From Eye to Insight

Leica
MICROSYSTEMS

Step into the Microhub era. Meet Mica.

reddot winner 2023

Mica.
This changes everything.

More than just a highly automated microscope, Mica unites widefield and confocal imaging in a sample-protecting, incubating environment.

With the simple push of a button, you have everything you need – all in one place – to supercharge fluorescence microscopy workflows, power up your research and streamline your path to results.

Like an airport hub that brings together passengers and guides them to their destination, the world's first Microhub brings the users of the lab together with their experiments and guides them to their experimental destinations.

What if every scientist could access spatial information?

Mica empowers every researcher to move from setup to beautifully visualized results and analysis efficiently, accurately, and confidently. Now you can focus on your science, not on figuring out your microscope.

Mica is unique in three aspects:

Access for all

Take control of your work in one easy-to-use digital imaging platform and move confidently from setup to beautifully visualized results.

No constraints

Visualize four colors, simultaneously, in widefield and then freely switch to confocal to more easily correlate data and explore unexpected paths with live or fixed samples.

Radically simplified workflows

Benefit from automation and AI to enable deeper understanding and a faster track to results.

"I see it as a lab in box, in the sense that it compresses the analysis, the acquisition, a confocal microscope, and a widefield microscope into a very small self-contained storage unit that is capable of temperature control and multiple label imaging. At the moment we literally have rooms dedicated for microscope and rooms dedicated for analysis. With Mica, this is compressed into a small square footage that can fit in a corner of a room and does not require a specialized dark light or a dark room because it's self-contained."

Res. Prof. Francesco Cutrale, PhD.,
University of Southern California

Step into the era of
Access for all

Everyone can now leverage microscopy to make more discoveries

You're in control, regardless of whether you use a microscope every day or once in a blue moon. Mica enables experiments to go right – right from the start. The intuitive user interface intelligently automates sample-finding, parameter setting and image focus. All you need to do is define your sample and what type of experiment you're doing. Mica will automatically set everything up for you to get the best imaging results. Manual set up and focus maintenance during acquisition are now a thing of the past.

Mica's **Sample Finder** quickly and automatically generates an in-focus overview of the relevant areas so you don't ever need to manually locate your sample and bring it into focus.

With a single click of the **OneTouch** button, all settings are automatically optimized to match the requirements of the current sample and application. Pick from a scale of "sample protection" to "image quality" and all your illumination and detection parameters are adjusted accordingly.

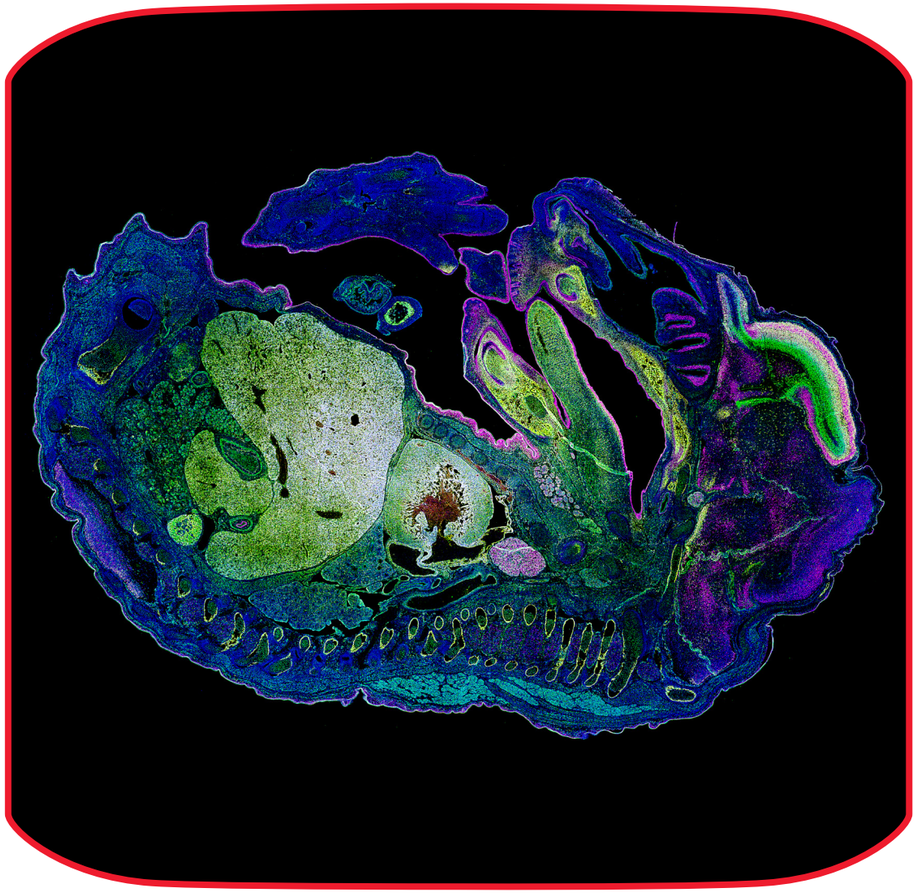
Using Mica saves you both imaging and training time. Through **Intelligent Automation,** all opto-digital components are fully motorized and automated, reducing the number of setup steps needed to generate quality images. Mica is so easy to use, you don't need to invest much time in training to operate it. You also don't need to be an imaging specialist to collect the required data and get meaningful results.

