High-quality data acquisition made easy

ZEISS Celldiscoverer 7

Adaptable Automation for Advanced Workflows

zeiss.com/celldiscoverer

ZEISS

Seeing beyond

Your Boxed Microscope with Adaptable Automation for Advanced Workflows

If your research requires explorative high-content imaging, you are often faced with a trade-off between the desired image quality and the need to capture large amounts of data efficiently. ZEISS Celldiscoverer 7 is your research companion for collecting statistically relevant data, giving you easy access to high-quality imaging, adaptability to demanding experiments, and stable long-term operation.

System calibration, sample carrier detection, focus adjustment, aberration correction – all these prerequisites for quality results are done automatically, leaving you free to get on with other projects. Whether working with 2D or 3D cell cultures, tissue sections or small model organisms, you will acquire better data in shorter times.

While you enjoy the high level of automation, you don't have to sacrifice flexibility. Freely combine imaging modes like multi-fluorescence, label-free imaging, transmitted light contrasts, and stunning 3D confocal imaging – always customized to your research needs.

360°

Simpler. More Intelligent. More Integrated.

**Easy Access to High-Quality Imaging**

You don't have to become a microscopy expert to acquire high-quality data. Simply insert your sample carrier and let ZEISS Celldiscoverer 7 make all the necessary settings. Automatic calibration routines ensure optimal conditions and reproducible results. The system finds and keeps the focus after detecting the sample carrier and its optical properties. Spherical aberrations are corrected automatically to always deliver best contrast and resolution. For demanding long-term imaging, Celldiscoverer 7 gives you automated water immersion and integrated incubation to keep your cells happy with just the right environmental conditions. Without manual adjustments, even if you operate the microscope remotely, you get unbiased data that meet your highest expectations.
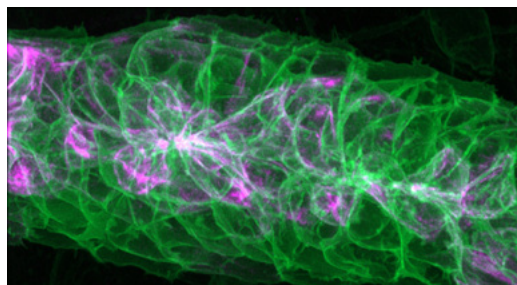
Adaptable to Demanding Experiments

Optimized for explorative high-content applications, Celldiscoverer 7 gives you experimental freedom with a range of imaging modes that can be freely combined to tailor data acquisition to individual requirements. Go for fast widefield imaging to perform live cell experiments and rapid time-lapse recordings. Enable label-free imaging in multi-well plates without artifacts. Enjoy a wide spectral range for multi-fluorescence experiments and add unique transmitted light contrast methods. For stunning 3D data, add confocal imaging with LSM 900 and Airyscan. Combine all these possibilities in customized workflows and let the built-in intelligence of Celldiscoverer 7 work for the benefit of your research.
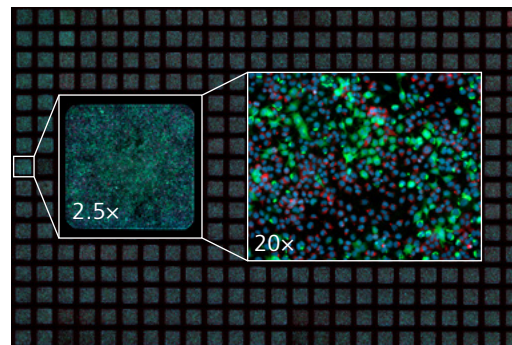
Reliable in Multi-User Environments

In facilities with multiple users, the robustness of an imaging system is key for its acceptance and efficient use. Once a workflow has been set up with Celldiscoverer 7, it can be executed reproducibly again and again, even if the system has been used for other experiments in the meantime – no manual recalibration is needed. The robust design of the system enables stable long-term operation and prevents unwanted user intervention – damaged objective lenses are a thing of the past. Predictive service offers lasting and optimal instrument performance for increased system uptime and reliable results from automated imaging. Predictive analytics allow to determine the optimal time point for the next service visit, e.g., when a component is about to reach the wear limit.


▶ Click here to view this video

2.5×

20×

Your Insight into the Technology Behind It

An Easy-to-Use Integrated Microscope

Observing live samples over days or imaging lots of multi-well plates puts your microscope through its paces. To get reproducible, unbiased data, you must ensure optimal environmental conditions such as a low light intensity, temperature, CO_2 etc. That's why Celldiscoverer 7 brings you a unique combination of a stable box, darkroom, and integrated research microscope with incubation. It simplifies your laboratory setup and makes work more comfortable and efficient.

All system components are optimized for hassle-free imaging. New users and multi-user facilities especially will enjoy the automation and usability features when setting up and repeatedly execute complex experiments. You'll systematically avoid accidental hardware changes that might lead to biased data or even damage your microscope – resulting in higher productivity and better data with less training and maintenance. What's more, as your needs grow you can expand Celldiscoverer 7 with confocal technology, external cameras, deconvolution, environmental control – whatever you need to scale up challenging live cell observation.

▶ Click here to view this video
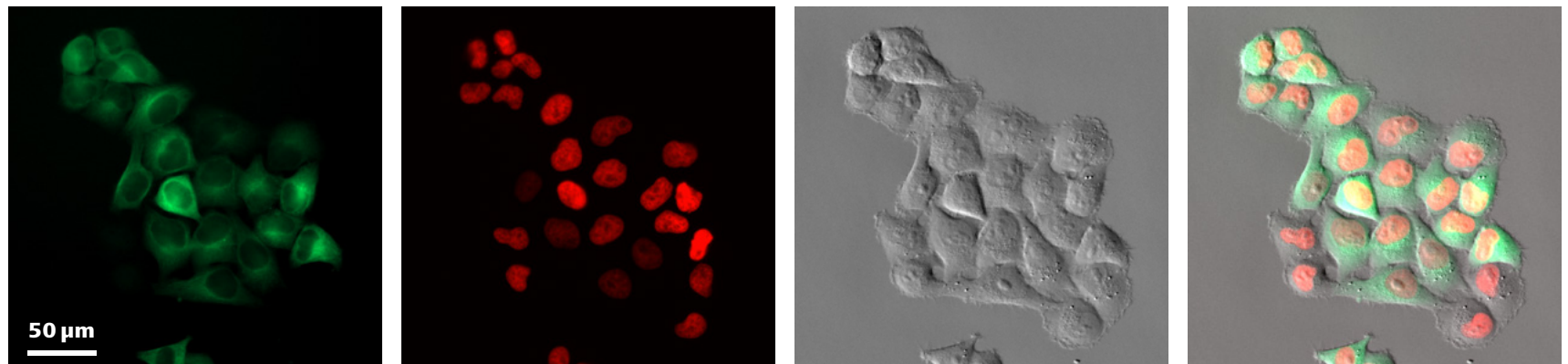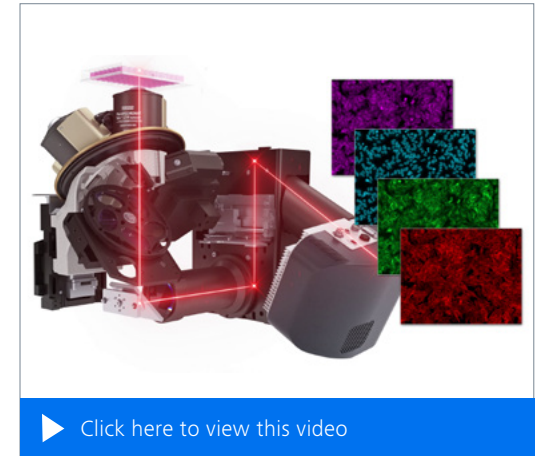
72 h cell growth assay using a waterimmersion objective. HeLa Kyoto cells expressing H2B-mCherry Tubulin eGFP (Neumann et al., Nature 2010 Apr.1.; 464(7289):721-7) imaged every 15 minutes for 72 hours using Autoimmersion; individual channels of the green (eGFP) and red (mCherry) fluorescence and the phase-gradient-contrast as well as an overlay. Sample courtesy of I. Charapitsa, Chemical Biology Core Facility, EMBL, Heidelberg, Germany

Your Insight into the Technology Behind It

ZEISS Celldiscoverer 7 Recognizes and Adapts Automatically to Your Samples

Live cell imaging requires objectives with high numerical apertures. Those objectives will only deliver high contrast and sensitivity if their optics can adapt to variations in bottom thickness or to the material of different sample carriers. You are free to use Petri dishes, chamber slides, multiwell plates, plastic or glass, thin or thick vessel bottoms, low skirt or high skirt plates. Automatic sample recognition detects all relevant vessel features while loading your sample. Then Autocorr adjusts the correction ring of the objective to compensate for spherical aberrations. The Find Focus function automatically places your sample in focus and Definite Focus keeps it there. It's never been easier to get crisp images with low phototoxicity from deep inside your sample.
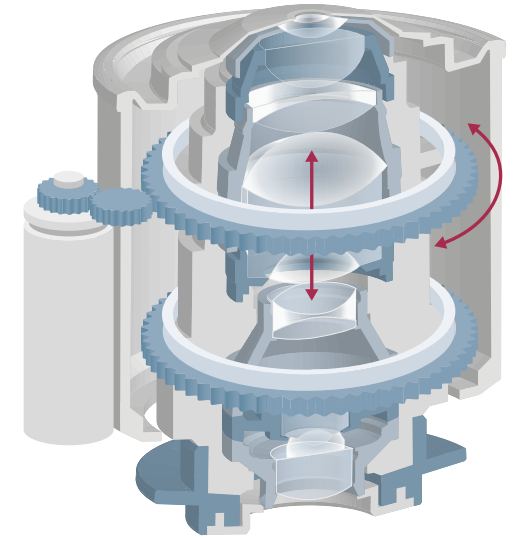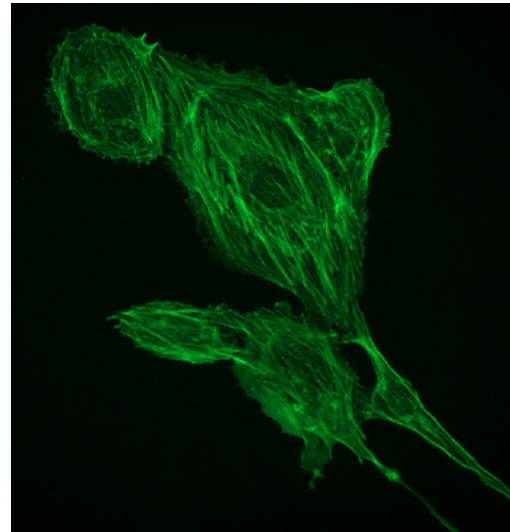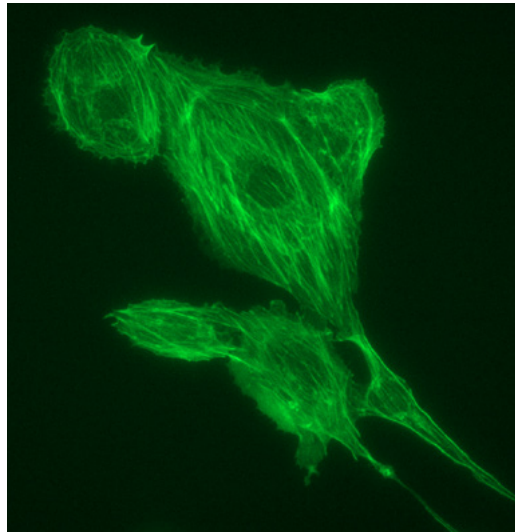
Left image shows spherical aberration due to unadjusted optics. Right image shows the same structure using an Autocorr objective. The correction results in increased contrast, resolution and intensity, providing low phototoxicity. The images show tubulin in FluoCell prepared slide #1.
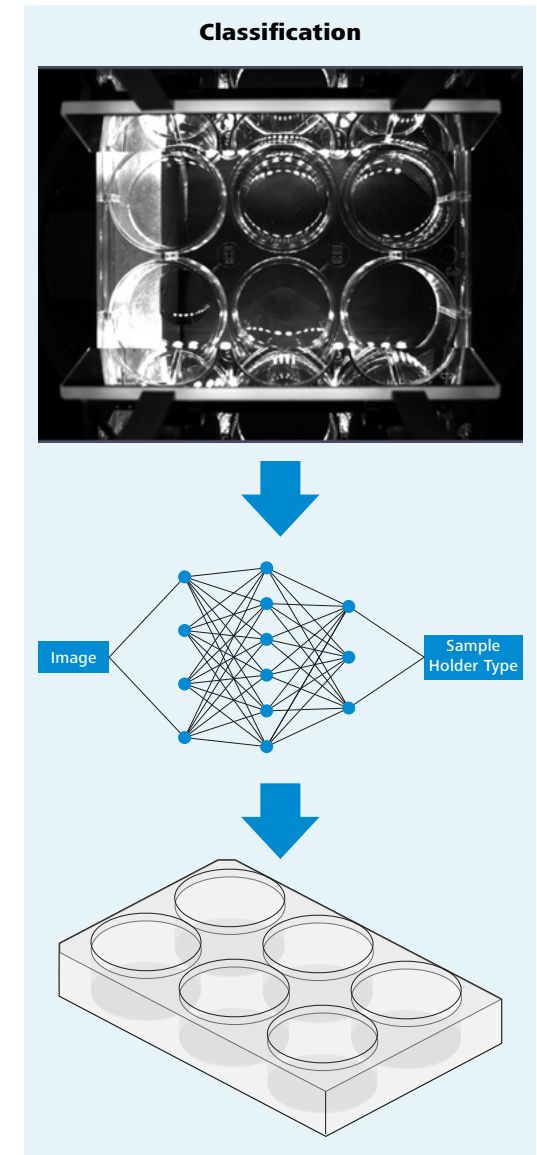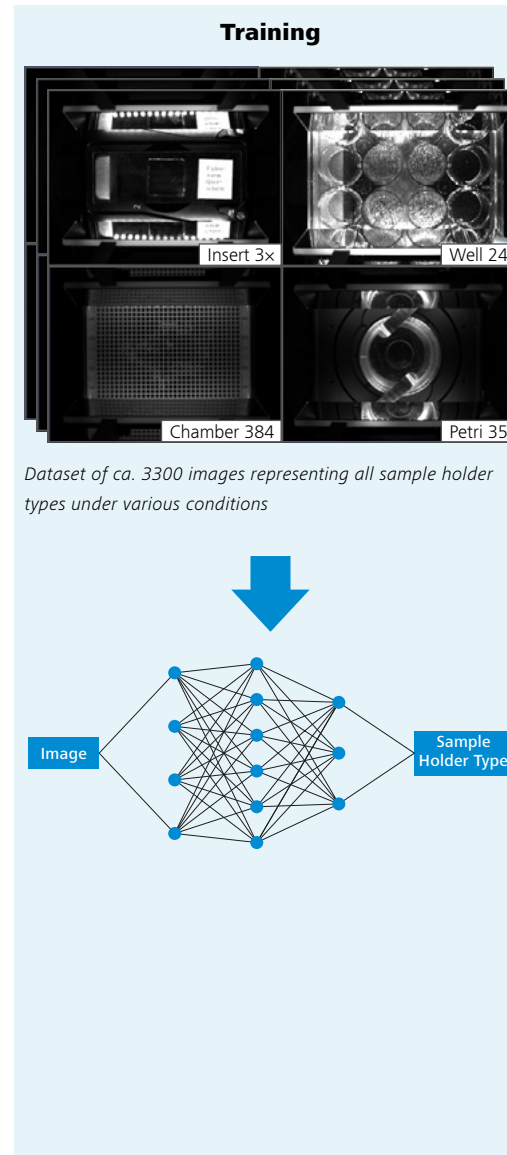
Your Insight into the Technology Behind It

