Research Highlight #2011

Katrin Roth, Ph.D., and Lea Wanke
Core Facility Cellular Imaging at the University of Marburg, Germany

Utilizing Innovative Imaging Technology to Help Solve Complex Research Questions

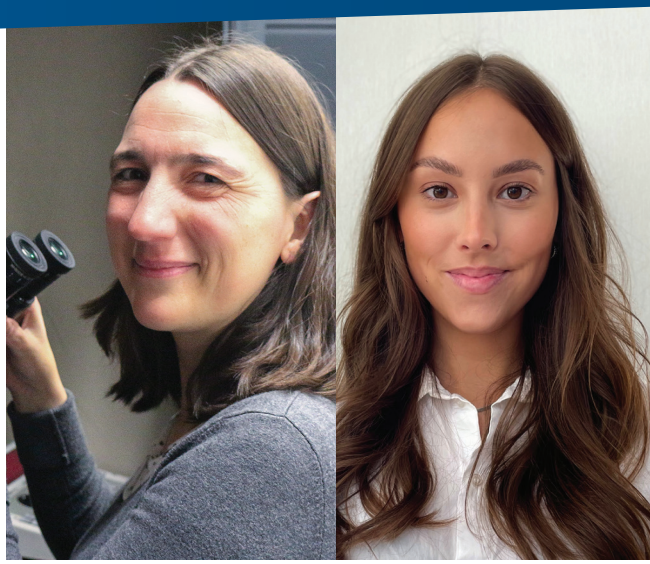
At the University of Marburg in central Germany, Dr. Katrin Roth's and Lea Wanke's day-to-day routines are never the same at the Core Facility Cellular Imaging. This facility operates a range of microscopes including light-sheet, multiphoton, confocal, and widefield to help researchers examine everything from cellular interactions and subcellular structures to cells within an experimental tumor.

Katrin, the head of the facility, and scientific associate Lea are problem solvers with the flexibility to work with different projects, samples, individuals, and microscopes. These are necessary attributes for anyone working in an imaging facility, as having vast scientific knowledge greatly affects the success of any given microscope user, for example, by encouraging the use of the best embedding or clearing technique. Katrin, Lea, and other scientists at these types of facilities can be seen as educators, brainstormers, and knowledgeable "image analysts," which is a developing career path that can have a profound effect on the future of science.

Collaboration at the Imaging Facility

Katrin's interest in microscopy started at a young age with a simple microscope that only used natural light, and years later she gained professional experience as a medical technician imaging fluorescence in situ hybridization of leukemia cells. After completing her Ph.D., in Berlin, Philipps University was looking for a specialist in intravital microscopy and Katrin was awarded the position. Since starting this role, she has brought in a wider variety of techniques and microscopes, and has grown the position into the a full-fledged Core Facility.

It was here that she also met Lea Wanke, who studied biomedical science at the University of Marburg. During her bachelor's thesis, Lea worked closely with Katrin and learned many of the microscopy techniques that are a part of her daily work since joining the team at the facility. Their wide range of projects and research topics keeps them busy, constantly learning, and pushing the limits of microscopy techniques and applications.



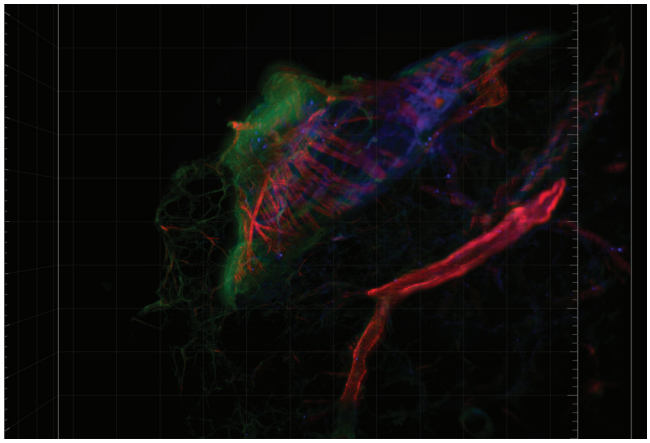
ABOUT THE RESEARCHERS

Katrin Roth, Ph.D., is the head of the Core Facility Cellular Imaging at the University of Marburg, Germany. She obtained her Ph.D. from Free University in Berlin while conducting an intravital microscopy project with alive anesthetized mice and confocal microscopy of tissue slides. After her Ph.D., she joined Philipps University as a specialist in intravital microscopy, and the Core Facility Cellular Imaging was developed out of this two years later. Dr. Katrin Roth is also a member of the German Bioimaging Society.