Designed to save you time and effort compared to conventional microscopes

85% fewer steps to the first image

1/3 less time to the first image

1/2 of the training time



Mouse embryo (E15.5) cryosection captured with the PL APO 20x/0.75 CS2 objective. Section shows Tbr2 cells labeled with CF488A, Satb2 cells labeled with CF555 and Ctip2 cells with CF633 plus nuclei counterstaining with DAPI. The acquisition of two sections took less than 5 minutes, while previously it took 2 hours on the lab's comparison device. Sample and images are courtesy of Giulia Di Muzio at the lab of Dr. Pei-Chi Wei at the DKFZ, Heidelberg, Germany.

"One of our main challenges around the lab has been to support both the expert users and the novice users. The great thing for us about Mica is that experts get amazing images without feeling like they are hobbled by the training wheels that are in place in other systems. One other great thing is that it is easy to learn enough that novices get meaningful quantitative results."

Prof. Scott E. Fraser, PhD.,
University of Southern California

Step into the era of
No constraints

Access key contextual information with absolute spatiotemporal correlation

Now researchers can **simultaneously visualize four colors in widefield and then freely switch to confocal** to more easily correlate data and explore unexpected paths of investigation.

Mica offers simultaneous four-color imaging and patented FluoSync™ spectral unmixing technology, meaning that in one exposure, you can generate **4 x more data with 100% spatiotemporal correlation**, whether using widefield or confocal imaging.

A look inside: using an array of four detectors combined with hybrid unmixing, Mica allows you to detect up to four different labels with true dye separation and no spatiotemporal mismatch, with just one exposure and without the need to set up filters.

Ideal conditions for live-cell imaging

Mica is designed for live-cell imaging which helps users get reliable results, ranging from fast, short-term experiments to studies that can go on for much longer.

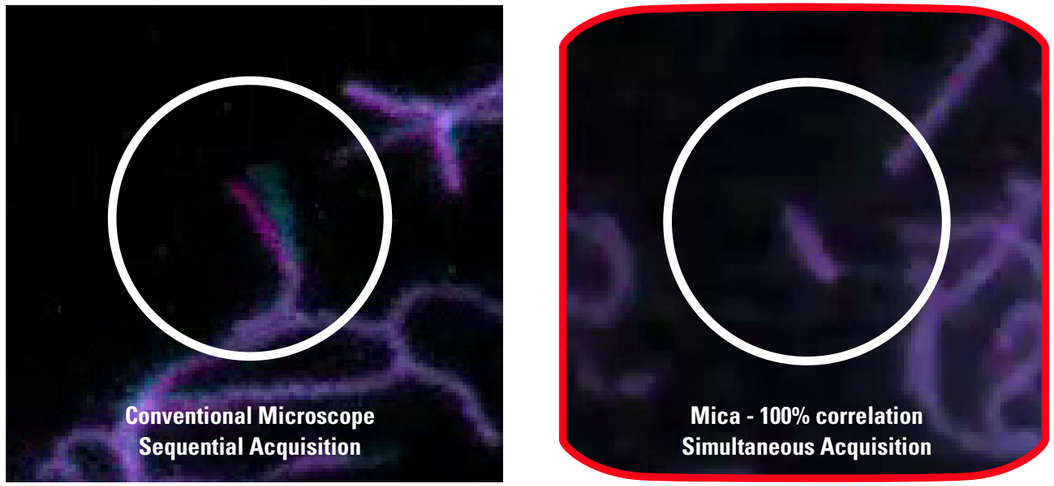
The **integrated incubation system delivers physiological-like conditions** with reliable regulation of temperature and pH, enabling live-cell imaging for weeks. Mica protects the sample from stray light, helping to keep your sample stable and ultimately benefiting your imaging experiment. But not only is this conducive to the well-being of your samples, it's good for humans, too. Mica enables you to enjoy a brightly lit lab – freeing you from the constraints of sitting in a dark room for hours monitoring your experiment. Optionally, oxygen levels can be controlled to perform hypoxia experiments.