AI-Based Detection of Multiple Sample Carrier Types

A large variety of sample carriers such as multi-well plates, petri dishes, chamber slides, and object slides can be imaged using Celldiscoverer 7.

Sample carriers from different manufacturers, which may differ in design, are reliably recognized by the system using AI and neural networks specially trained by supervised machine learning with thousands of images representing all sample carrier types under various conditions.

The sample carrier detection lasts only seconds. It automatically adjusts all microscope settings to prevent sample collision and ensure optimal imaging conditions. This means you always get reproducible, high-quality results.

Training

Dataset of ca. 3300 images representing all sample holder types under various conditions

Classification

Your Insight into the Technology Behind It
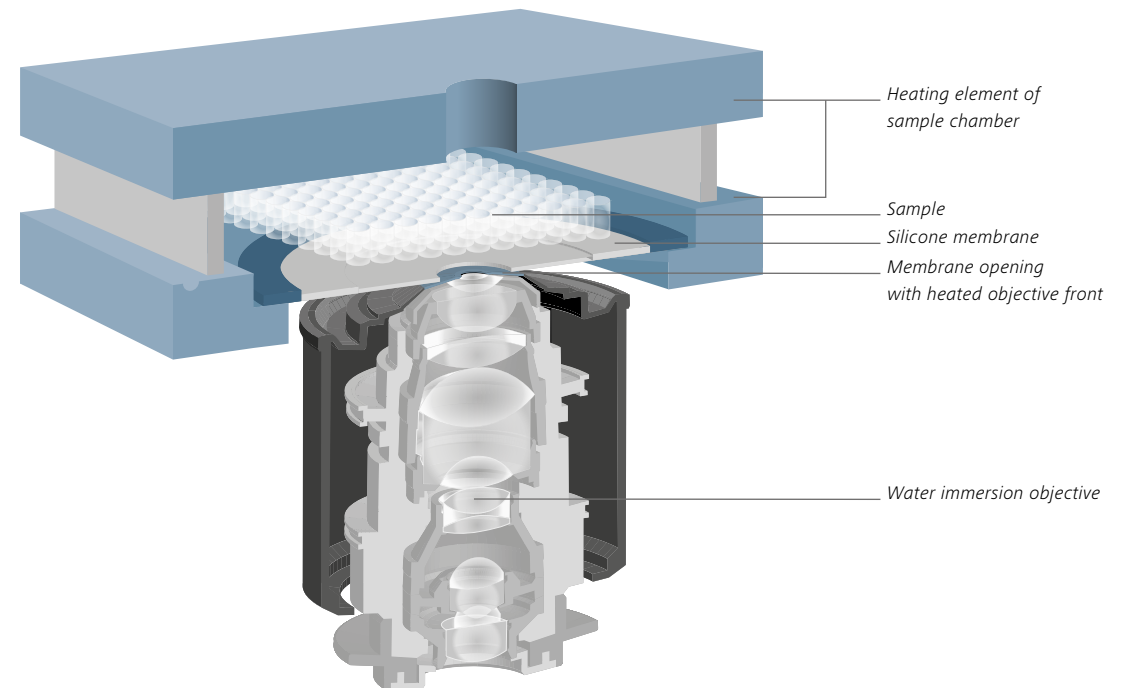
There Is No Life Without Water …

… and no live cell imaging without water immersion. In cell biology or screening applications, your samples mostly consist of water and / or will be mounted in aqueous solutions.

Celldiscoverer 7 combines an outstanding water immersion objective with rapid automated immersion supply and removal. A unique elastic silicon membrane fits perfectly between the objective and sample chamber. The silicon membrane simultaneously seals the sample chamber to avoid unnecessary airflow while protecting the system from potential liquid spillage. Just select the water immersion objective and water is supplied instantly to the front lens.

Within seconds the immersion is building up and the lens is ready to use. When you switch back to a dry objective, the immersion water is automatically removed.

Until now, automated imaging systems often struggled as the immersion water quickly evaporated. Celldiscoverer 7 solves that problem by automatically monitoring the immersion and adding water in regular intervals, as needed. With Celldiscoverer 7 you can perform unbiased live cell experiments at 37 °C over several days or carry out extensive scanning processes on multiwell plates.

By adapting the refractive index of your imaging system to the samples, you'll achieve more efficient light collection and increased sensitivity. And less phototoxicity significantly increases viability of even your most challenging living samples.

Heating element of sample chamber

Sample

Silicone membrane

Membrane opening with heated objective front

Water immersion objective

A silicone membrane allows automatic water immersion and seals the sample chamber.

Your Insight into the Technology Behind It

Get in Focus, Then Stay in Focus

Use the hardware-based Find Focus function to automatically focus your sample and find your region of interest quickly with just a single click. This significantly reduces the time to your first image and minimizes sample illumination.
Then select Definite Focus to maintain the focal position throughout your experiment, whether it takes a few seconds or several days.
Or combine both methods with the powerful content-based autofocus of ZEN imaging software. Celldiscoverer 7 can automatically create focus maps for multiple positions in long-term time-lapse experiments. Simply choose the best focus strategy for the experiment at hand.

Move to the Edge …

… but not one step more, thanks to the Adaptive Lens Guard. High optical performance often compromises on the possible scanning area. The Adaptive Lens Guard protects the objective from collisions with your sample vessel or hardware components, automatically maximizing the available scanning area. Sample carrier holders are designed so that the entire sample can be imaged even at maximum magnification, e.g., in chamber slides. Bottom thickness, skirt height and lateral dimensions are important geometrical features of the different sample carrier types – especially when working with multiwell plates.

Celldiscoverer 7 automatically detects these features and adapts accordingly. It also calculates the maximal possible scanning area automatically, depending on the individual sample carrier, objective and current focus position in your experiment. The available scanning area is always indicated on your monitor. Change your experimental parameters and the scanning area will adapt automatically, in real time.

Your Insight into the Technology Behind It

**Capitalize on LED-Technology for
Live Cell Imaging**

Celldiscoverer 7 brings you all the advantages of
LED technology for efficient widefield illumination
with low phototoxicity, fast switching times and
homogeneous illumination. Real-time and long-
term stabilization with performance optimization
ensure comparability of images. That's what
delivers gentle imaging, increased throughput,
excellent data quality and reproducible results
over a very broad spectral range.
The LED module includes up to 7 individually
controlled excitation lines for maximum flexibil-
ity in the choice of dyes, from deep blue to far
red. You always get enough excitation power to
shorten exposure times and to speed up your im-
age acquisition.
All LEDs are hardware-triggered for precise, fast
illumination. During sample navigation LEDs are
tightly synchronized with camera frame rates.
An automated rectangular excitation field stop
illuminates only the active field of view, greatly re-
ducing phototoxicity and fluorescence bleaching.
Use high-efficiency multi-bandpass filter sets for
fast acquisition of multiple fluorescent channels.
Celldiscoverer 7 simply switches LEDs on / off –
without moving any mechanical parts – so you
get high-speed multi-channel imaging, even when
combined with transmitted light.
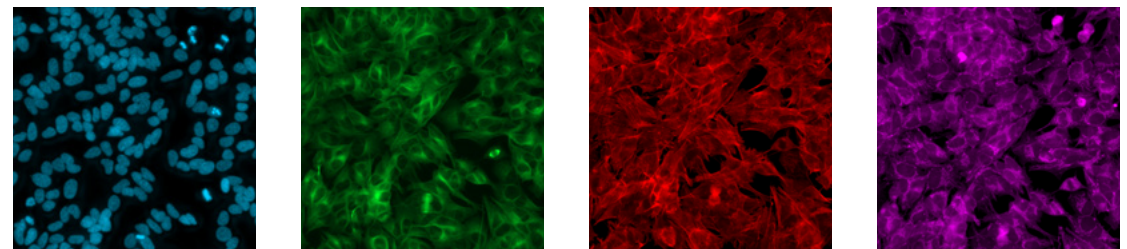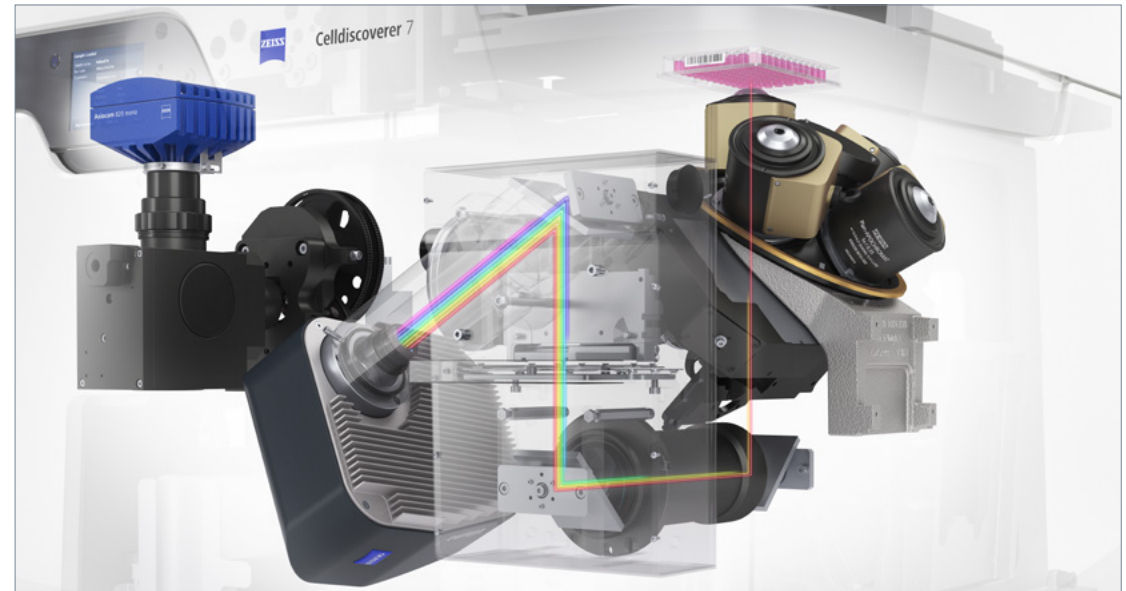
SH-SY5Y cells cultured on a 384 microwell plate. Multichannel image at a single position using the 20×/0.95 objective. Extended depth of focus from Z-stack. Hoechst – Chromatin (blue), anti-alpha-tubulin antibody FITC for alphas tubulin (green), Phalloidine for actin (red), MitoTracker Deep Red for mitochondria (purple). Sample courtesy of P. Denner, Core Research Facilities, German Center of Neuro-degenerative Diseases (DZNE), Bonn, Germany.

