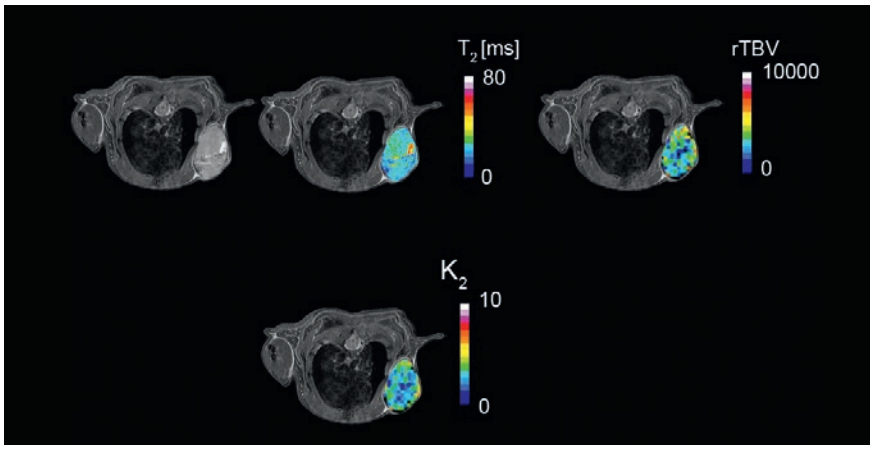
Astrid Hagelkruys et al.
A single allele of Hdac2 but not Hdac1 is sufficient for normal mouse brain development in the absence of its paralog. 2014, Development (Seiser Group, MFPL)

Martina Minnich et al.
Multifunctional role of the transcription factor Blimp1 in coordinating plasma cell differentiation. 2016, Nat Immunology (Busslinger Group, IMP)

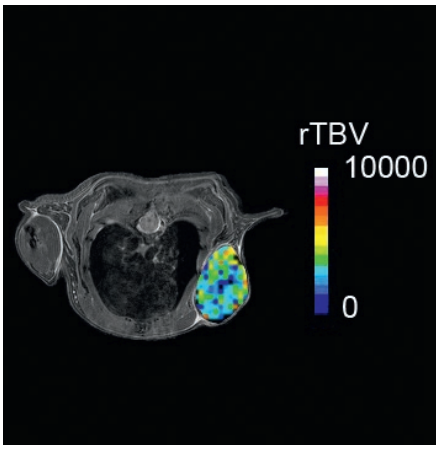
Elif Eroglu et al.
SWI/SNF complex prevents lineage reversion and induces temporal patterning in neural stem cells. 2014, Cell (Knoblich Group, IMBA)

ELIF EROGLU

In her paper, Elif from the Knoblich Lab at IMBA, identified the mechanism through which the most frequently mutated protein complex in human cancer acts in stem cell lineages. Elif showed that the chromatin remodeling SWI/SNF complex provides a sense of direction for stem cell lineages so that cells go from multipotent to terminally differentiated and not backwards. Without SWI/SNF, the lineages revert and form brain tumors that kill the fly. Elif identified the conserved chromatin regulator Hamlet as a key SWI/SNF target that acts in a molecular clock, providing temporal identity to the multipotent cells, so that the right neurons are produced at the right time.



Multi-parametric breast tumor magnetic resonance imaging (MRI)



Iris Uribesalgo (Penninger Group, IMBA)

Molecular Medicine

The rapid advances of deep-sequencing and functional genetic tools have fundamentally changed the way one can study disease. One of the greatest challenges for the next decade is the translation of complex genome and epigenome data into better mechanistic understanding and, ultimately, better clinical therapies. Molecular Medicine research takes advantage of the unique infrastructure at the VBC to functionally study disease mechanisms, and to find and probe new targets and concepts for the development of rational therapies.