Fast cellular events can be imaged with absolute spatiotemporal correlation using FluoSync™ technology

FluoSync is a streamlined approach for simultaneous multicolor fluorescence imaging, a new way to do **spectral unmixing that allows simultaneous imaging on the fly**. It enables the acquisition of up to four fluorophores at the same time in either widefield or confocal mode. This overcomes the spatiotemporal mismatch between labels of moving objects during sequential acquisition and ensures **100% data correlation**. This patented technology eliminates the time taken to switch filters when acquiring multi-color images, thus increasing temporal resolution, and minimizing crosstalk.

FluoSync means you see more. Miss nothing. Work without barriers.

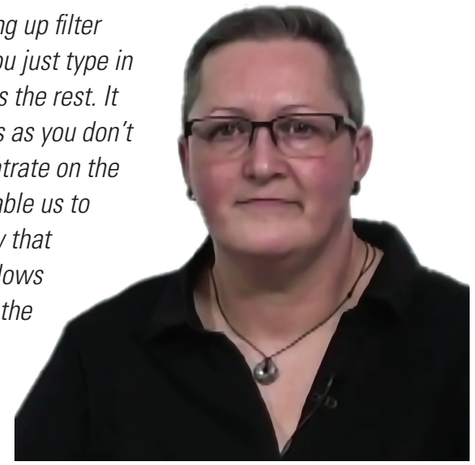
Download the Whitepaper on FluoSync



U2OS cells stained with MitoTracker green (Mitochondria structure, cyan) and TMRE (active mitochondria, magenta). Single time point from a sequential acquisition (pictured left) and simultaneous acquisition (pictured right) of the two channels over 2 minutes 100 frames using the PL APO 63x/1.2 W motCORR CS2 objective.

"FluoSync is amazing. It takes away the burden of looking up filter specs and deciding if a dye matches your filters. Now you just type in the new fluorophore and the Intelligent Automation does the rest. It makes it easier and safer to try new dyes and constructs as you don't have to worry about filter matching. You can just concentrate on the science and not technical details. The FluoSync also enable us to capture rapidly moving structures like vesicles and know that there is no motion artifact separating the colors. This allows us to have more confidence that any changes we see in the structures are real results."

Dr Lynne Turnbull,
Principal Scientist - Leica Labs @ EMBL Imaging Center



Mica. Supercharge your imaging workflows.

Run your live-cell experiment without constraints

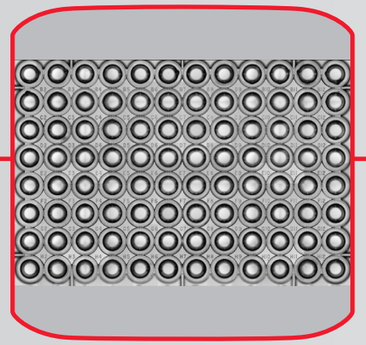
With Mica you can run long-term live cell experiments with high contrast brightfield and/or multi-color fluorescence applications with 100% correlation.

Turn on the incubator

Mica is an incubator. The whole volume around the sample is heated up to the required temperature and equilibrated to the desired CO_2 level and humidity.

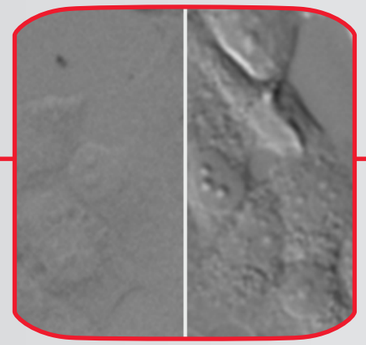
Overview the sample

Mica's **Sample Finder** quickly and automatically generates an in-focus overview of the relevant areas, without manual searching and focusing.



