

## Microscopy Imaging Center (MIC)

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PD Dr. Ruth Lyck  
MIC Coordinator



Dr. Guillaume Witz  
MIC Scientific Assistance  
Biolmaging and BigData Specialist



Dr. Yury Belyaev  
MIC Scientific Assistance  
Light Microscopy Specialist

### Structure Profile

The MIC was founded in 2005 and has since developed into the University of Bern's center of excellence for high-end microscopy in the life sciences. Experts in microscopy from a total of 15 institutes from the Medical Faculty, the Faculty of Science and the Vetsuisse Faculty of the University of Bern and from the University of Fribourg have joined forces to provide central access to numerous high-end microscopes and imaging systems for all university members. The directive panel of the MIC is the MIC Commission, which in 2018 involved 32 representatives from the participating institutes. The steering panel of the MIC is the MIC Board consisting of the MIC chair, the representatives from the participating faculties and the MIC coordinator. In 2018, Olivier Pertz succeeded Volker Heussler as the MIC board representative of the Faculty of Science. The MIC oversees 52 instruments including 41 light microscopes, 8 electron microscopes, two atomic force microscopy systems and one micro computed tomography (micro-CT) instrument. In 2018, this equipment has benefitted 334 active users. Highly qualified scientists provide expert knowledge for a multitude of microscopic applications and support usage of the sophisticated instruments. MIC technical staff helps in choosing the appropriate instrument, offers sample preparation services and assists in handling of the microscopes. A specialist in bioimage analysis and processing of big image data gives advice on the appropriate data processing and image analysis strategy. The MIC is furthermore instrumental in identifying new technologies to be implemented at the University of Bern and thus in supporting strategical novel acquisitions for example through R'Equip programs. The service portfolio and teaching activities of the MIC as well as the yearly resources in terms of personal points are laid down in the performance mandate signed between the MIC board and the rector of the University of Bern.

### Research Partners

- Swiss Biolmaging – Swiss Microscopy and Imaging Core Facility Network, [www.swissbioimaging.org](http://www.swissbioimaging.org)
- German Biolmaging (GerBI) – German national network of microscopists and imaging specialists, [www.germanbioimaging.org](http://www.germanbioimaging.org)
- Euro-Biolmaging – The European Research Infrastructure for Imaging Technologies in Biological and Biomedical Sciences (Euro-Biolmaging, EuBI or EuBI ERIC), [www.eurobioimaging.eu](http://www.eurobioimaging.eu)

- European Light Microscopy Initiative (ELMI)- Communication network between European scientists working in the field of light microscopy and the manufacturers of their equipment, [www.embl.org/elmi](http://www.embl.org/elmi)
- Neubias – The Network of European Biolmage Analysts, COST Action CA15124, [eubias.org/NEUBIAS](http://eubias.org/NEUBIAS)
- Science IT Support (ScITS, [www.scits.unibe.ch](http://www.scits.unibe.ch)), PD Dr. Sigve Haug, Mathematical Institute, University of Bern, Bern, Switzerland
- Prof. Paolo Favaro, Institute of Computer Science, University of Bern, Bern, Switzerland
- Prof. Raphael Sznitman, ARTORG Center, Ophthalmic Technology Lab, University of Bern, Bern, Switzerland
- Dr. Akitaka Ariga, Laboratory for High Energy Physics (LHEP), University of Bern, Bern, Switzerland

### Service Profile

As an inter-disciplinary organization, the MIC brings together researchers from various disciplines in the field of life sciences. They provide expert knowledge in microscopy to make the discipline «Microscopy» accessible to the researchers' community of the University of Bern at an uppermost expert level. The expertise ranges from live imaging of whole organisms to organs, cells and subcellular dynamics. High-throughput setups are available to screen large cohorts of living or fixed samples. The MIC portfolio provides imaging from 2D to 4D and from the mesoscopic scale to the ultra-structural level. Electron microscopy allows resolution up to the nanometer range in transmission or scanning mode and can be combined with serial block face sectioning. Atomic force microscopy allows for the analysis of surfaces of materials or organism with micrometer to nanometer resolution. For details of the full range of MIC activities and services, please visit the MIC homepage at [www.mic.unibe.ch](http://www.mic.unibe.ch).

### Teaching Profile

The MIC sustains a wide range of teaching activities. In 2018, the lecture series on Advanced Microscopy was attended by 56 students at the master and PhD level. MIC workshops on selected microscopy techniques are offered by MIC experts. MIC trainings cover a multitude of topics, ranging from basic wide-field microscopy to confocal microscopy and from software handling to writing own scripts for automated image acquisition or analysis. The MIC also offers a broad palette of activities in the frame of a PhD program in microscopy named Cutting Edge Microscopy (CEM),

which is offered to PhD students with a specific interest in in-depth knowledge of microscopy. In 2018, the MIC organized a 3-day summer school and a 2-day visit of the Nikon Imaging Center at the Institut Curie and the Institut Pasteur in Paris, France, for the 20 students enrolled in the CEM PhD program.