Selected publications from our students

Magdalena Paolino et al.
The E3 ligase Cbl-b and TAM receptors regulate cancer metastasis via natural killer cells. 2014, Nature (Penninger Group, IMBA)

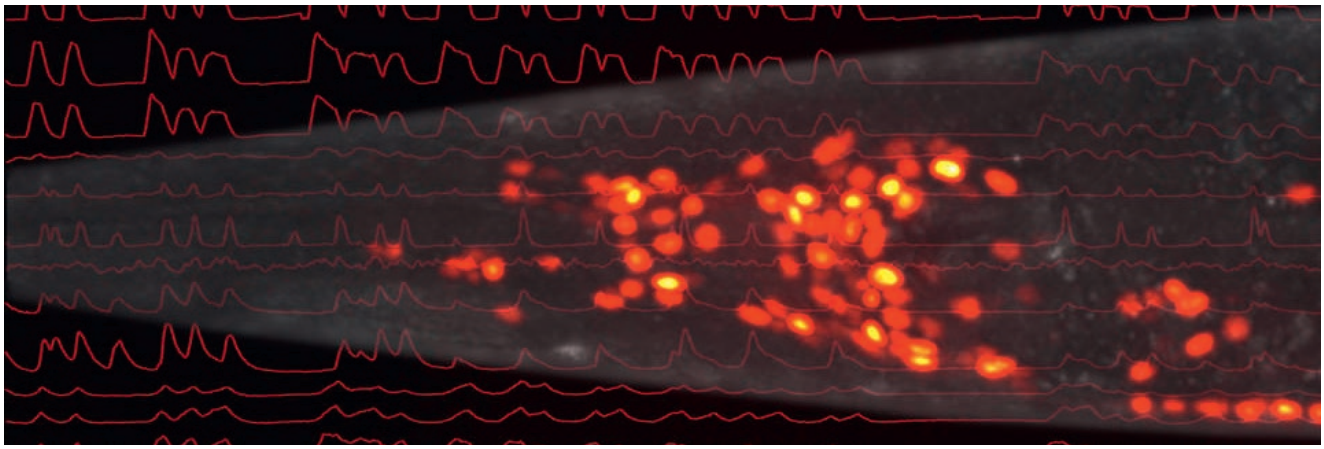
Martin Breuss et al.
Mutations in the β-tubulin gene TUBB5 cause microcephaly with structural brain abnormalities. 2012, Cell Rep (Keays Group, IMP)

Daniel Wenzel et al.
iPSC-based cell therapy for Recessive Dystrophic Epidermolysis Bullosa. 2014, Sci Transl Med (Penninger Group, IMBA)

Philipp Rathert, Mareike Roth et al.
Transcriptional plasticity promotes primary and acquired resistance to BET inhibition. 2015, Nature (Zuber Group, IMP)

MAREIKE ROTH

Mareike started her PhD at the IMP in 2011 in the Zuber lab, which has a general interest in identifying novel drug targets for cancer therapy. Coming with a background in biomaterials and structural biology, entering the field of cancer genetics and epigenetics was an exciting but at the same time challenging opportunity. With great support from her PhD supervisor, she decided to focus on chromatin dependencies in cancer across different tissues. As part of this topic, she collaborated with her lab mate Philipp Rathert to identify chromatin factors that influence the response to BRD4 inhibition. For her the coolest part of this story was to see how the remodeling of the regulatory landscape rapidly renders some leukemia types resistant to BRD4.



C. elegans whole brain imaging superimposed with neuronal activity measurements *M. Zimmer (IMP)*

Neuroscience

Neuroscience labs at the VBC use and develop cutting-edge molecular, optical, and computational tools to address fundamental questions of how neural circuits coordinate adaptive behaviors, and how brains and sensory systems develop and evolve. Labs with expertise from many areas such as molecular biology, neurophysiology, computational neuroscience, and quantitative analysis of behavior form a collaborative and inspiring environment.

Selected publications from our students

Salil S. Bidaye et al.
Neuronal control of Drosophila walking direction. 2014, Science (Dickson Group, IMP)

Ruth M. Fischer et al.
Co-Expression of VAL- and TMT-opsins uncovers ancient photosensory interneurons and motorneurons in the vertebrate brain. 2013, PLoS Biology (Tessmar Group, MFPL)

Tina Schrödel, Robert Prevedel et al.
Brain-wide 3D imaging of neuronal activity in Caenorhabditis elegans with sculpted light. 2013, Nat Methods (Zimmer and Vaziri Groups, IMP)

TINA SCHRÖDEL

Tina, a PhD Student in the Zimmer Lab at IMP, was interested in how the worm C. elegans "thinks" and makes decisions. Tina, a biologist, teamed up with a physicist postdoc in the Vaziri Lab, Robert Prevedel, and together they developed a two-photon technique for brain-wide calcium imaging in C. elegans. Both their complementary expertise and working in close proximity were critical for the success of the project, and allowed them to develop a method that is now being used to image activity in large portions of living brains.