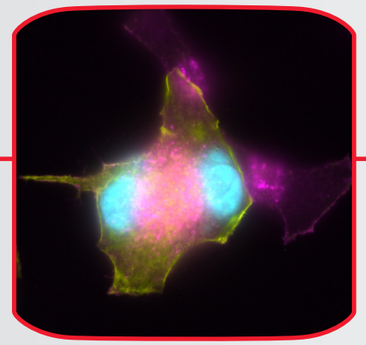
Increase contrast

Simply click on **IMC and you get Integrated Modulated Contrast**. Now you can see contrast in unstained samples which would show little contrast when using brightfield.



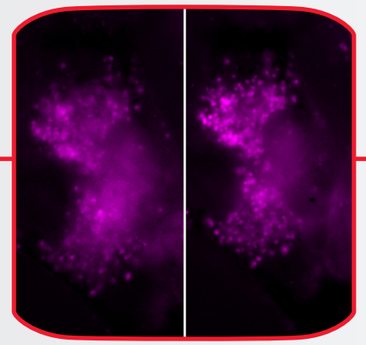
Get higher magnification

Mica enables live cell imaging with higher magnification by **automatically applying and maintaining water immersion**, even during long-term experiments. Now you don't need to worry about manual interaction.



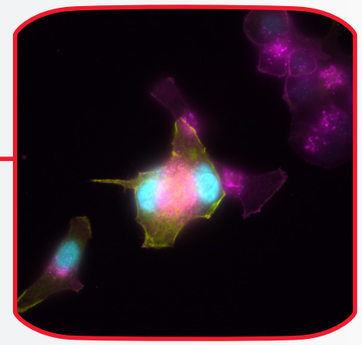
Optimize optics

An objective with a CORR ring offers the best optical performance with various samples. With Mica, just **click on SmartCORR and the optics are optimized** to yield the brightest and most crisp images.



Run your experiment

Ready to run your experiment? If you want to **measure fast dynamics with 100% spatiotemporal resolution**, our patented FluoSync technology helps you achieve absolute correlation.



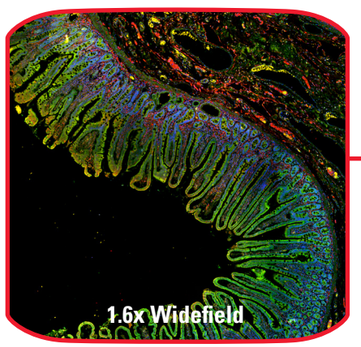
T47D cells expressing H2B-eGFP (cyan) located to the histones in the nuclei and LifeAct-mCherry (yellow) labeling actin. The cells were incubated with WGA-Alexa 680 (magenta) to label vesicles in the endocytosis pathway.

Seamlessly move from fast overview to high resolution

With Mica you can swiftly go from overview to the right position for high resolution imaging. The FluoSync technology enables simultaneous imaging making the imaging up to 4 times faster.

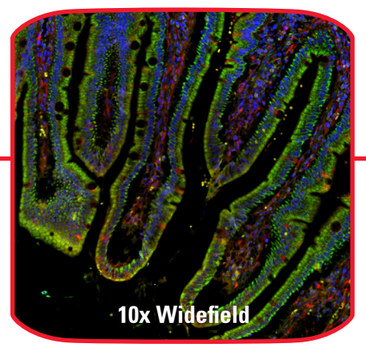
Create overview

Find the sample structure on the carrier and observe the overall morphology of the colon slice. Identify a region of interest for more detailed inspection.



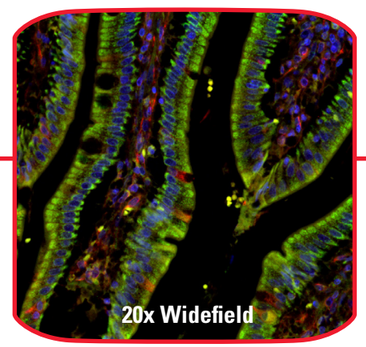
Get more details of a substructure

Switching to the next higher magnification allows to assess the integrity of the tissue and locate areas suitable for further analysis.