Your Insight into the Technology Behind It

100 μm

▶ Click here to view this video

SH-SY5Y cells cultured on a 384 microwell plate. Timelapse has been acquired using 20× magnification and phase gradient contrast. Sample and assay courtesy of P. Denner, Core Research Facilities, German Center of Neurodegenerative Diseases (DZNE), Bonn, Germany.
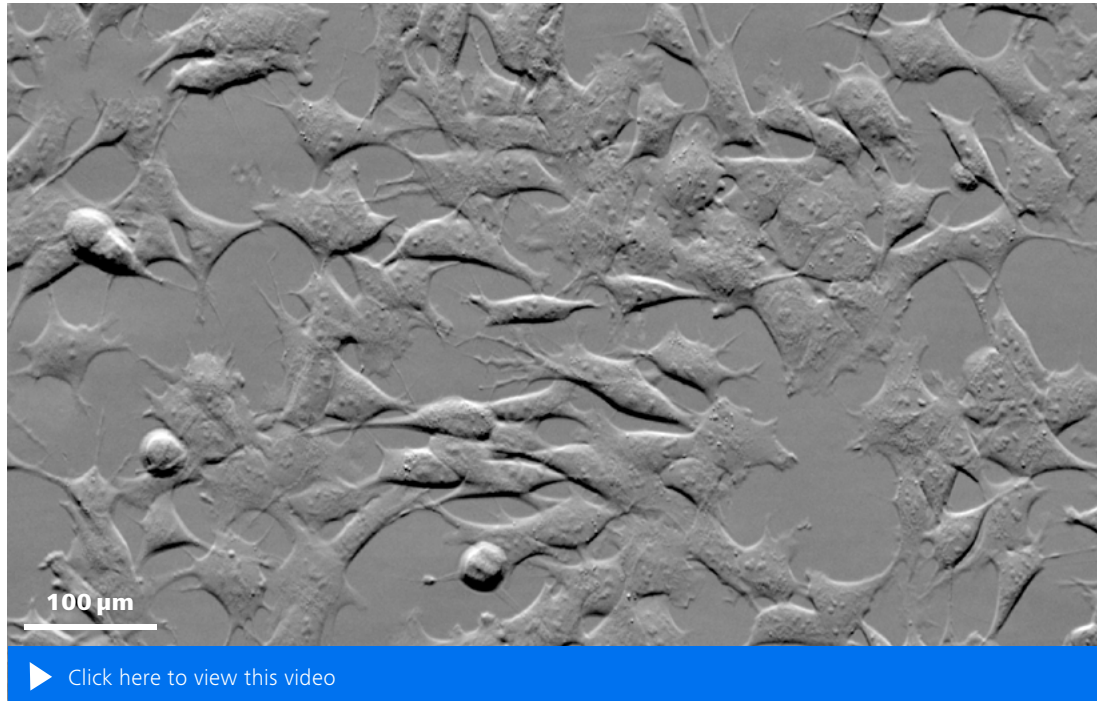
Use a Unique Transmitted Light Contrast

With Celldiscoverer 7 you can use transmitted light brightfield, oblique and phase gradient contrast. This unique relief contrast adapts automatically to the sample carrier geometry, providing excellent contrast to the very edge of the vessel. It's fully compatible with all objectives, filter sets and sample carriers. This contrasting method stays robust, even against liquid meniscus or plastic lids. Use the far-red transmitted light LED for gentle imaging at very high speeds. You can perform applications based on label-free assays or let the system automatically combine transmitted light with multiple fluorescence channels. Most multi-bandpass filter sets support the combination of transmitted light and fluorescence, without reducing sensitivity or speed. On top of that, this unique motorized transmitted light unit allows dispensing directly on the optical axis, without disturbing the environmental conditions. The dispensing unit is always integrated. As soon as you open the hatch on top of your Celldiscoverer 7, the transmitted light unit will automatically change place with the dispensing unit. You now have direct on-axis access to the specimen for pipetting. You can add agents while maintaining continuous physiological conditions.

10

Expand Your Possibilities

ZEISS Plan-Apochromat 20×/0.95 Autocorr Objective

This objective delivers high numerical apertures without applying immersion. It is optimized for thin vessel bottoms. No matter if your cells prefer glass or plastic – this objective will adapt to bottom material and thickness variations. With the increased sensitivity, this objective is ideal to generate crisp images on large areas or multiple positions at high speed. In combination with the built-in magnification changer, it combines the benefits of three objectives into one: 10×/0.5, 20×/0.8 and 40×/0.95 – at a fixed working distance.

ZEISS Plan-Apochromat 5×/0.35 Objective

This objective is your choice for efficient sample navigation. It creates impressive overview images by delivering an unparalleled information density in a single shot, especially in combination with the microscope camera Axiocam 820 mono. Many screening applications will strongly benefit from the high resolution on large fields. The objective easily handles thin and thick vessel bottom made of glass or plastic.
In combination with the built-in magnification changer, it combines the benefits of three different objectives into one: 2.5×/0.12, 5×/0.25 and 10×/0.35 – at a fixed working distance.

ZEISS Plan-Apochromat 20×/0.7 Autocorr Objective

From thin to thick, from plastic to glass – this objective adapts automatically to every sample you load on your Celldiscoverer 7. It delivers an unparalleled numerical aperture of 0.7 through 1.2 mm plastic bottom without compromising image resolution and contrast. This tremendous flexibility will make the lens your multipurpose objective, especially if you would like to image cells, which can only grow on plastic bottom.
In combination with the built-in magnification changer, it combines the benefits of three objectives into one: 10×/0.35, 20×/0.7 and a 40×/0.7 – at a fixed working distance.

ZEISS Plan-Apochromat 50×/1.2 W Autocorr and Autoimmersion Objective

This objective delivers high light collection efficiency and resolution. In combination with the Autoimmersion function, it matches perfectly to samples in aqueous solution. Since it reduces phototoxicity to a minimum, it's your choice for your most demanding life cell applications, e.g. long-term imaging of subcellular structures. Optimized for thin bottoms, it adapts automatically to the bottom material and thickness. No matter which field of view you prefer, this objective will deliver a constant numerical aperture of 1.2 and combines the benefits of three objectives into one: 25×/1.2, 50×/1.2 and 100×/1.2 – at a fixed working distance.

Expand Your Possibilities

**LSM 900: Automated Confocal 3D Imaging**

Life happens in 3D – and your research often calls for optical sectioning to image your samples with best possible contrast and resolution. When combining Celldiscoverer 7 and LSM 900 you get the best of both worlds: ease of use and automation from a fully integrated microscope platform and the superb confocal image quality and flexibility. You easily separate multiple labels with spectral imaging. Automatically analyze dynamic processes with photomanipulation for FRAP, FRET or related techniques. It's never been easier to precisely connect widefield and confocal imaging with fast mixed-mode acquisition or combine both imaging modalities into advanced workflows. LSM Plus lets you easily optimize the results of your multi-color and live cell experiments and increases the resolution of your confocal images by a factor of 1.3- to 1.4-fold.

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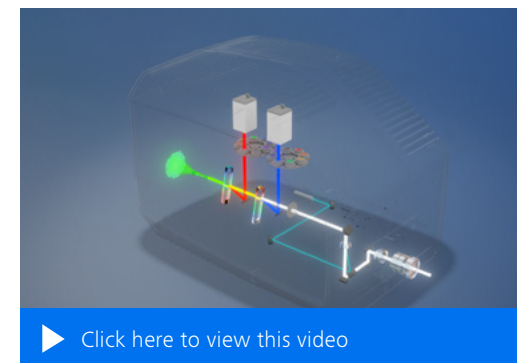
LSM Plus: Improving the Whole Confocal Experience

LSM Plus improves literally any confocal experiment with ease, independent of detection mode or emission range. Its linear Wiener filter deconvolution needs next to no interaction while still ensuring a reliable quantitative result. Apply LSM Plus with no extra effort and benefit from:

- **Enhanced signal to noise** at high acquisition speed and low laser power—particularly useful for live cell imaging with low expression levels
- **More spatial information** and even greater resolution enhancement for bright samples that allow to close the pinhole of the LSM
- **Integrated workflows** to combine the advantages of LSM Plus with Airyscan super-resolution imaging
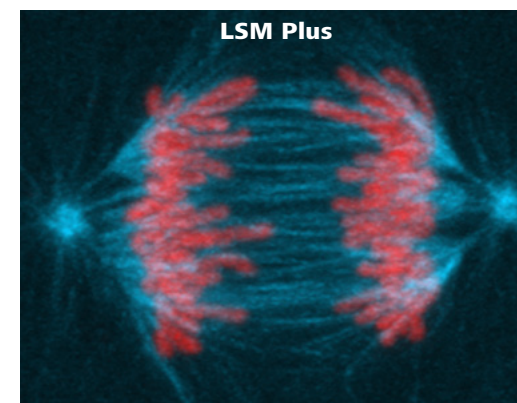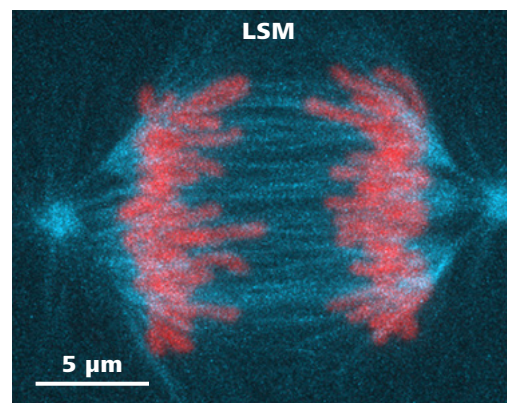
Live imaging of LLC-PK1 dividing cell (porcine kidney), expressing H2B-mCherry (red) and α-Tubulin-mEGFP (cyan). Maximum intensity projection of 37 Z-planes. Comparing without (left) and with LSM Plus (right).