Arabidopsis thaliana field experiment

E. Kerdaffrec (GMI)

Plant Biology

Plants are central to life. They have evolved many unique properties, such as the ability to capture solar energy, a mode of multicellularity that allows them to grow and propagate without motility even in harsh environments, complex RNA silencing pathways, and a high degree of developmental plasticity. Labs at the VBC study plants because of these unique properties and because they are ideal models for a broad variety of fundamental biological questions. Students are at the forefront of international plant research, studying key biological questions at every level, molecular and organismal levels to population genetics and evolution.

Selected publications from our students

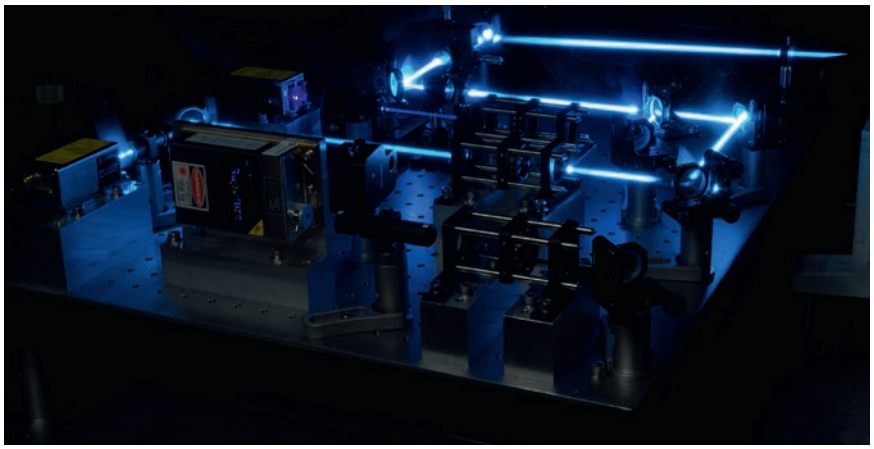
Marisa Rosa et al.
The Arabidopsis SWR1 chromatin-remodeling complex is important for DNA repair, somatic recombination and meiosis. 2013, Plant Cell (Mittelsten Scheid Group, GMI)

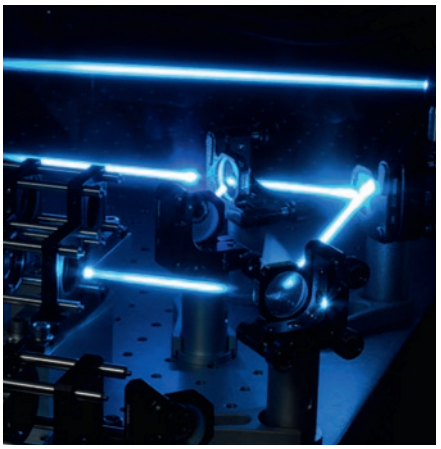
Vladimir V. Cavrak et al.
How a retrotransposon exploits the plant's heat stress response for its activation. 2014 PLoS Genet (Mittelsten Scheid Group, GMI)

Jiradet Gloggnitzer et al.
Nonsense-mediated mRNA decay modulates immune receptor levels to regulate plant antibacterial defense. 2014, Cell Host Microbe (Riha Group, GMI)

JIRADET GLOGGNITZER

When beginning his PhD in the Riha Lab at the GMI, Jiradet wanted to characterise the dramatic phenotypes of Arabidopsis plants with defects in a RNA quality control pathway, known as nonsense-mediated mRNA decay (NMD). By carefully following up an unexpected result, he discovered that plants exploit the NMD molecular machinery to fine-tune their immune system. When faced with a pathogen threat, plants transiently shut down their quality control in order to produce more immune receptors, which boosts disease resistance and ensures the survival of the plant.





Custom-built photo-activated localization microscopy *R. Prevedel/J. Tkadletz*

Bioengineering and Computational Biology

Today's questions in biology are increasingly being tackled using methods and concepts from mathematics, physics, computer science, and engineering. VBC students work in a collaborative and stimulating research environment that brings biology together with expertise in bioinformatics, statistics, scientific modeling, computer vision, data visualization, virtual reality, microfluidics, and optical engineering. They are supported by outstanding scientific services, a large computer cluster, and a state-of-the-art technical workshop. Together, this offers unique opportunities for highly interdisciplinary research projects, which will provide new insights into fundamental biological questions.