### Highlights 2018

In 2018, MIC has received funding from the University of Bern allowing for employment of an expert in Bioluminescence. On September 1<sup>st</sup> 2018, Guillaume Witz joined the MIC to play his specific part in supporting the MIC in the areas of Bioluminescence and Big Data in microscopy. After his graduation from physics, Guillaume joined the field of life science and became an imaging specialist with in-depth experience in multi-dimensional imaging and 4D image reconstruction. He further contributes to the MIC with his knowledge in developing software solutions and pipelines such as high-performance computing (HPC) and deep learning for the automated processing of large and complex microscopy datasets. Guillaume is localized with the Science IT Support at the Mathematical Institute (<http://www.scits.unibe.ch>). With his expert knowledge, Guillaume provides valuable input allowing to increase the quality of microscopic image analysis at the University of Bern.

On July 4<sup>th</sup>, 2018, the MIC organized the MIC Research Day in the lecture hall of the Department of Infectious Diseases and Pathobiology of the Vetsuisse Faculty. This afternoon event was attended by more than 100 researchers interested in microscopy-oriented scientific projects of colleagues at the University of Bern and the University of Fribourg. CEM PhD students who were perfectly up to the task chaired the presentations. Overall, the MIC Research Day provided the opportunity to acquire knowledge about new and sophisticated microscopy techniques at the University of Bern and to interact with local experts in the field.

The 2<sup>nd</sup> MIC Summer School took place from July 4<sup>th</sup> to 6<sup>th</sup>. On July 4<sup>th</sup>, the students actively participated in the MIC Research day. This event was followed by the Students' Day on July 5<sup>th</sup> and an introduction to the interconnection of microscopy-related problems and science IT solutions on July 6<sup>th</sup>. Overall, the MIC Summer School 2018 was a great success in terms of scientific discussions, sharing ideas and personal exchange.

On November 30, 2018, record high 185 participants from the University of Bern, from all over Switzerland, France and Germany attended the traditional MIC Symposium entitled *From Organoids to Organisms: Multiscale Imaging*. Nadia Mercader and Olivier Guenat as the scientific committee ensured a well-balanced and highly informative content. After the welcome addresses by Hans-Uwe Simon and Britta Engelhardt, six scientific talks of Swiss and internationally renowned scientists and two company presentations imparted their most recent achievements in the areas of intravital microscopy or *in vitro* imaging of organoids. The lunch break was intensely used as a platform for discussion and networking. Active participation of company representatives provided latest information on technology development at first hand. We thank the scientific committee for preparing the interesting program, the speakers for sharing their research results and enthusiasm for microscopy, the students of the PhD program Cutting Edge Microscopy for help in the

organization, all the participants for their interest in microscopy and the sponsors for the generous financial support of the symposium.



Impressions of the MIC Symposium 2018.

In 2018, the following colleagues were elected as new members of the MIC commission. Kerry Woods represents life science imaging expert knowledge at Vetsuisse. Giuseppe Locatelli is the Two-Photon microscopy expert at Theodor Kocher Institute. Sigve Haug contributes to the MIC commission with his expert knowledge on Science IT. Guillaume Witz started his position as the new Bioluminescence and Big Data specialist and is also a new member of the MIC commission.

### Selected Publications

Many important publications that have been realized with the help of the MIC cannot be listed due to space restrictions.

Please see the depository BORIS for a complete list of MIC affiliated publications (<https://boris.unibe.ch/>, institute section '09 Interdisciplinary Units').

- Mossu A, Rosito M, Khire T, Li Chung H, Nishihara H, Gruber I, Luke E, Dehouck L, Sallusto F, Gosselet F, McGrath J, Engelhardt B. A silicon nanomembrane platform for the visualization of immune cell trafficking across the human blood-brain barrier under flow. *J Cereb Blood Flow Metabol* 2018 Dec 19:271678X18820584. doi: 10.1177/0271678X18820584
- Sfriso R, Zhang S, Bichsel CA, Steck O, Despont A, Guenat OT, Rieben R. 3D artificial round section micro-vessels to investigate endothelial cells under physiological flow conditions. *Sci Rep*. 2018 Apr 12;8(1):5898. doi: 10.1038/s41598-018-24273-7
- Hlushchuk R, Zubler C, Barré S, Correa Shokiche C, Schaad L, Röthlisberger R, Wnuk M, Daniel C, Khoma O, Tschanz SA, Reyes M, Djonov V. Cutting-edge micro-angiography-CT: new dimensions in vascular imaging and kidney morphometry. *Am J Physiol Renal Physiol*. 2018 Mar 1;314(3):F493-F499. doi: 10.1152/ajprenal.00099.2017
- Bagonis MM, Fusco L, Pertz O, Danuser G. Automated profiling of growth cone heterogeneity defines relations between morphology and motility. *J Cell Biol*. 2019 Jan 7;218(1):350-379. doi: 10.1083/jcb.201711023
- V'kovski P, Gerber M, Kelly J, Pfaender S, Ebert N, Braga Lagache S, Simillion C, Portmann J, Stalder H, Gaschen V, Bruggmann R, Stoffel MH, Heller M, Dijkman R, Thiel V. Determination of host proteins composing the microenvironment of coronavirus replicase complexes by proximity-labeling. *Elife*. 2019 Jan 11;8. pii: e42037. doi: 10.7554/eLife.42037