Learn more about LSM 900 and LSM Plus
Download LSM 900 product information brochure

Expand Your Possibilities

Airyscan 2: A Unique Combination of Super-resolution Imaging and High Sensitivity

Airyscan 2 is an area detector with 32 circularly arranged detection elements. Each of these acts as a small pinhole, contributing to super-resolution information, while the complete detector area collects more light than the standard confocal setting. This produces much greater light efficiency while capturing enhanced structural information. All Airyscan modes are optimized for fast and gentle life cell imaging, perfectly serving the main purpose of ZEISS Celldiscoverer 7, to treat your sensitive samples gently. The unique High Sensitivity (HS) mode leads to a 4 – 8× improved SNR accompanied by 1.5× resolution improvement.
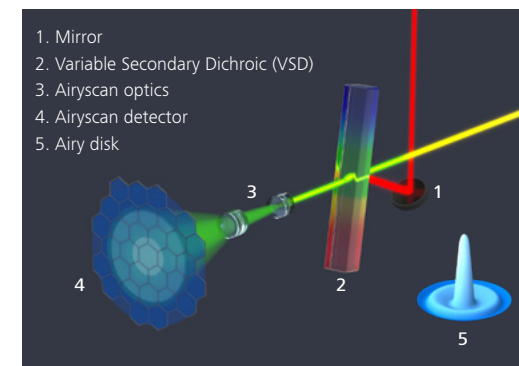
32 Views Mean More Information: Powerful Deconvolution with Airyscan jDCV

Each of the 32 detector elements has a slightly different view on the sample, providing additional spatial information that makes Joint Deconvolution possible. You can push resolution and acquisition speed to discover more structural information in less time. Super-resolution 3D imaging with up to 1.9× resolution improvement at 4 – 8× improved SNR becomes possible.
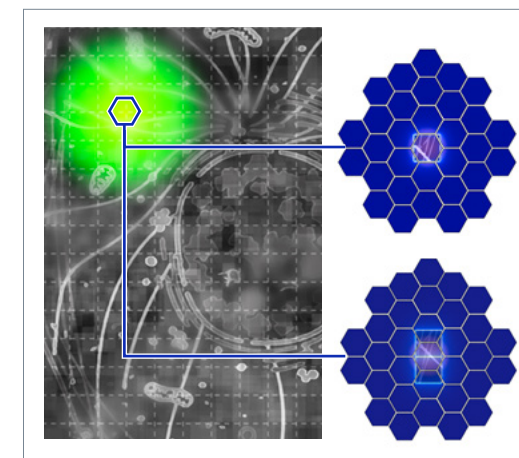
Airyscan Multiplex: Your Turbo for Confocal Acquisition

The Multiplex mode for Airyscan 2 employs smart detection schemes that enable two times faster imaging through parallelization while maintaining best resolution and SNR. Use this mode to image dynamic processes, or to achieve higher throughput and productivity.

Airyscan 2 in Multiplex modes HS-2Y / CO-2Y scans two super-resolution image lines with high SNR in a single sweep for rapid tiling of large areas, efficient live cell imaging, or for fast volumetric imaging.

> **i** **Learn more about Airyscan 2 and Airyscan jDCV**
> Download LSM 900 product information brochure

1. Mirror
2. Variable Secondary Dichroic (VSD)
3. Airyscan optics
4. Airyscan detector
5. Airy disk

Schematic beam path of ZEISS Airyscan 2.

For each illumination position, Airyscan HS mode generates one superresolution image pixel. The spatial information provided by Airyscan 2 in the Multiplex modes HS-2Y and CO-2Y allows to scan 2 lines in a single sweep.

Expand Your Possibilities

Easily achieve stable environmental conditions for your demanding live-cell experiments. You can control the temperature with the optional heating unit or a Julabo cooling circulator. In combination with a humidifier, optional CO_2 and / or O_2 module you control athmospheric conditions.

Depending on your most common imaging needs, you can now choose between Axiocam 712 mono R2, Axiocam 807 mono, or Axiocam 820 mono, offering highest applicational flexibility, sensitivity, throughput and resolution.


No matter if you choose a ZEISS Axiocam or a third party camera – if you have to increase acquisition speed and sensitivity for special applications, Celldiscoverer's additional camera port provides the flexibility you need.

Your Celldiscoverer 7 can load multiwell plates, dishes, chamber-slides or standard slides.
All sample holders are optimized for large scanning areas, fully compatible with water immersion and autoclavable.

Celldiscoverer 7 allows you to run perfusion experiments efficiently, while maintaining homogenous and stable environmental conditions.
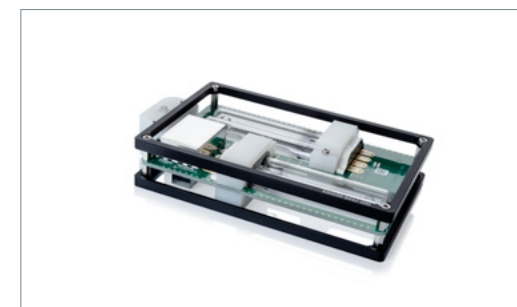
Celldiscoverer 7 offers an effective way to keep the sample chamber clean. The insert plate for UV disinfection is automatically recognized by the system and you start the disinfection workflow via the touchscreen.

Expand Your Possibilities

ZEN Imaging Software Shortens the Path to Your Goal

ZEN – is the single user interface you will see on all imaging systems from ZEISS. ZEN imaging software leads you simply and quickly to the result. At all times you see which options the system is making available to you and which step is appropriate to take next.

ZEN makes it easy to operate every imaging system from ZEISS correctly and intuitively. As a result you save time, reduce training and support costs, and get faster answers to your questions.

Benefit from Advanced Automation Features

- Simple and intuitive carrier-based navigation via mouse and keyboard, plus a dedicated multi-well view
- An automation wizard to create scan profiles for routine or reoccurring tasks
- A range of hardware- and software-based focus strategies to set up even complex multi-position experiments in multiwell plates
- Fast overview images for sample navigation: Create an overview of your cells just once to automatically identify the relevant regions for subsequent imaging
- Cell viability put first with samples illuminated only as long as the camera acquires an image
- An optimized CZI file format with lossless compression for large datasets and seamless integration into existing image analysis workflows
- Open interfaces: Use your CZI dataset in all major software packages that use the BioFormats library, e.g., Fiji, Python, Matlab, Icy, Knime, Imaris, Arivis.

Expand Your Possibilities

Automated microscopy is your solution to create unbiased and statistically relevant high-quality data. Dedicated ZEN software workflows increase your productivity, and minimize the time required for user training.

Automated and reproducible data acquisition

Use Experiment Designer, Guided Acquisition and Automated Photomanipulation in ZEN to automate repetitive acquisition tasks and to image multiple carriers within one workflow. With the Connect Toolkit, you keep the context between your sample and images acquired from different sample areas.

Shorter time to result with simultaneous data processing

Perform time-consuming image processing tasks simultaneously during image acquisition with the Direct Processing module.

Out-of-the-box image analysis

The modules from our Bio Apps portfolio optimized for specific types of application, e.g., cell counting or confluency measurement, shorten your time to result.
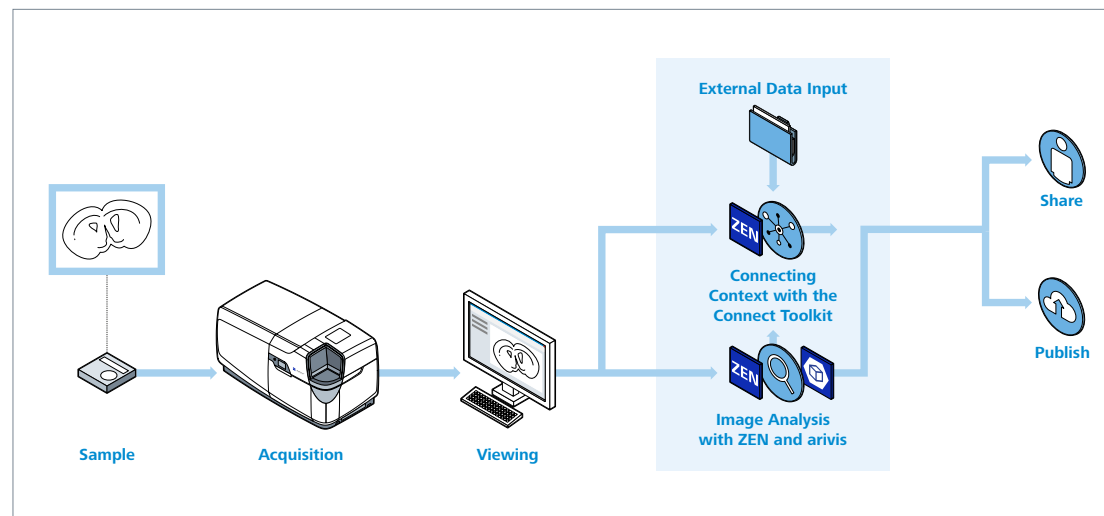

ZEN microscopy software integrates all steps from your sample to reproducible data for publication.

Workflow customization

The wizard-based ZEN Image Analysis guides you to build analysis workflows that adapt to your specific applications. For advanced segmentation, you can employ the ZEN AI Toolkit.

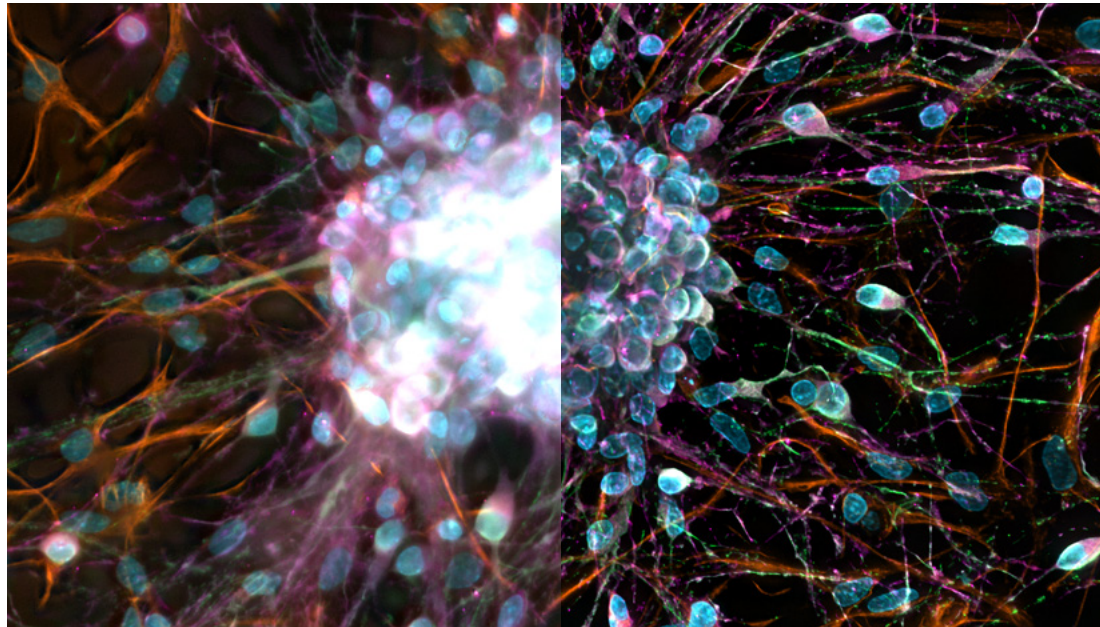### Advanced processing and analysis

With arivis Cloud, you can create new processing modules and recombine existing ones. Use arivis Pro for sophisticated analysis in 3D and arivis Hub to scale up your analysis tasks.

▶ Click here to view this video
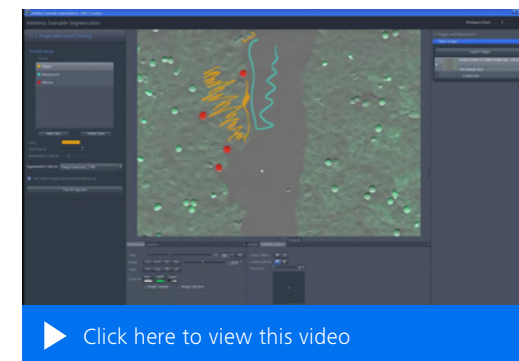
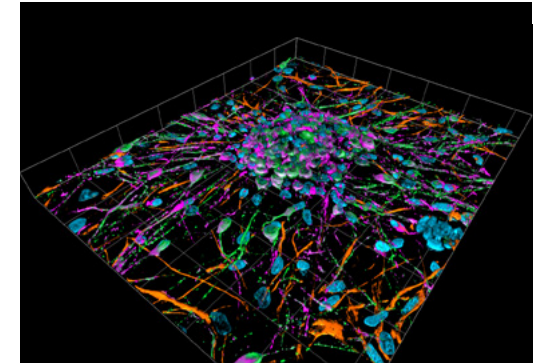*ZEN AI Toolkit: Use the power of machine learning to easily segment your images.*

Expand Your Possibilities

Comparison between widefield (left) and deconvolved (right) Z-stack projection using GPU-based Deconvolution.