Selected publications from our students

Muhammad A. Zabidi, Cosmas D. Arnold et al.
Enhancer--core-promoter specificity separates developmental and housekeeping gene regulation. 2015, Nature (Stark Group, IMP)

Radka Slovak et al.
Scalable open-source pipeline for large-scale root phenotyping of Arabidopsis. 2014, Plant Cell (Busch Group, GMI)

Daniel E. Bath et al.
FlyMAD: rapid thermogenetic control of neuronal activity in freely walking Drosophila. 2014, Nat Methods (Straw and Dickson Groups, IMP)

DAN BATH
At the Vienna Biocenter "crazy ideas" materialise! Dan in Barry Dickson's Lab wanted to understand the integration of excitatory and inhibitory information in the central brain. To address this question he needed to quickly activate neurons in freely-moving animals: "Coming from a background in biology, the technical requirements of establishing the method were far beyond my capabilities." Through collaboration with Andrew Straw's group, in particular John Stowers, they managed to bring FlyMAD (the Fly Mind Altering Device) from a crazy idea to a functional method that surpassed our original goals.

Arabidopsis thaliana natural variation *E. Kerdaffrec (GMI)*

Evolutionary and Population Biology

Nothing in biology makes sense except in the light of evolution (T. Dobzhansky). Various VBC labs study how species have evolved, or how evolution has impacted on specific biological processes, ranging from gene regulation to cell biology, development, or neural circuits. Another strength at the VBC is the elucidation of connections between genotype and phenotype at the population level, partly to understand evolutionary adaptations, but also as a tool to unravel genes and regulatory sequences crucial for particular morphological or behavioural phenotypes.

Selected publications from our students

Cosmas D. Arnold, Daniel Gerlach et al.
Quantitative genome-wide enhancer activity maps for five Drosophila species show functional enhancer conservation and turnover during cis-regulatory evolution. 2014, Nat Genetics (Stark Group, IMP)

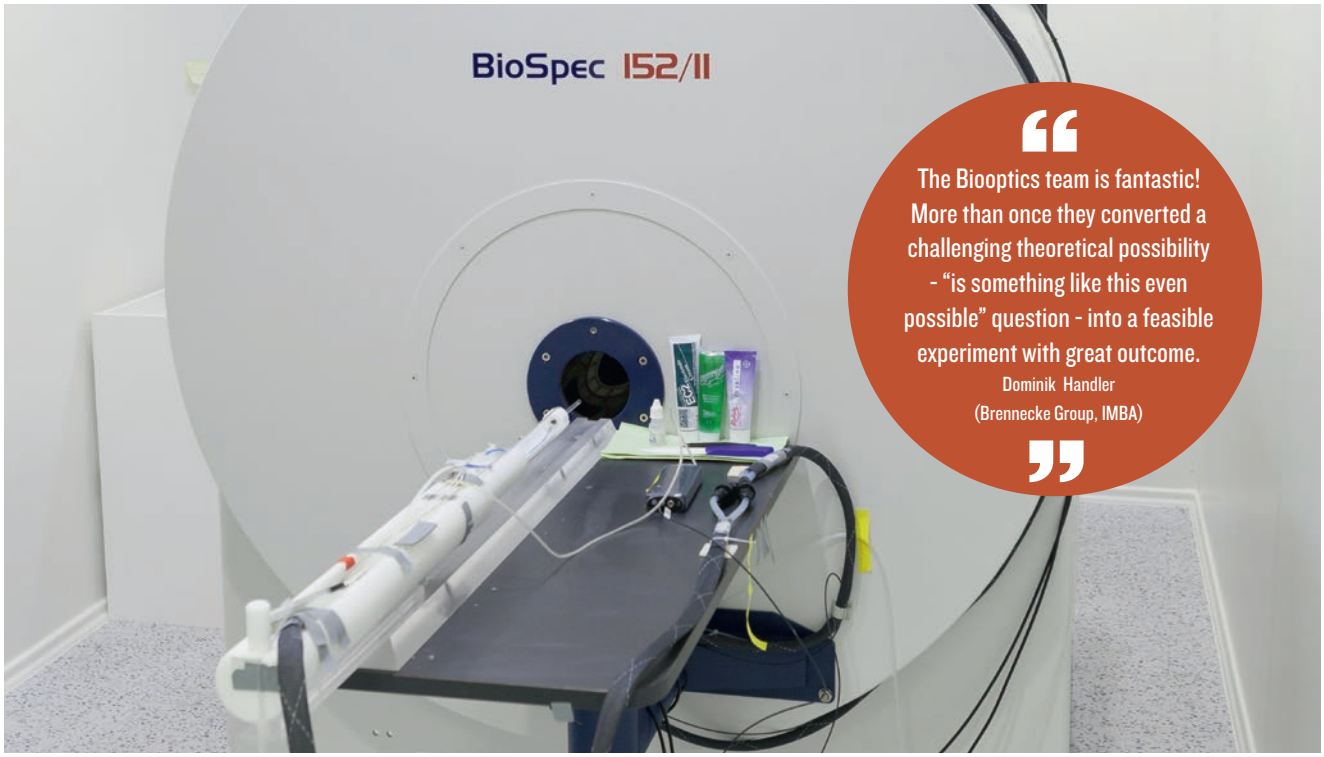
Benjamin Backfisch, Vinoth Babu Veedin Rajan et al.
Stable transgenesis in the marine annelid Platynereis dumerilii sheds new light on photoreceptor evolution. 2013, P Natl Acad Sci USA (Raible and Tessmar Groups, MFPL)