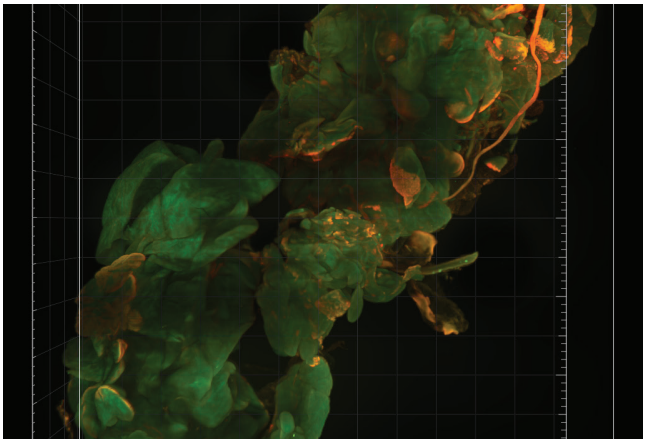
Lea Wanke obtained her bachelor's in biomedical sciences at the University of Marburg and stayed for her master's degree. The group she did her bachelor thesis in worked closely with Katrin and taught her many of the microscopy methods needed to complete her degree. Currently, she works with several projects at the Core Facility Cellular Imaging with a large range of tasks across several projects.

Facility website:

https://www.uni-marburg.de/de/fb20/forschung/corefacilities/zellulaere-bildgebung



Mouse lung slice with vasculature (red), collagen (green), and DAPI (blue).



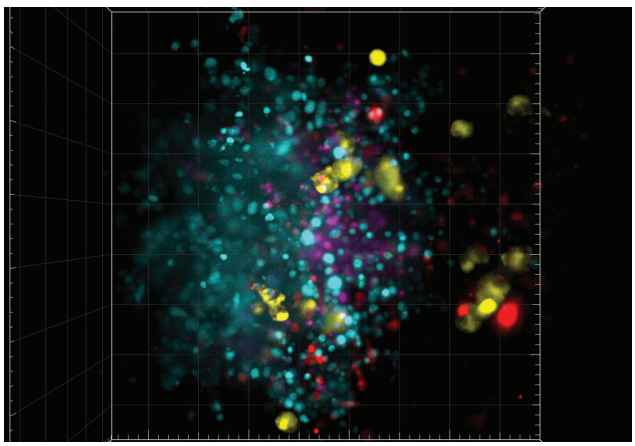
Ethyl cinnamate cleared mouse pancreas, Angiotensin receptor 1 (green) and Chromoganin A (in langerhans islets, red).

Small-to-Large Sample Requirements

The Core Facility Cellular Imaging is located within the Center of Cancer and Immune Biology, so the main focus of their lab centers around cancers, but they also do work in immunology, neurology, and biology. Katrin elaborates on the types of samples they regularly work with:

> "We have everything from cells to whole animals. With widefield microscopes, we look at fixed cells, either pathological or normal histologically. There are also paraffin-fixed sections and tissue sections. Newer samples include tissue slices, thicker tissue samples, whole organs, and up to full mice. Lea has also done work with subcutaneous tumors."

As expected, different biological samples have different imaging requirements, so researchers benefit from close collaboration with Katrin and Lea, who continually become more adept at which microscopy techniques perform best for different applications.



Pancreatic cancer spheroid (turquoise) with cytotoxic T lymphocytes (red9, macrophages (yellow), and caspase assay kit (purple)). Imaged with TruLive 3D.