Rat cortical primary culture. Antibody staining of bIII-tubulin (Cy2, green), Nestin (Cy3, red) and DCX (Cy5, purple), nuclei stained with DAPI (blue). 3D reconstruction of the deconvolved Z-stack (shadow projection). Sample courtesy of H. Braun, LSM Bioanalytik GmbH, Magdeburg, Germany.

Get More Details with Deconvolution

When imaging three-dimensional samples, out-of-focus light sometimes blurs your structure of interest. For these images, you need deconvolution – a combined optical and mathematical method – to increase contrast and improve the signal-to-noise ratio and resolution. With Celldiscoverer 7 it is easier than ever before to first acquire a Z-stack of your samples and then deconvolve the image to reassign all detected photons to their origin. With ZEN imaging software you use advanced deconvolution algorithms, including a novel approach with depth variant point-spread-functions for deep imaging. Combine this with Celldiscoverer 7's unique Autocorr objectives and you will get excellent results from thicker samples, e.g. 3D-cell culture. And you will get them up to 30 times faster than with the traditional technology that works on your processing PC's CPU, thanks to Celldiscoverer 7's GPU-accelerated, parallel CUDA processing. Use the increased speed to extract maximum information from the large datasets you acquired in those demanding long-term, time-lapse or multiwell screening applications.

Expand Your Possibilities
Smart Data Acquisition

Guided Acquisition

Perform fully automated targeted acquisition of objects of interest:

- Save time and storage space by focusing the image acquisition on objects of interest (e.g., rare events) only.
- Automate your workflow comprising of overview scan, object detection via automated image analysis, and high-resolution, multidimensional image acquisition for each detected object, even with immersion objectives.
- Customize focusing strategies for both overview scan and detailed acquisition.
- Automatically save all images, tables, and settings in one folder for easy access and reuse.
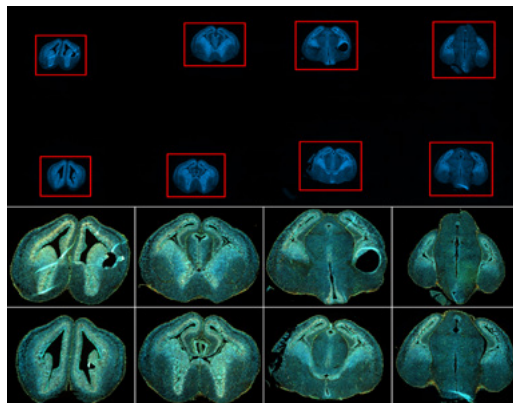

Sample courtesy of P. Grigaravicius, FLI – Leibniz Institute on Aging, Jena, Germany

Experiment Designer

Configure multi-carrier time series and inhomogeneous acquisition experiments:

- Support for all experiment dimensions: time series, Z stacks, tile images and channels.
- Operation via a graphical interface using four types of experiment blocks along a timeline: Acquisition, Execute, Pause, Interaction.
- Synchronous or asynchronous control of hardware actions during the experiment.
- Definition of a number of iteration loops.
- Powerful processing functions to extract or fuse multiblock images.
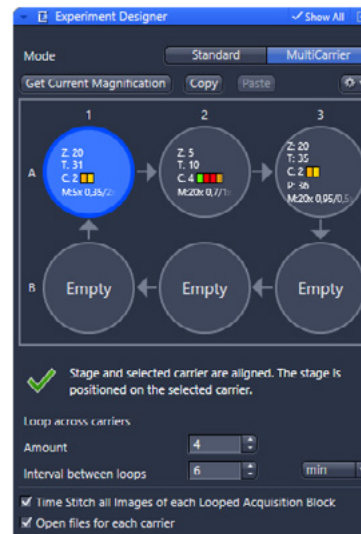
Automated Photomanipulation

Automate photoactivation or photobleaching at multiple positions based on image analysis. The system executes the following steps without user interaction:

- Acquisition of a multi-position image
- Identification of photomanipulation ROIs based on a customized, pre-defined image analysis
- Photomanipulation experiment as defined for bleaching and time series tools
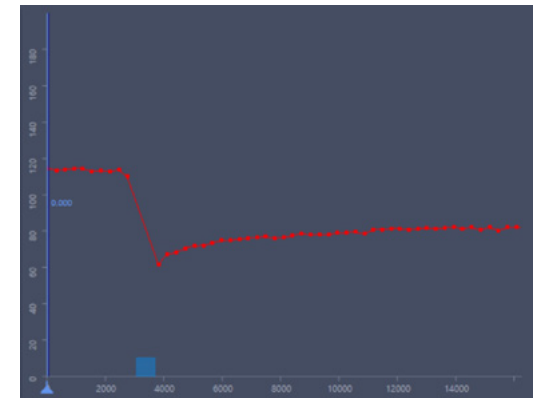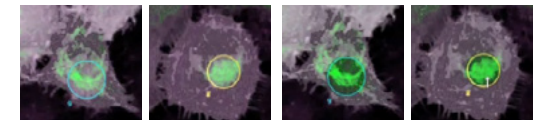
Expand Your Possibilities
Efficient Data Processing

Direct Processing

Perform time-consuming image processing tasks simultaneously during image acquisition:

- Deblurring for fast and easy 2D background removal with truly quantitative output.
- Supports a selection of processing methods, such as deconvolution, Airyscan processing, raw convert, denoising or unsharp mask.
- Employs pipeline to set up a sequence of image processing functions.
- Remote processing to maximize computational resources during acquisition.
- Instantaneous side-by-side comparison of raw and processed data.

arivis Cloud

Use this AI image analysis platform to:

- Create state-of-the-art instance segmentation models that can be imported and used in ZEN workflows.
- Annotate and train Deep Learning models for your own application or data set
- Easily share training data and models.

Within ZEN, Deep Learning inference is compatible with your favorite workflow tools like Guided Acquisition, Image Analysis Wizard, or Bio Apps.

Macro Environment

Customize and automate ZEN using powerful Python scripts:

- Integrated script editor with debugging, recording and code completion.
- Integration of arivis Cloud modules and external software packages like Python, MATLAB or Fiji in an automated workflow is easily possible.
- Uses IronPython in order to integrate .NET-based functions.
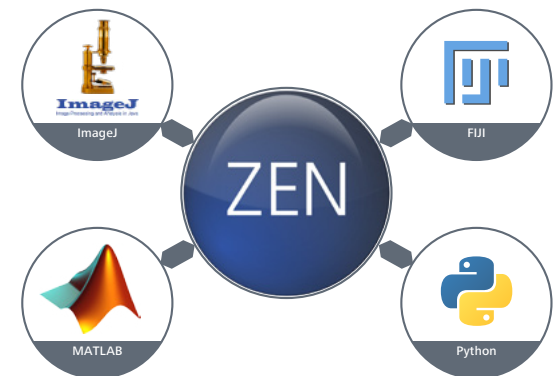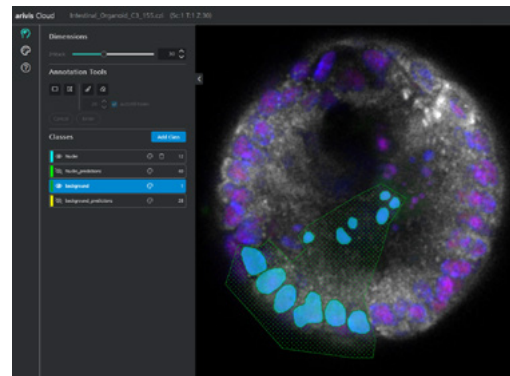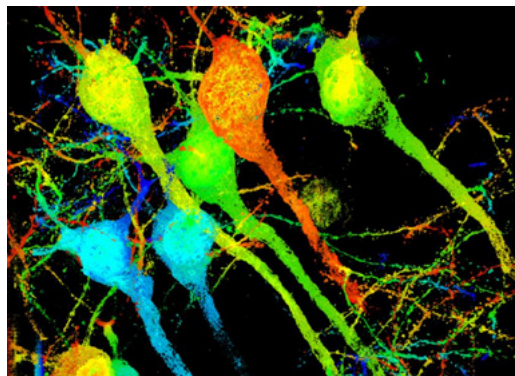
Expand Your Possibilities
Smart and Powerful Image Analysis and Visualization

Bio Apps

Execute out-of-the-box image analysis and tailored results presentation with interactive measurement tables, heatmaps and plots optimized for measurements in screening applications with multi-well setups.

- Cell counting
- Automated spot detection
- Confluency
- Gene and protein expression
- Translocation
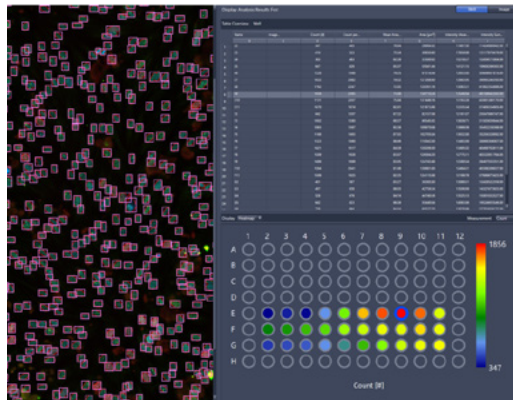
Segmentation / Object Classification

Enable machine-learning algorithms to segment images or to classify segmented objects:

- Train a simple image segmentation model by labelling your data or import pre-trained deep neural networks.
- Train an object classification model in an environment with intuitive class assignment, compatible with objects obtained by conventional segmentation or Intellesis segmentation.
- Fully supports any multidimensional data-sets including tiles, Z stacks or multi-channel images.
- Compatible with most common image formats such as CZI, OME-TIFF and imported third-party formats.
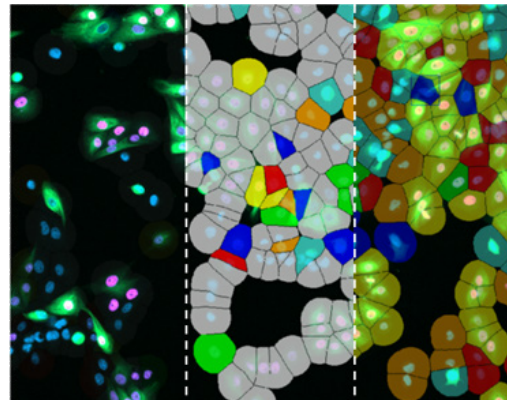
3D Visualization

Visualize 3D/4D image stacks:

- Display 3D volume models using efficient ray tracing technology, even for large data.
- Display up to 6 channels and time series.
- Choose from five rendering methods: Transparency, Volume, Max Intensity Projection, Surface, mixed and with up to three clipping planes.
- Improved transparency mode for better visualization of dense structures, such as dense fluorescent data.
- Bridge functionality: Send to arivis Pro with saved settings and sample pipelines for fast and easy 3D analysis.
- Generate animations.
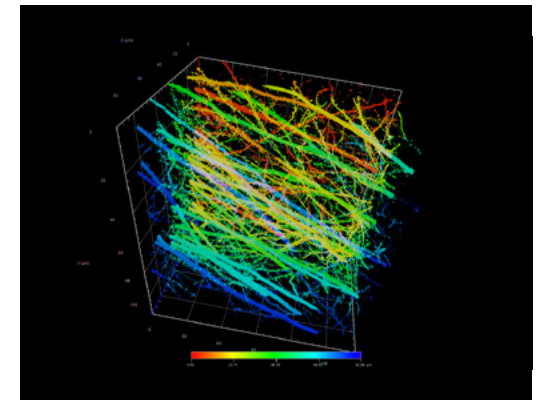
Expand Your Possibilities

Connect All Your Multimodal Data to Keep the Whole Picture

Expanding classic correlative microscopy, the Connect Toolkit is open to all your images: you can load complex multidimensional images as easily as simple overview images. It makes no difference whether your imaging technology is from ZEISS or from third parties.