Quan Long, Fernando A Rabanal et al.
Massive genomic variation and strong selection in Arabidopsis thaliana lines from Sweden. 2013, Nat Genetics (Nordborg Group, GMI)

FERNANDO RABANAL
Fernando, a PhD Student in the Nordborg Lab at GMI, read publications in which flow cytometry was used to estimate genome size, and became interested in pushing the limits of the methodology to detect small megabase differences among different natural lines of Arabidopsis thaliana. The BioOptics team had never used flow cytometry for this type of application; nevertheless, he found them to be not only extremely professional, but also genuinely curious in setting up the appropriate parameters for this experiment. The results later became a central part of his publication; and it was this "easiness" of having everything needed in house (equipment and expertise) that encouraged him to attempt this experiment.

Scientific Facilities

"Discovery in modern Life Sciences is increasingly dependent on technology. The Vienna Biocenter provides students free access to a broad spectrum of the most important and most recent technological breakthroughs." Julius Brennecke, Group Leader, IMBA

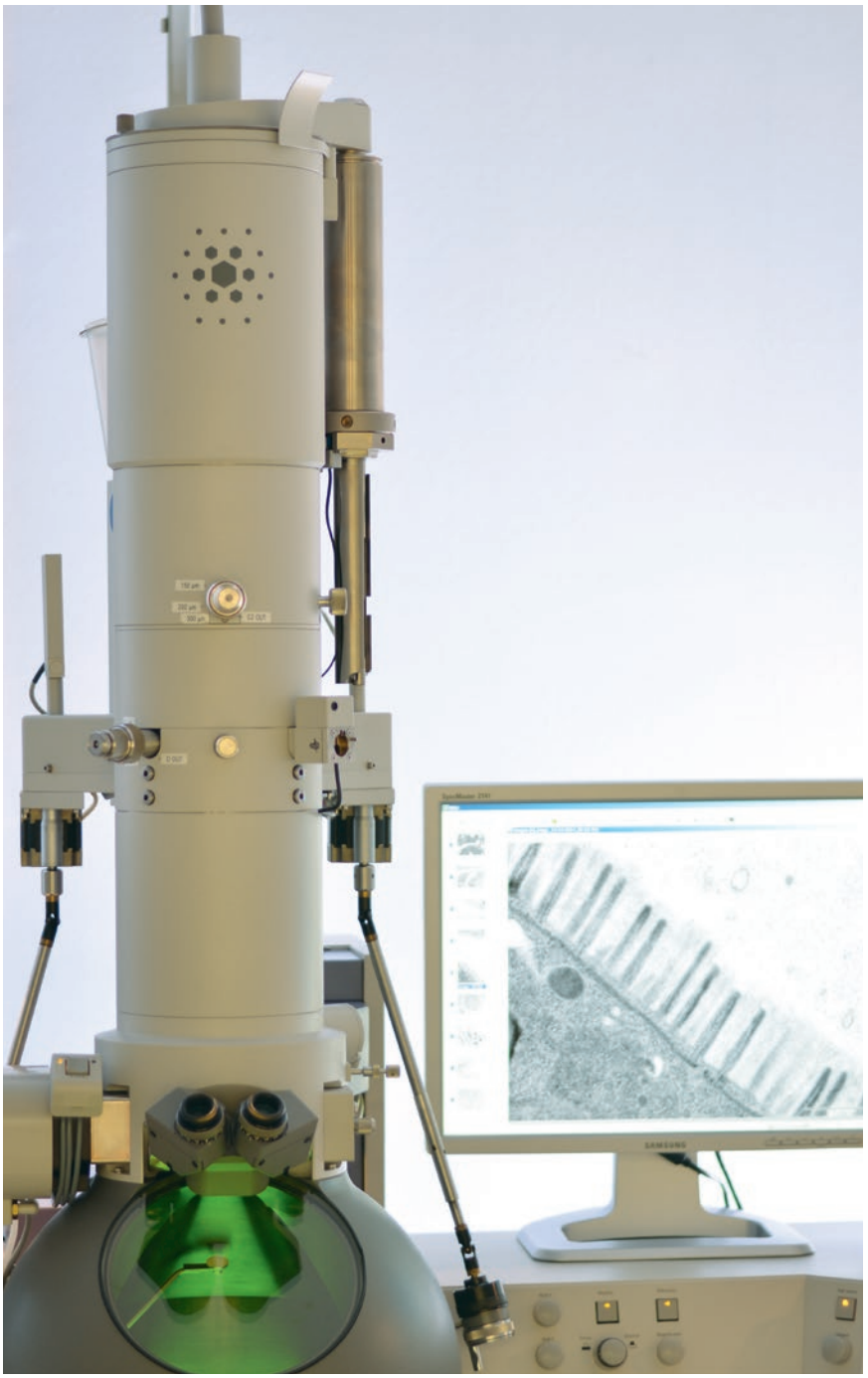


"The Biooptics team is fantastic! More than once they converted a challenging theoretical possibility - "is something like this even possible" question - into a feasible experiment with great outcome.
Dominik Handler
(Brennecke Group, IMBA)"

State-of-the-art 15.2 T MRI Bruker system, unique in Europe *R. Gutzat*

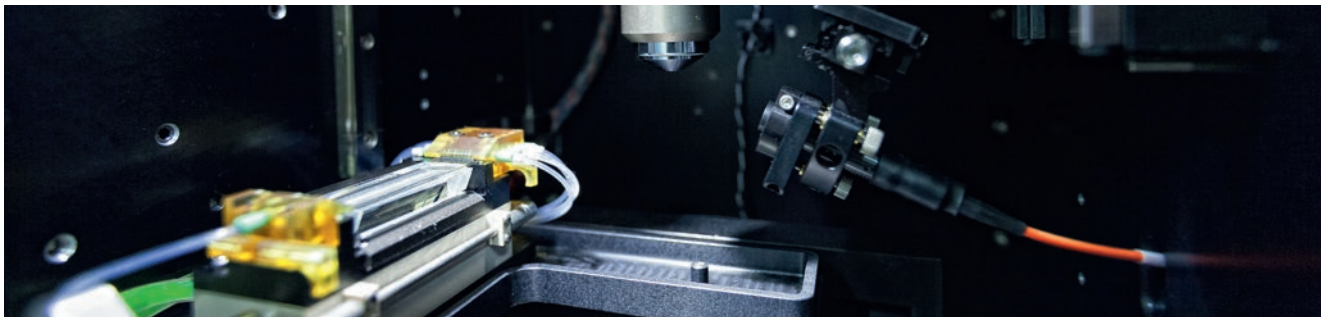
One of the most valuable assets at the Vienna Biocenter is the support provided by our Scientific Facilities. There are scientific services both at the institutes and the Vienna Biocenter Core Facilities GmbH – all dedicated to supporting science.
The facilities do not simply receive samples and process them, they help researchers with experimental design and provide consulting and comprehensive training - come in with a question, and discuss what is the best setup to address it!
The reason for their success is two-fold: the expertise of skilled professionals and cutting-edge instruments.
The facilities offer the state-of-the-art protocols and instruments and develop custom-made alternatives.