Light-Sheet Imaging and Processing

Katrin mentioned that Lea is an expert in light-sheet microscopy following her project using them to image subcutaneous tumors. Light-sheet fluorescence microscopes were found to be the best solution after learning that multiphoton microscopes could not offer a large enough field of view to visualize these structures. Each technology at the facility has its unique features and capabilities, and Katrin and Lea have found that light-sheet microscopy is great for 3D projects. The facility's LCS SPIM and TruLive3D Imager light-sheet microscopes (Bruker) are optimized for large, cleared samples and live samples, respectively. Lea goes into detail about what she enjoys when using the LCS SPIM:

> "I don't have many research questions on my own, but I like doing microscopy on the large-scale sample microscope with users and teaching them how to image the tissues that they come to the facility with. It's often organs, like lungs or pancreas, or they take a tissue slice, and then we figure out the best possible way to image them with mounting and clearing techniques."

The large amount of data that light-sheet microscopes produce requires creative thinking for the best results. For example, Lea mentions one trick she learned is to process the data from light-sheet microscopes at a lower resolution first, and if the data look like she wants, she'll analyze and process them at a higher resolution. This is important because sometimes samples die, bleach, or move, especially during time-lapses, so processing something at a lower resolution (2 TB versus 18 TB) ensures that your target structure can be seen. Katrin also adds that there is a lot of value to letting the microscope analyses run overnight to save time and analyze data while they are not in the lab.

Rewarding Work and Future Goals

Leading an imaging facility involves a unique set of challenges, such as having to repair microscopes that break down or coordinating time slots when several researchers have projects at the same time. Researchers also come to the facility at different starting points and finding the best path to the desired results can be very fast or take more brainstorming and experimenting. However, Katrin believes it is rewarding when she is able to manage these situations, oftentimes with Lea helping by jumping from room to room and handling different tasks between different microscopes at the same time. Despite the unique set of challenges, Katrin and Lea have proven that they are great at working with these researchers and managing several projects at once, resulting in successful images with loads of information.

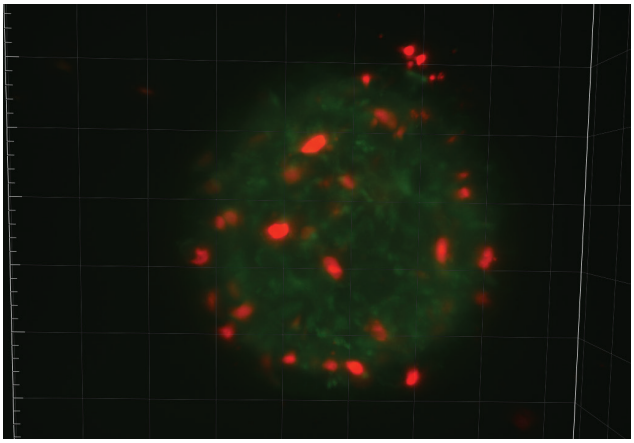
Katrin greatly enjoys working with the clinical research unit and the central projects there, which is the basis for some of her long-term goals:

> "So, my plans and dreams are that in the future these research associations will make me a central project manager for a metrology platform or for a central service unit. A new project is planned that will be over a longer period of 12 years. This new focus would be very helpful because you can have more projects, a lot of users, and work in one field of research."

Katrin is very involved in each project at the facility and likes the idea of focusing her efforts to make the biggest impact. She is also quick to mention that she is happy to work with Lea who makes a variety of contributions. Lea takes a turn speaking about what has stood out to her during her time working at the facility:

> "It's always a highlight of my job to open the images we take and see them for the first time. It's so interesting to see if they worked how you imagined they would. I also hope that I can use the methods I learned in the future and my career will benefit from the practical knowledge."