All image data can be aligned, overlayed and shown in context. So long as your external images adhere to the well-established Bio-Formats standard, the Connect Toolkit will even keep their metadata.

Acquire Overview Images for Easy Navigation

Image your sample at low magnification. Then switch to your high-resolution image acquisition of choice. With the Connect Toolkit you only need to align it once, then use the overview image to navigate and find your ROIs. All subsequent high-resolution images will be shown in context as you zoom in and out across the borders of resolution domains and imaging technologies. A single click on the overview image brings your stage to the right position to examine or reevaluate any of your ROIs with the full image overlay.

Smart Data Management

All the images are saved in well-structured database projects, complete with an intuitive label attached automatically to each image file. You'll always stay on top of things – during your experiments as well as months afterwards when analyzing your work. It's easy to find all your overlay images and their connected datasets. You can even search for imaging parameters with the built-in filter function.
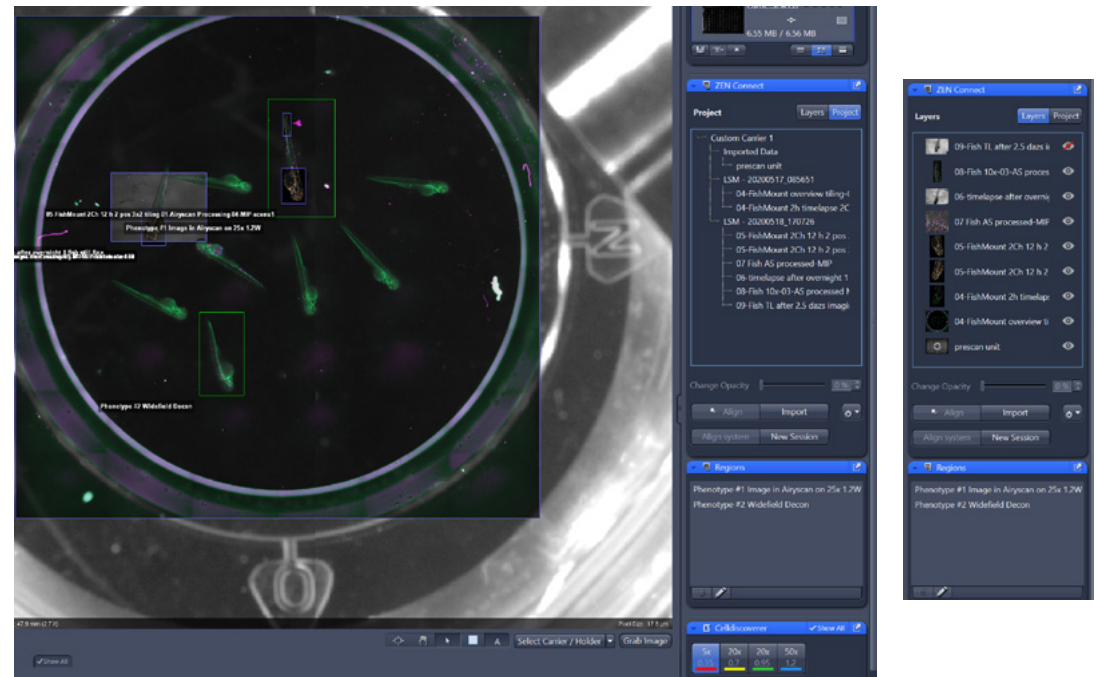
Expand Your Possibilities

ZEISS Predictive Service Maximizes System Uptime

Once connected to your network and activated, this advanced technology will automatically track the health status of your instrument and collect system log files in the background to improve remote diagnosis.

Relevant technical data such as operating hours, cycle counts or voltages are periodically monitored via a secure connection to our data center. The ZEISS Predictive Service application evaluates the performance of your microscope as system data can be received and analyzed.

Our support engineers will diagnose any issues by analyzing data on the Enterprise Server – remotely and without interruption to your operation.

- **Maintain highest system availability**
  Increase your uptime through close monitoring of the system's condition as remote support can often provide immediate solutions.
- **Data security**
  Ensure highest data security standards using well established technologies like PTC Thingworx and Microsoft Azure Cloud. No personal or image data is uploaded, only machine data.
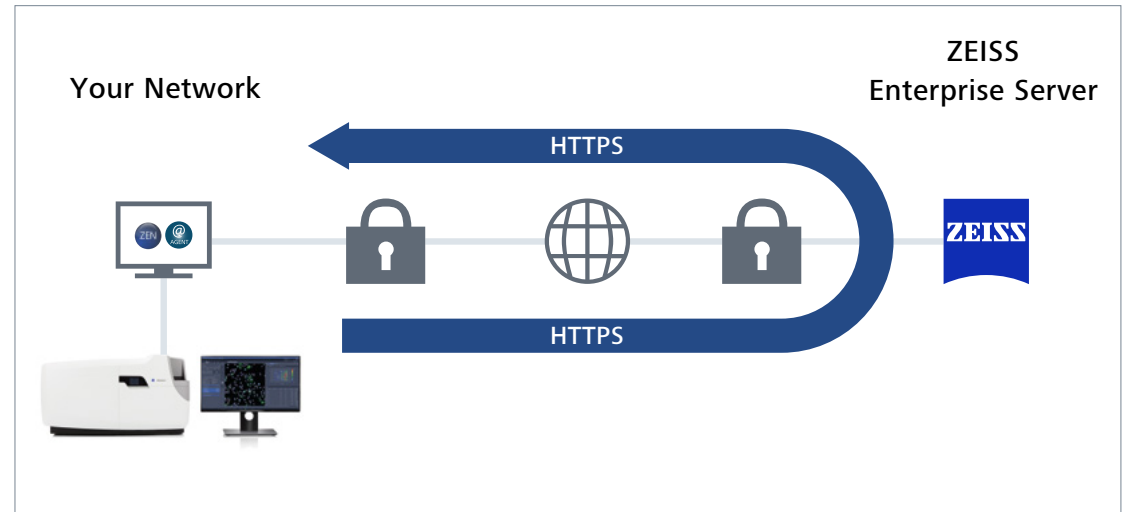
- **Fast and competent support**
  Use secure remote desktop sharing to easily get an expert connected.
- **Optimum instrument performance**
  As the status of your system is monitored, necessary actions can be planned before they become urgent.

ZEISS Preventive Service Add-on:
- Usage patterns and health data are acquired and collected via ZEISS Predictive Service platform.
- Data is analyzed to detect and predict defects before occurrence.
- Future failures and potential downtime are avoided by preventive service during regular service visits.

Tailored Precisely to Your Applications

Typical Applications	Task	ZEISS Celldiscoverer 7 Offers
Multiwell plates for Live Cell or fixed endpoint assays	Evaluate and document cell culture from multiwell plates.	Transmitted light – phase gradient contrast for high-resolution images through glass and plastic vessels
		Up to 7 LED excitation wavelengths
		Low magnification, large field of view – high numerical aperture lenses
		Automatic sample carrier detection and calibration
	Scan the maximum area of a multiwell plate at different magnifications and resolutions.	Adaptive Lens Guard and automatic sample carrier calibration ensure maximized scan area depending on the plate type 100 % plate scanning from 2.5× to 100× is possible whole well – single shot
Label free assays	Perform label free growth curve assays over several days.	Transmitted light source: high-speed IR-LED (725 nm) offering low phototoxicity
		Stable Incubation with temperature (heating / cooling), CO_2 and O_2 control
		Simple and reproducible Hardware Autofocus for focus drift compensation
		Autoimmerson for water immersion lens
High-Content Screening	Acquire high resolution images of multi-labelled cell culture from multiwell plates quickly.	Up to 7 LED excitation wavelengths
		Autocorr objectives for automated aberration correction
		Adaptive Lens Guard and automatic sample carrier calibration ensure maximized Scan area
		Barcode reader for easy sample identificiation
		Preview Scan
		Open Application Developement for Python scripting – open access to third party analysis tools
		Fast Multibandpass Main Beam Splitter and Emmission Filter Wheels
		Large working distance enables higher / better 3D content screening
	Pharmacological or chemical or drug screening.	Option to add a plate loader
Transfected and non-modified Live Cell Cultures	Evaluate and document transfection rate and transfection stability using fluorescent markers.	Transmitted light – phase gradient contrast for high-resolution images through glass and plastic vessels
		Stable Temperature and O_2/CO_2 controlled enviroment
		Autoimmerson for water immersion lens
	Work with different sample carriers.	Automatic measurement of sample carrier bottom thickness and Autocorr Objectives for enhanced contrast and resolution
		Adaptive Lens Guard and automatic sample carrier calibration ensure maximized scan area

Tailored Precisely to Your Applications

| Typical Applications	Task	ZEISS Celldiscoverer 7 Offers
Label-free fixed and thin tissue slices or small organisms	Document and evaluate cell and tissue morphology and growth state.	Transmitted light – phase gradient contrast for high-resolution images through glass and plastic vessels
	Change quickly between large overview scans and high resolution imaging.	Quick change of field of view using triple magnification changer
		Large working distances of 5× and 20×/0.7 objectives offer fast, high resolution and deep imaging
Fixed fluorescently labelled tissue, cell culture samples or small organisms	Identification, quantification and qualification of cell types, pathological and pharmacological pathways using cell-, tissue and protein markers in 2D and 3D samples.	Up to 7 LED excitation wavelengths
		GPU-accelerated 3D-Deconvolution
		Large working distances of 5× and 20×/0.7 objectives offer fast, high resolution and deep imaging
Multi-labelled living tissue section, organs, small organisms, organotypic-, spheriod or cell culture preparations	Short-term or long-term observation of physiological and morphological parameters in 2D/3D during growth, differentiation, motility and interaction.	Autoimmerson for water immersion lens
		Autocorr objectives for automated aberration correction
		Stable incubation with temperature (heating/cooling), CO_2 and O_2 control
		LED illumination unit with up to 7 excitation wavelengths
		Experiment Feedback for adaptive experiments
		GPU-accelerated 3D-Deconvolution
		Large working distances of 5× and 20×/0.7 objectives offer fast, high resolution and deep imaging
	Analyse the embryogenesis of small model organisms.	Large working distances of 5× and 20×/0.7 objectives offer fast, high resolution and deep imaging
		GPU-accelerated 3D-Deconvolution
Stimulus-induced responses of cells, tissue or whole organisms	Observation of stimulus-induced responses of cells, tissue or organisms without disturbing the environmental control.	Semi-automatic dispensing work flow
		Dispensing unit allows to add compounds into the field of view
		Option to install a perfusion chamber

Tailored Precisely to Your Applications

| Typical Applications, Typical Samples	Task	ZEISS Celldiscoverer 7 with LSM 900 Offers
Antibody stained tissue slices	Document morphological relations of structures	Airyscan 2 with GaAsP detector for imaging
	Resolve morphological structures at high resolution while avoiding photobleaching.	Airyscan 2 HS mode with Joint Deconvolution for efficient and gentle super-resolution imaging.
	Image large field of views and conduct tiling experiments for large specimen.	Use low magnification lenses for a large field of view combined with LSM Plus for high image quality at fast acquisition.
		Use Airyscan 2 Multiplex modes to combine high resolution and high-speed acquisition.
Live cell culture	Study the motility of vesicles and organelles	Up to 8 frames per second confocal time lapse imaging
Live cell culture with two labels	Study the motility of subcellular structures	Airyscan 2 with GaAsP detector and Multiplex mode for time lapse imaging in 2D or 3D at up to 8 frames per second
	Explore the interaction of two proteins exploiting the Förster Resonance Energy Transfer effect	FRET analysis tool, available in ZEN
Live cells with multiple labels	Image over a long time in an automated way	Experiment Designer or Guided Acquisition software tool combined with three parallel spectral channels
		Combine different acquisition modes, via mixed mode.
		Combine the experiment in the Connect Toolkit
	Conduct time laps experiments of cell culture or whole organisms using multiple labels to follow morphological changes.	Capture all your signals simultaneously and use LSM Plus to improve structural information, even at lowered laser power.
Live or fixed cells with multiple labels and overlapping emission signals	Examine the interplay of multiple proteins	Parallel acquisition of all signals with three spectral channels and linear unmixing, combined with LSM Plus for enhanced image quality
Cellular structures with weak labels	Image subcellular structures at physiological expression levels	LSM 900 with GaAsP detector or Airyscan 2 at best sensitivity, pushing structural information even further with Joint Deconvolution.
Study molecular dynamics	Photomanipulation	Use Automated Photomanipulation for bleaching or photocativation
Plant roots	Follow the changes of subcellular structures over time with high resolution	Airyscan 2 with GaAsP detector for high resolution imaging beyond 40 µm deep into tissue with up to 6 full frames per second (512 × 512 pixel)
	Follow morphological changes over time while avoiding phototoxic effects on the living plant sample.	Capture your signals simultaneously on up to 3 GaAsP detectors and use LSM Plus to improve structural information even at lowered laser power
Model organisms, e.g. Zebrafish, *Drosophila* or *C. elegans, Arabidopsis*	See fine details of the organization and dynamics of endogeneously expressed FP proteins	Airyscan with GaAsP detector for high sensitivity imaging and increased resolution beyond 40 µm deep into tissue.
	Image large fields of view at high volume rates to capture developmental processes	Flexibly adjust the required resolution. Ensure reduced laser exposure for all your labels and high image quality with LSM Plus.
Cleared samples	Image whole organs or entire organisms	Specialized objective with long working distance and autocorrection for bottom material and thickness available (20× 0.7)