> “The Workshop Team designed and built several one of a kind “magnetoscopes” that allow us to investigate the influences of magnetic fields on cells and tissues. Without these unique resources our scientific ventures would not be possible.”
>
> Simon Nimpf
> (Keays Group, IMP)



100kV transmission electron microscope *H. Kotisch (CSF)*

The Scientific Facilities at our campus include



Inside NGS Sequencing System *R. Gutzat*

- **Molecular Biology and Protein Technologies**
  High throughput technologies like multiplexed-based assays and automated liquid handling systems; Sanger sequencing; protein production and purification.
- **Mass Spectrometry**
  Protein analysis through protein identification, characterisation of posttranslational modifications and protein quantification.
- **Flow Cytometry**
  Analytical flow cytometry and cell sorting.
- **Light Microscopy**
  Cutting edge optical imaging techniques with over twenty microscopy systems, and support on image processing, and analysis. Plus, a R&D lab that develops tailored microscopy solutions.
- **Advanced Microscopy**
  Electron microscopy systems with high-resolution 2D or 3D imaging and a comprehensive multimodal MR imaging with a field strength of 15.2 T.

Fore more detailed information visit these websites:
Vienna Biocenter Core Facilities GmbH: www.vbcf.ac.at
IMP/IMBA/GMI Core Facilities: http://cores.imp.ac.at/
MFPL Scientific Facilities: www.mfpl.ac.at/research/scientific-facilities.html

- **Next Generation Sequencing**
  Full service for all common sequencing applications, as well as development of novel methods and protocols.
- **IT, Bioinformatics, and Scientific Computing**
  High-performance computing, data analysis and development of computational tools and methods.
- **Plant Sciences**
  High quality state-of-the-art, environmentally controlled plant growth facilities.
- **Histopathology**
  Complete tissue processing and analysis for a wide range of samples.
- **Scientific Workshop**
  Manufacturing and building of custom equipment and experimental setups.

This list is not comprehensive, there are many more departments supporting VBC researchers: from a media kitchen, to a library or a graphics department.

> “Having one of Europe’s leading Mass Spectrometry facilities just two floors down came in really handy for my project. Likewise, the next generation sequencing unit was vital for my efforts to profile small RNA populations and to obtain ChIP-sequencing results.”
>
> Jan Suhren
> (Mochizuki Group, IMBA)

Scientific Training

"My vision for science education is to create nurturing and collaborative environments, where students are not afraid of being wrong, hence empowering them to ask questions, think creatively, and innovate."

Inês Crisóstomo, Scientific Training Coordinator

Fernando Rabanal (Nordborg Group, GMI), Ines Barbosa (Zuber Group, IMP) *R. Gutzat*

Scientific Training

Students become scientists by doing science. The main focus of their training is therefore their own research project. The PhD programme's role is to ensure all students have the support and resources necessary to develop projects that matter and that are based on a rigorous scientific approach. To this end, the programme offers multiple courses, a seminar series, a retreat and a student-organized symposium.

Harris Kaplan (Zimmer Group, IMP)

PRIMING YOUR PHD COURSE

Within the first months of his/her tenure, each PhD student will join this intense three-week course. Students will be introduced to their peers, as well as the different research topics and technologies on campus. This enables all students to make the most of the existing expertise and infrastructure. Furthermore, everyone will receive specific training on analytical and critical thinking as well as on communication skills.

MONDAY SEMINARS

Every Monday VBC PhD students present their work to the scientific community on campus. This student driven seminar series is the central hub of the institutes and enables the sharing of knowledge and expertise between the different groups and disciplines. At the same time, the seminars are an excellent means of training good presentation skills as each student who presents their project receives feedback from faculty.

FLEXIBLE CURRICULUM DESIGNED FOR AND WITH PHD STUDENTS

The VBC PhD curriculum is flexible and oriented at the needs of the students. Numerous seminars and journal clubs take place on a regular basis that students can join. To facilitate further learning and scientific development, students have the opportunity to take advanced courses (programming, advanced microscopy, data analysis, etc.) and career development workshops. Each student is free to choose which courses he/she wants to participate in - or to suggest and develop a new course. To expose students to the wider researcher community, the programme encourages all students to attend international courses and conferences.

J. Bassler

PhD Students take the lead

Not only in their labs – something easily visible from the VBC publication record - but also in various other activities, PhD students are central players. Student representatives and/or volunteers organize different activities throughout the year. The highlights are the annual retreat and the PhD symposium. The programme provides students with a budget, for these activities, that they can independently manage.