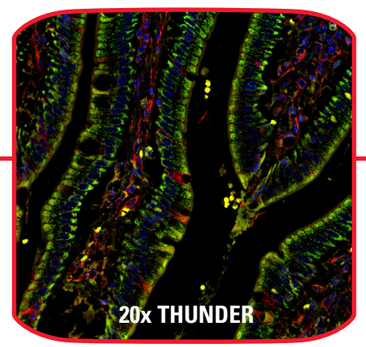
Select the cell of interest

Start to see the higher details and select the single cell to get subcellular information. However, some details remain hidden.



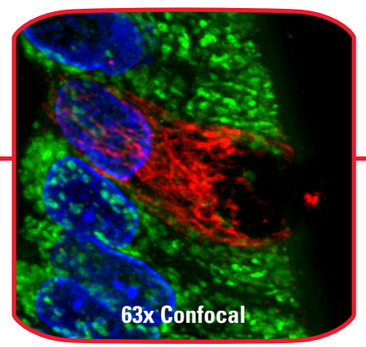
Remove the haze

THUNDER is the method of choice to get more contrast and see more. This enables you to make the right selection and step further into the details of the sample.



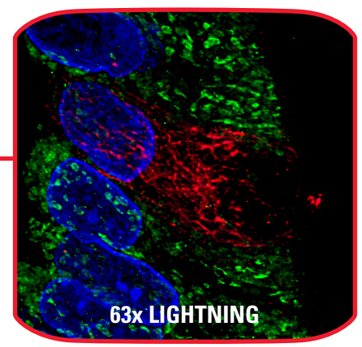
Get the subcellular information

Switch from widefield to confocal mode with just a simple click to get more subcellular information.



Get more subcellular information

Adding LIGHTNING offers access to higher details of the subcellular structures seamlessly integrated into the whole workflow from fast overview to high resolution.



Intestine tissue section acquired with different objectives ranging from low to high magnification (1.6x, 10x, 20x, 63x), using widefield and confocal imaging. 20x widefield images are processed with THUNDER and 63x confocal images with LIGHTNING. Nuclei are labeled in blue, mitochondria in green, and detyrosinated tubulin in red.

Mica.
Select the right modality in real-time.

Extract more information using opto-digital solutions

The Microhub brings **widefield and confocal modalities to your fingertips**: Mica's flexibility and multimodal capabilities make it the perfect choice for meeting the ever-changing needs of your experiments. You can select from **multiple imaging modalities all within one system**, including widefield, confocal, THUNDER computational clearing, LIGHTNING, Z-stacks, time-lapse and more.

THUNDER removes the out-of-focus blur that comes with three-dimensional samples through Computational Clearing (CC), an innovative and exclusive opto-digital technology from Leica.

LIGHTNING is a fully automatic adaptive process for extraction of information. It reveals fine structures and details that are otherwise simply not visible.