ZEISS Celldiscoverer 7 at Work

500 µm

50 µm
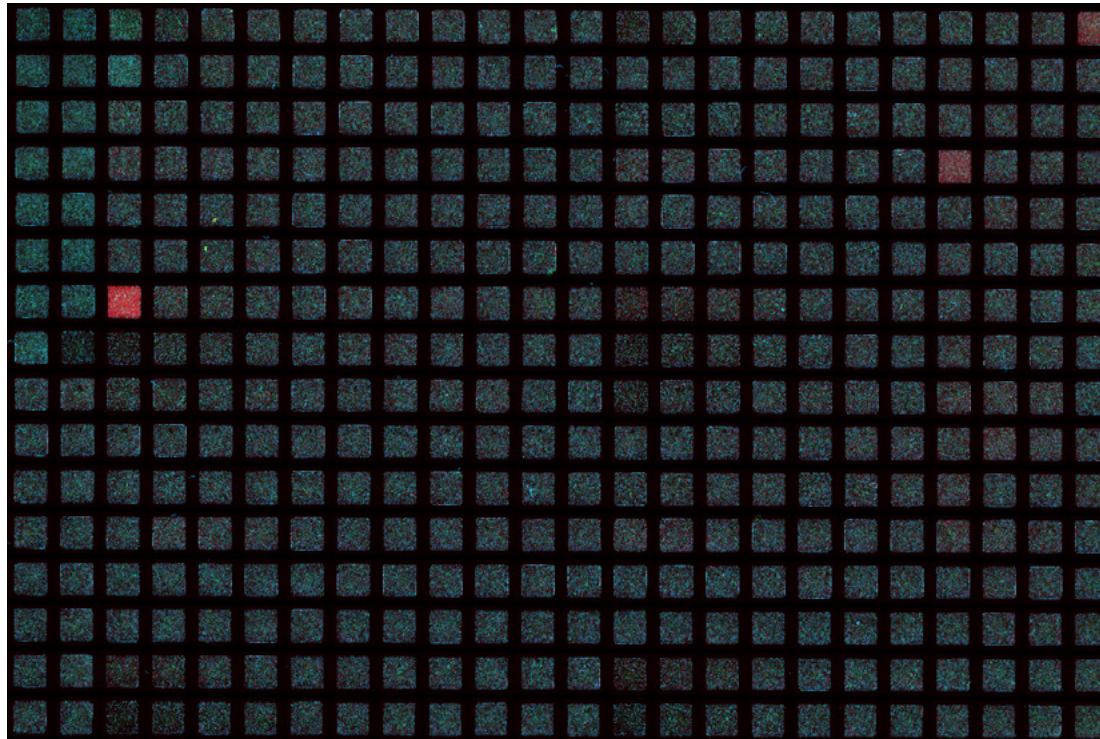
**Whole well, single shot.**

384 microwell plate imaged with 2.5× magnification in 3 channels. Each well fits into one single image. You avoid time-consuming scanning of wells and subsequent stitching and increase your throughput. The overall image quality and resolution allows e.g., segmentation of single cell nuclei and therefore counting of cells.
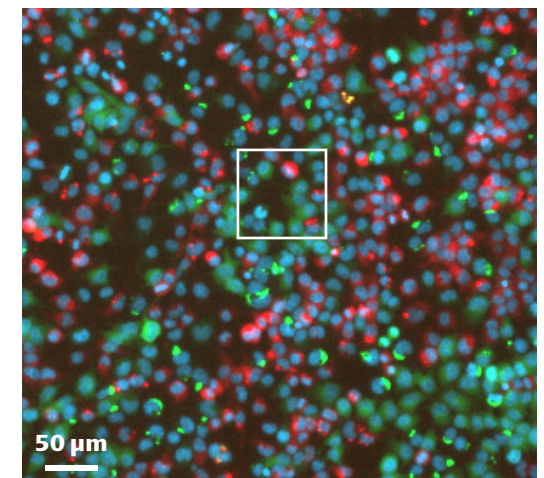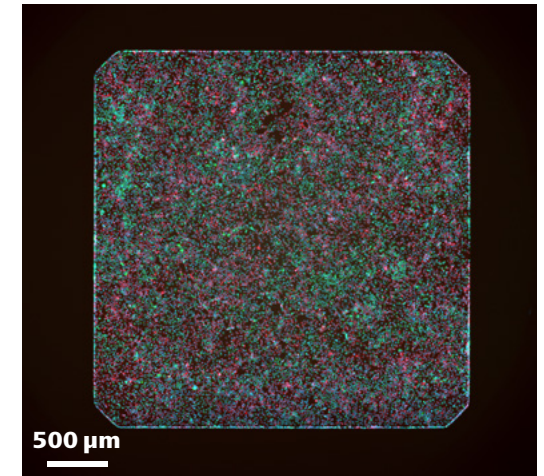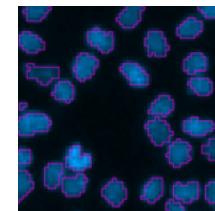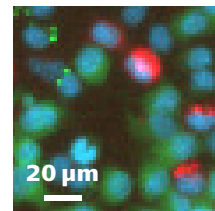
20 µm

Sample courtesy of P. Denner, Core Research Facilities, German Center of Neurodegenerative Diseases (DZNE), Bonn, Germany.

ZEISS Celldiscoverer 7 at Work
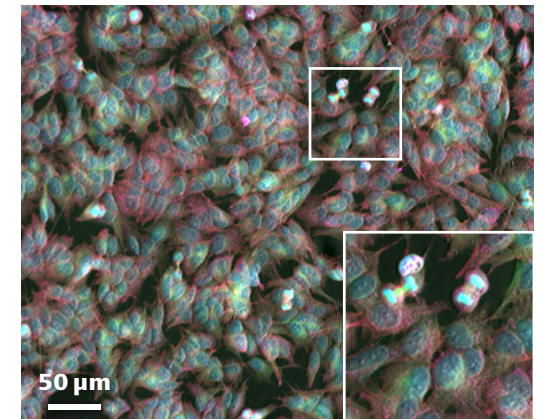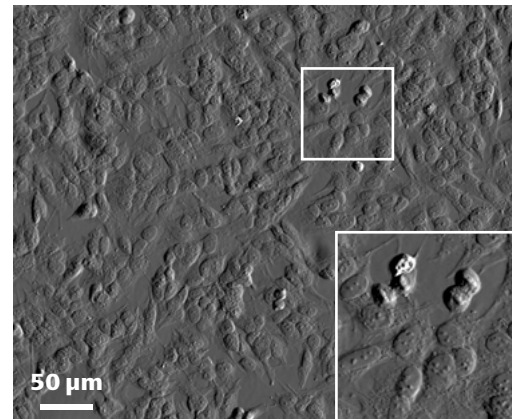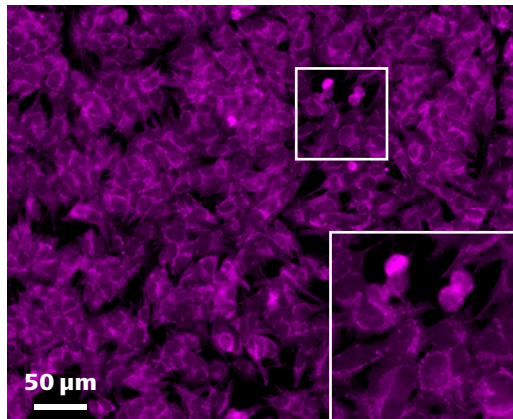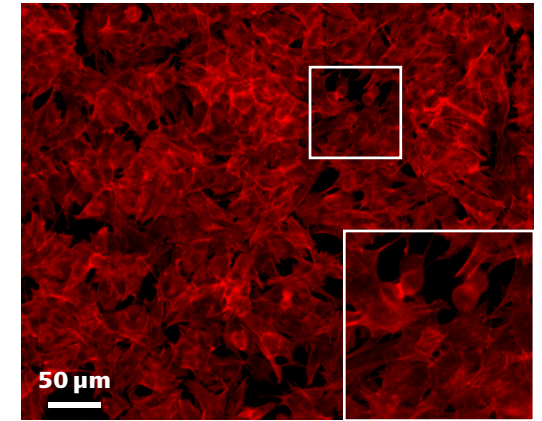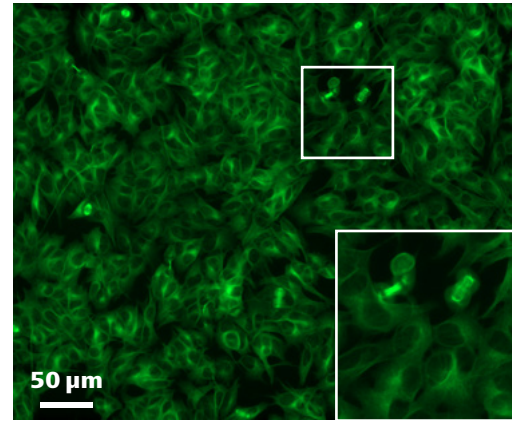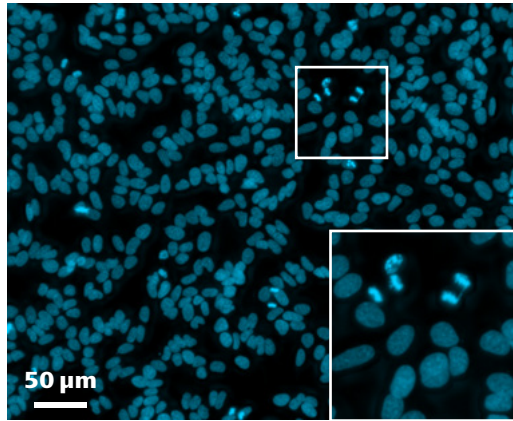
SH-SY5Y cells cultured on a 384 microwell plate. Five channel image at a single position using Plan-Apochromat 20×/0.95; EDF from Z-stack; Hoechst-Chromatin (blue), anti-alpha-tubulin antibody FITC for alpha tubulin (green), Phalloidine for actin (red), MitoTracker deepRed for mitochondria (purple), phase gradient contrast, overlay image. Sample courtesy of P. Denner, Core Research Facilities, German Center of Neurodegenerative Diseases (DZNE), Bonn, Germany.
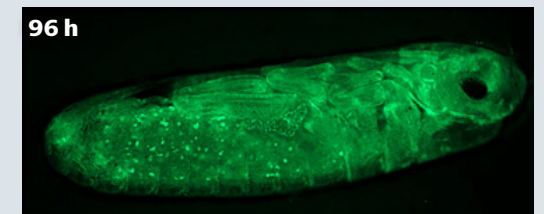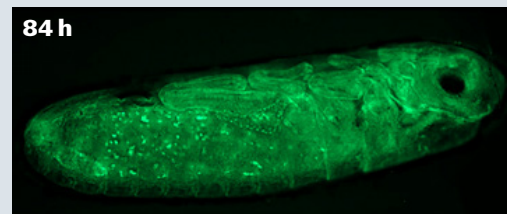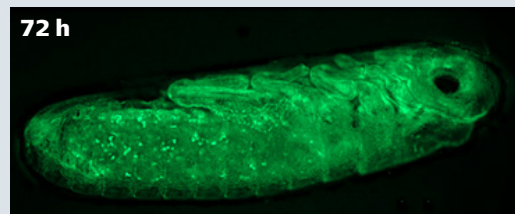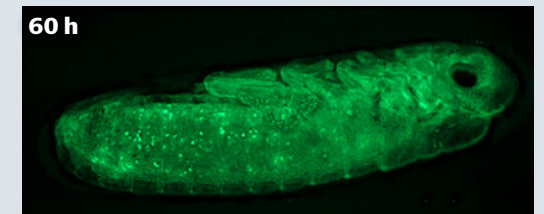
ZEISS Celldiscoverer 7 at Work
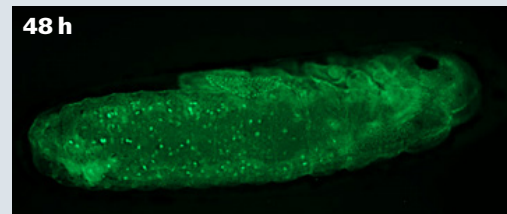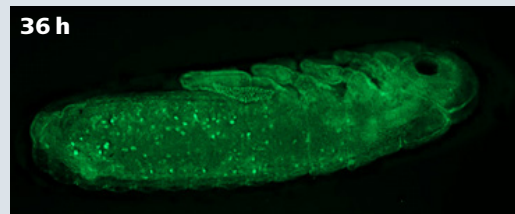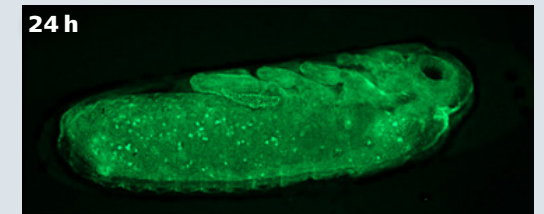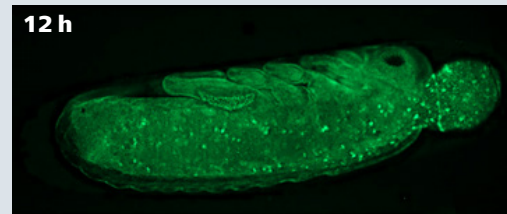
▶ Click here to view this video