PHD RETREAT

Every year the students organise a two-day retreat at a location outside the city, allowing for an informal environment to discuss their projects and to interact with invited speakers. Recent topics were:

- 2014 "Scientific Integrity", invited speaker Ivan Oransky, from Retraction Watch.
- 2015 "Communication", invited speaker Martin Krzywinski, from Canada's Michael Smith Genome Sciences Centre (regular contributor to Nature Methods Op-Ed pieces on Statistics and Data Visualization).

PHD SYMPOSIUM

Once a year, VBC PhD students organize a unique event: a two-day scientific symposium with approximately 15 external, high-profile speakers that brings together students from the Vienna Biocenter, from other Viennese institutes, and from numerous international locations.

> "The introductory course showed me that there is a whole campus to back me up during the PhD - fellow students, group leaders, and facility staff who are always there to offer help and support."
>
> Triin Laos
> (Dammerman Group, MFPL)

HARRIS KAPLAN (USA, ZIMMER GROUP, IMP)

The spirit maintained by faculty and students is one of interest in anything and everything: If you're here, we want to know why - we're endlessly curious and we believe you have something to teach us.
Presenting my work at the Monday seminars and at the PhD retreat has led to countless questions about my project, ones that made me think in new ways. Talking to students from outside my field forces me to carefully consider why my work is important - why should anyone else care? This is a question that every scientist should constantly ask him/herself, but that is all too easily forgotten in the details of everyday work. At the VBC, you learn to appeal to a broad audience, and that's a useful skill in any career!

Living in Vienna

For the last decade, Vienna has consistently been at the top of many rankings of the most livable cities.

Impressions of Vienna *C. Robinson/R. Gutzat*

Whether you are a city or a country person, in Vienna you will feel at home: Being a major European capital, Vienna offers a vast cultural programme ranging from world renowned museums, to concerts, theatre plays, and balls. The city offers parks (50% of the city are green areas) and is surrounded by beautiful countryside.

Vienna is a very international capital (the United Nations have one of their headquarters here) where you can easily get around without speaking German. And if you want to learn the language, the VBC offers free courses.

And then there are all of those small "big" things: being a very safe city, you can walk or bike anywhere at any time; or use the public transport system, which costs just 1 Euro per day.

How to apply

The VBC PhD Programme is run by a dedicated team, who supports the recruitment of PhD Students.

At the bench *R. Gutzat*

We look for motivated and knowledgeable students and our main aim is to find the best match with one of the participating research groups. We do not have a fixed number of positions, nor any kind of quotas. On average, we recruit 30 new students per year.

THE APPLICATION PROCESS

During the application period we provide information on the research groups offering positions on our website.

Based on the online applications we invite 50 applicants to Vienna for five days, during this time the applicants have the opportunity to learn first-hand about the programme and research at the VBC (the programme covers all travel and accommodation costs for this visit).

On the second day there will be a formal interview, and applicants who perform well in the interview then have the opportunity to discuss potential research projects with individual group leaders and get to know the different labs.

Over the next days, students can select which groups they would like to join, and the groups also choose which applicants are a good fit for the team – considering that the emphasis is on finding the best possible match.

On the last day, most applicants will have found a match and are offered a position (they then have 3 weeks to accept or decline).

WHEN TO APPLY?

There are two calls per year:

Winter selection
15 September - 15 November

Summer selection
1 March - 30 April

If you are interested in applying and/or have any question do not hesitate to contact us. We want to help you find the best possible environment for your PhD!

WHAT'S REQUIRED?

- Completed online application (www.vbcphd.at) - Including contact information of two referees
- Master Degree (or equivalent degree) in Life Sciences or related subject
- Research experience

IS IT DIFFICULT TO GET INTO THE PROGRAMME?

The VBC PhD programme is competitive. Attracted by the high quality of research, the strong scientific support, and the great city of Vienna, many students apply in each selection. But if you are excited about research, enjoy discussing science, and can think independently, you have a great chance.

R. Gutzat

Christopher Robinson
(Programme Manager)
Inês Crisóstomo
(Scientific Training Coordinator)

Acknowledgements

We would like to thank the many people at the VBC that contributed to making this booklet a success. Special thanks to GMI, IMBA, IMP and MFPL for their continued commitment to the programme.

TEXT
VBC PhD Programme Steering Committee

PROJECT TEAM
Inês Crisóstomo and Christopher Robinson

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vienna BIOCENTER

In collaboration with:

universität wien

Young seedling of Arabidopsis thaliana

Wolfgang Busch


“
A PhD at the VBC –
your imagination
is the limit!
”
www.vbcphdprogramme.at