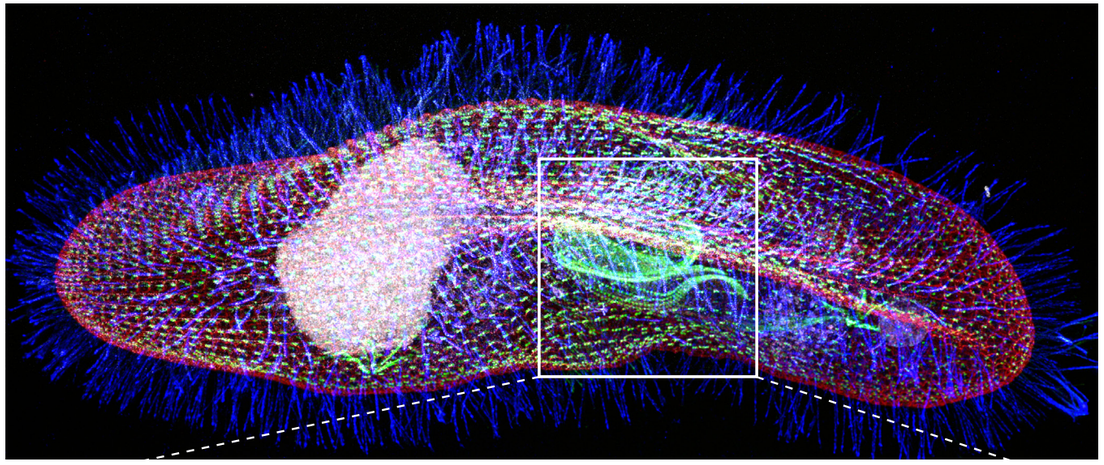


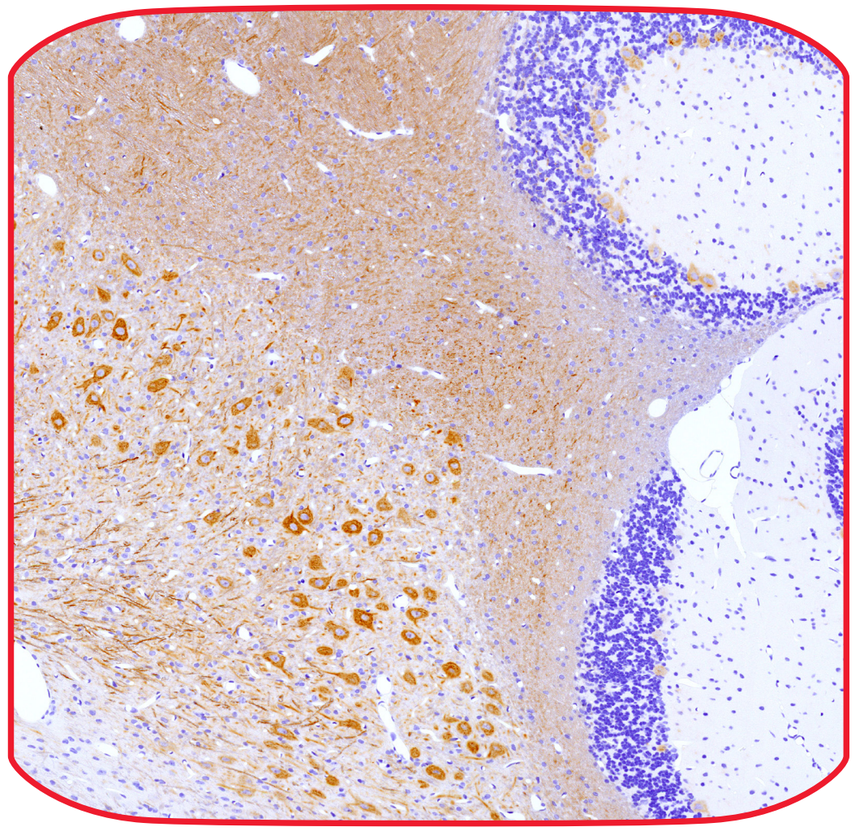
Image shows a protist Paramecium (Paramecium tetraurelia) stained to show the nucleus (Hoechst, white), the basal body, a protein ring found at the base of a cilium (AF488, green), the epiplasm, a thin dense layer at the base of a cilia where basal bodies are inserted (AF568, red) and the cilia (Star635P, blue). Images were acquired on Mica with HC PL APO CS2 63x/1.20 water objective using widefield (plus THUNDER ICC and LVCC) and confocal imaging (LIGHTNING grade, +5 sample protection to quality slider) plus LIGHTNING without moving the sample. Sample courtesy: A. Aubusson-Fleury, CNRS, GIF sur Yvette, France.

No compromise between fluorescent and color brightfield imaging

Why use color brightfield imaging in the first place? Because histological staining methods such as H&E and Nissl staining require color brightfield imaging to capture the information encoded by the color.

With conventional systems, you often have to choose between fluorescence or color brightfield because cameras are optimized for either fluorescence or color imaging. If you opt for a color camera, then you will lose some details when using fluorescence.

With Mica you no longer have to make this choice. Simply use the FluoSync detector to acquire color images with full resolution for each color.