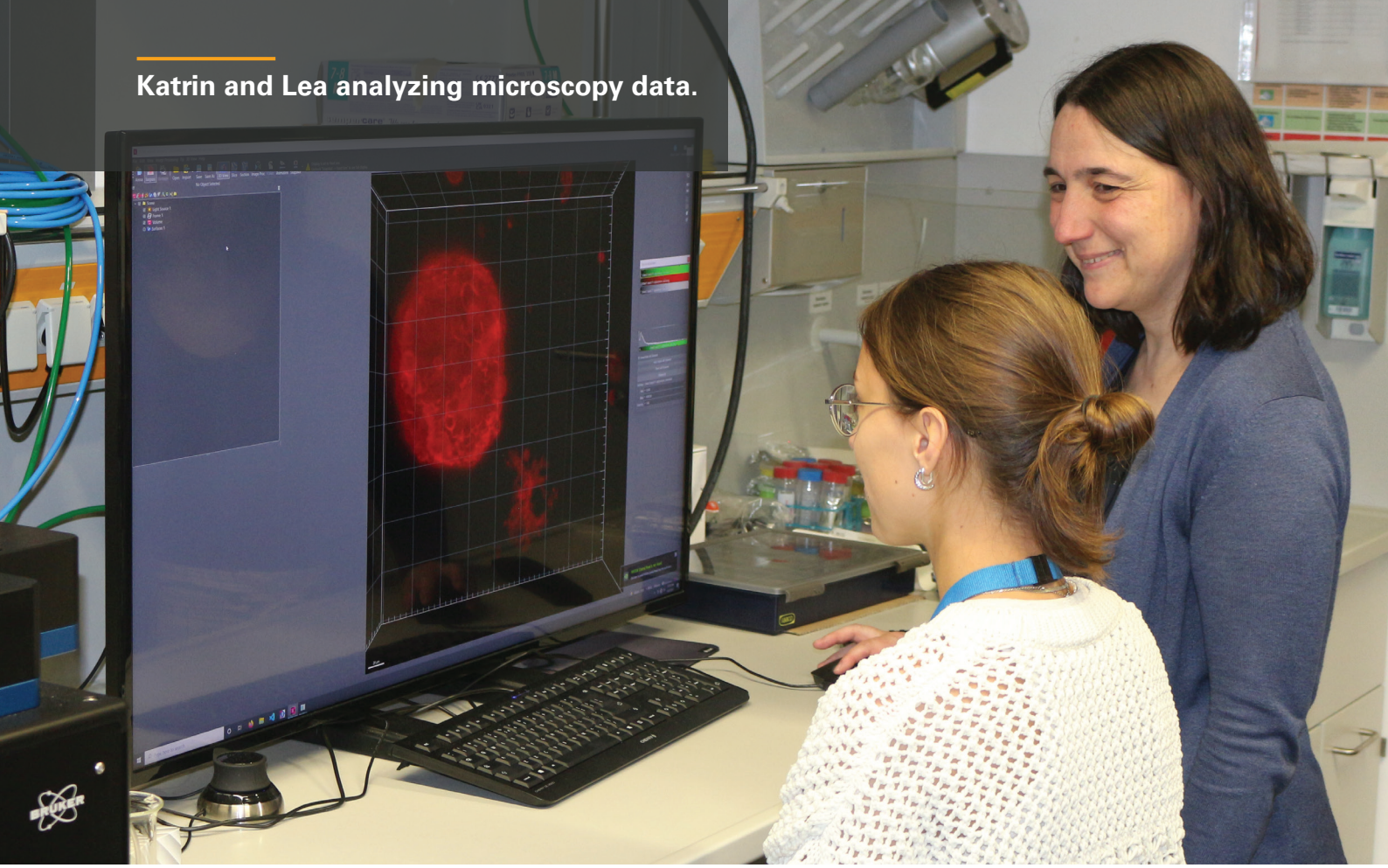
Katrin and Lea both hope to continue to create practical knowledge during their busy days at the facility. One specific case mentioned by Katrin is the importance of imaging organoids, which is a task that they both enjoy doing with the TruLive 3D Imager.



Lung organoid (CellTracker Green) for all cells and propidium iodide (red) for dead cells. Imaged with TruLive 3D.

Together, their contributions at the Core Facility Cellular Imaging span several fields of biology and will continue to positively impact the researchers who visit with their unique experimental questions and imaging requirements.

Katrin and Lea analyzing microscopy data.



Learn More

To discover more about light-sheet microscopy and Bruker's LCS SPIM and TruLive 3D Imager, visit here

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