DAB staining of a rat cerebellum

Step into the era of
Radically simplified workflows

Bringing you faster from sample to discovery

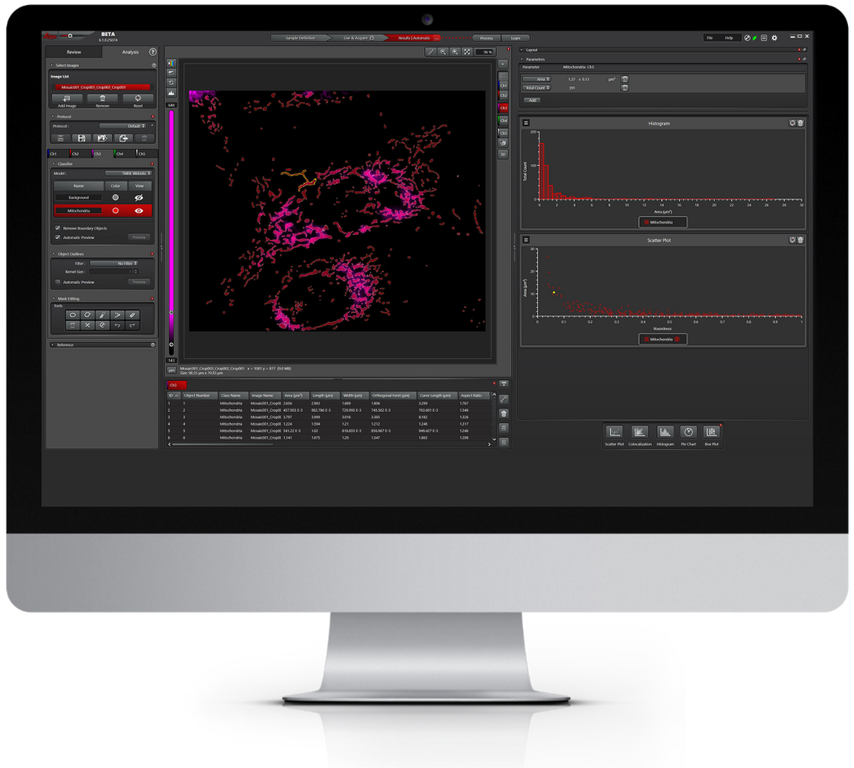
Mica fully integrates everything a researcher needs for radically simplified workflows, using automation and AI to enable deeper understanding and a faster track to results. **Over 60% of process steps are reduced through system intelligence**. For example, a basic multicolor experiment can be simplified from 24 steps using a conventional microscope down to just 8 steps with the use of Mica.

Let's have a look how this simplification makes a difference throughout the analysis process.

With its on-screen annotation you can simply mark the difference between the desired object and the background – simply by painting on the screen. **Mica will automatically train its pixel classifier** and identify the parameters required for the segmentation. Once trained you can repetitively apply the model to your images. Select which values you want to compare in order to create a visual representation. Exemplatory in the image on the right, the shape and fluorescence intensity of the mitochondrial membrane potential was analyzed with Mica.

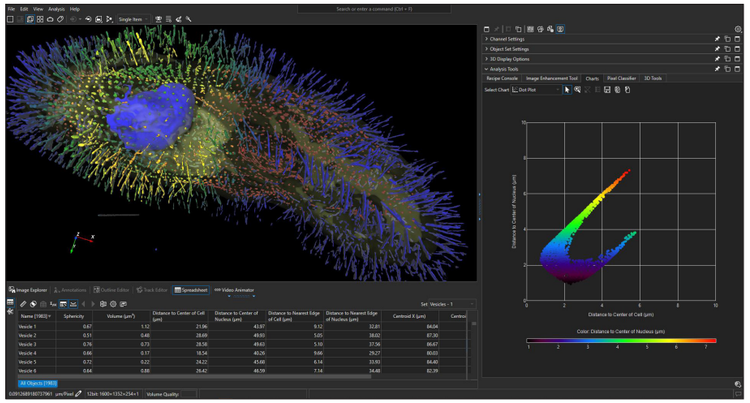
The model generated by your training can then be exported and shared – ensuring **100% repeatability and reproducibility**. You could even reuse existing models and enhance them through further training.

AI based training of mitochondrial segmentation using your scientific expertise



Consistent analysis across projects and users with AI powered analysis

Looking for extended analysis options? Mica can be combined with Aivia, the cutting-edge AI image analysis software from Leica Microsystems. Aivia is a uniquely innovative and complete 2-to-5D image visualization, analysis and interpretation platform designed for the reliable processing and reconstruction of highly complex images in a matter of minutes.



Analysis of cell parameters using the Aivia AI powered analysis software

Mica. Powered By:

Intelligent automation

All opto-digital components are fully motorized and intelligently automized. A single button remains on the Microhub – the open button. Everything else is swiftly woven into the workflow of the software.

OneTouch Auto-Illumination

With a click of the OneTouch button, all settings are automatically optimized to match the applicative demands and the current sample. Pick from a scale of "Sample protection" to "Image quality" and all illumination and detection parameters are adjusted accordingly.

4 labels simultaneously

Capture all 4 labels of different structures in a single acquisition for widefield or confocal. Simultaneous acquisition of multiple labels boosts the speed of acquisition by up to 4 times.

4 labels 100% correlated

Simultaneous acquisition of 4 labels overcomes the spatiotemporal mismatch between labels of moving objects during sequential acquisition. The data is now 100% correlated!

Patented FluoSync technology

FluoSync is a new way to perform spectral unmixing that enables simultaneous imaging on the fly. It allows you to detect up to 4 different labels with true dye separation and no spatiotemporal mismatch. FluoSync uniquely combines dedicated hardware and new hybrid unmixing.

Unified imaging modalities

Mica unifies transmitted and fluorescence light imaging modalities such as IMC, THUNDER and LIGHTNING in one Microhub – for both fixated and living specimens.

Point scanning confocal

Obtain highest resolution in all 3 dimensions with point scanning confocal including optical sectioning. The pinhole physically blocks out-of-focus light yielding the best axial resolution and is particularly suitable for 3D imaging of thick samples.

Mica is an incubator

The entire encapsulated inner sample space can be climate controlled (temperature, CO_2 and humidity regulation) and offers ideal conditions for short and long-term live cell observation.

Sample Finder

Mica's Sample Finder quickly and automatically generates an in-focus overview of the relevant areas. Manually locating the sample and bringing it into focus is now a thing of the past.

AI-based analysis

With artificial intelligence Mica recognizes objects in the images and enables any researcher to move efficiently, accurately, and confidently from imaging to analysis and beautifully visualized results. No imaging processing skills required.

Pixel classifier

Easily train Mica to recognize objects in images without image processing skills. Simply by drawing examples on the image the pixel classifier learns to reproduce the input and segments all objects in the images.

GUI operated annotations

Train the artificial intelligence with simple-to-use drawing tools right on the image within the Mica GUI.

Specifications

			Mica Widefield	Mica Widefield Live-Cell	Mica WideFocal	Mica WideFocal Live-Cell
TRANSMITTED LIGHT CONTRAST	Integrated modulation contrast (IMC), automatically adjusted and brightfield contrast in RGB or gray scale mode		x	x	x	x
INCIDENT FLUORESCENCE ILLUMINATION	LED	365 nm, 470 nm, 555 nm, 625 nm	x	x	x	x
FluoSync WIDEFIELD DETECTION	Simultaneous detection channels	4 with FluoSync fluorophore separation	x	x	x	x
	Detector type	5 MP CMOS	x	x	x	x
CONFOCAL ILLUMINATION	Laser diode	405 nm, 488 nm, 561 nm, 638 nm			x	x
FluoSync CONFOCAL DETECTION	Detector type	HyD FS			x	x
	Simultaneous detection channels	4 with FluoSync fluorophore separation			x	x
ENVIRONMENTAL CONTROL	Live Cell Package	Temperature (room temperature +3 °C to 45 °C), CO_2 (0 - 10 %), humidity		x		x
IMMERSION DISPENSION	Closed loop water dispenser. Water immersion for one objective is feedback controlled and does not require any interaction		opt.	x	opt.	x
THUNDER	Methods	Instant Computational Clearing (ICC), Small Volume Computational Clearing (SVCC), Large Volume Computational Clearing (LVCC)	x	x	x	x
LIGHTNING	Methods	Basic, upgradeable to LIGHTNING Expert			x	x

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In New Zealand please contact

bio-strategy
Part of DKSH Group

0800 34 24 66 [New Zealand]
sales.nz@bio-strategy.com
www.bio-strategy.com
shop.bio-strategy.com

MEET
MICA

Leica Microsystems CMS GmbH | Ernst-Leitz-Strasse 17–37 | D-35578 Wetzlar (Germany)
Tel. +49 (0) 6441 29-0 | F +49 (0) 6441 29-2599

https://go.leica-ms.com/Mica