Five days long-term imaging of cricket embryo-genesis. The development of an eGFP-expressing cricket embryo mounted in low-melt agarose was imaged every 5 minutes for a total length of 5 days.

During the first day the retraction of the yolk and dorsal closure can be seen followed by further growing of the embryo. EDF-images created from Z-stacks; acquired with 2.5× magnification using short exposure times of 35 ms.
Z-stacks were 350 µm thick and were acquired within 2.3 seconds.

Sample courtesy of S. Donoughe, BioLabs Building 2087, Harvard University, Cambridge, USA

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ZEISS Celldiscoverer 7 at Work

▶ Click here to view this video
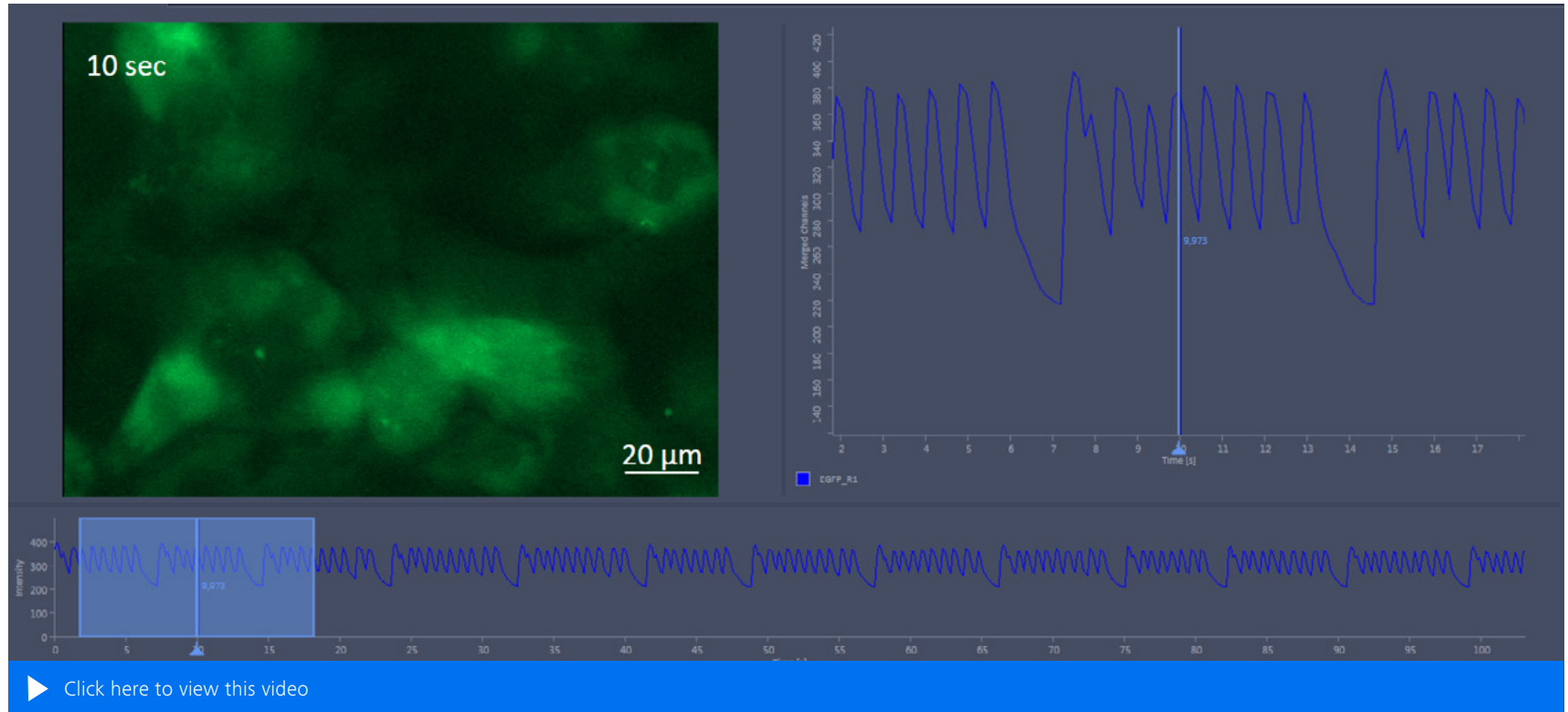
Calcium imaging in beating cardiomyocytes stained in green using a Calcium kit; imaging with 8 fps using Plan-Apochromat 50×/1.2 W with Autoimmersion; the green fluorescence changes intensity upon contraction of the cells; frequency of individual contractions analyzed with ZEN MeanROI tool; diagram shows delayed contraction in regular intervals caused by component given to the cells.

Sample courtesy of Sanofi-Aventis Deutschland GmbH, R&D IDD / in vitro Biology, Frankfurt, Germany

ZEISS Celldiscoverer 7 at Work
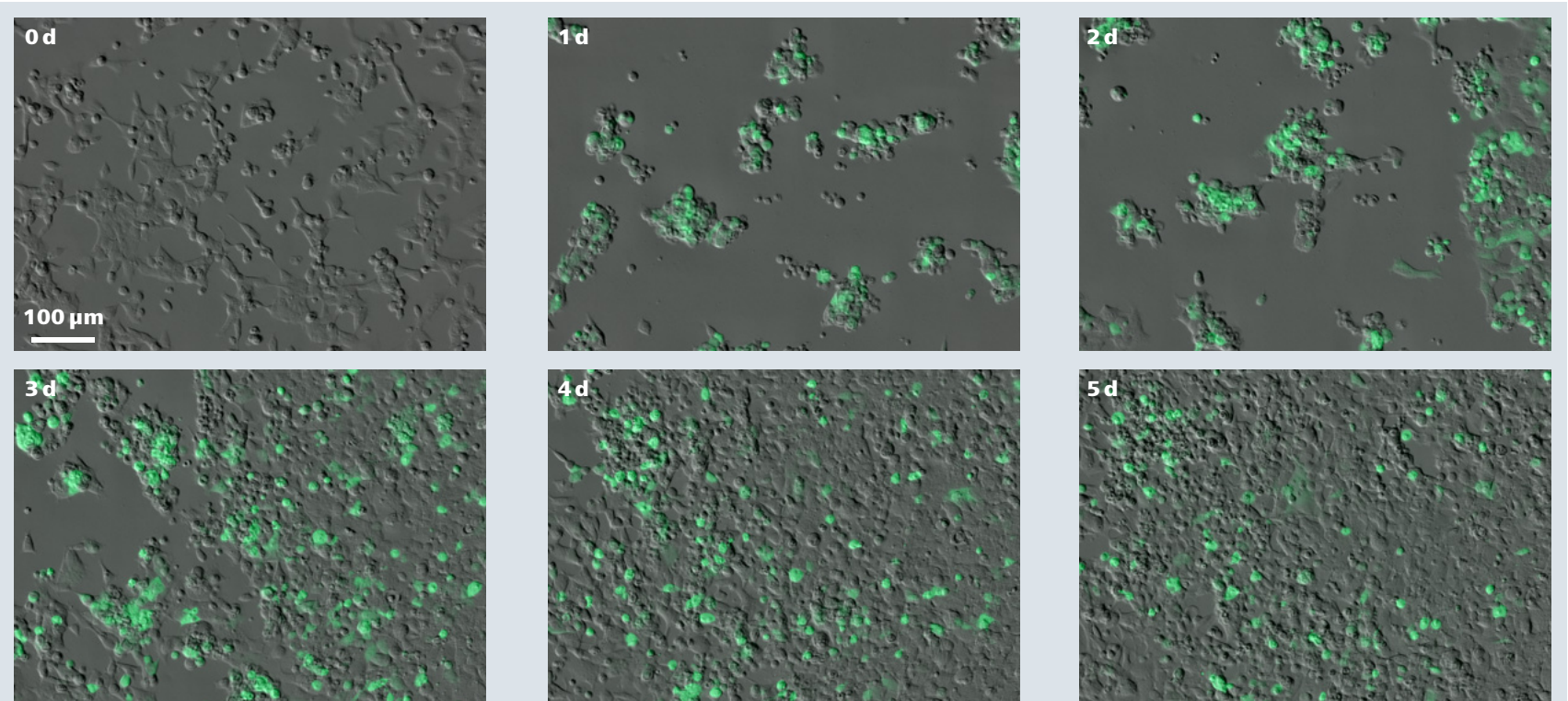
▶ Click here to view this video

GFP HEK (Human Embryonic Kidney) cells, transiently expressing eGFP. Imaged through a 1 mm plastic bottom; images taken every 5 minutes for a total of 5 days; imaging started shortly after induction of the expression via Tetracyclin treatment. Overlay of phase gradient contrast and green (eGFP) fluorescence:

- After one day: cells are subconfluent and start to express eGFP. Due to the transient transfection and the Tetracyclin treatment some round and dead cells are visible.
- After two days: cells have recovered from the transfection and start to grow again.
- At the end of the time series: cells are confluent and bright green due to eGFP expression.

Sample courtesy of Sanofi-Aventis Deutschland GmbH;
R&D IDD / in vitro Biology, Frankfurt, Germany

ZEISS Celldiscoverer 7 at Work

Expansion Microscopy in Mouse Brain

The goal of Expansion Microscopy is to make small structures visible that could otherwise not be observed with conventional or superresolution microscopy. Here, a protein-retention expansion technique was applied to expand the tissue. The sample is enlarged by a factor of 4.5 to 5 – up to several mm in X/Y dimensions and several hundred μm in the Z dimension. Especially the 5×/0.35 and the 20×/0.7 objectives of Celldiscoverer 7 are well suited to image such samples as they have a large field of view, high resolution and a large working distance.

Top: Whole brain
Bottom left: Axon bundles
Bottom right: Pyramidal cells

The images shown here are extended-depth-of-focus images created from Z-stacks acquired with a 2.5× magnification imaged through 1.2 mm of polystyrene. Staining: YFP expressing neurons.
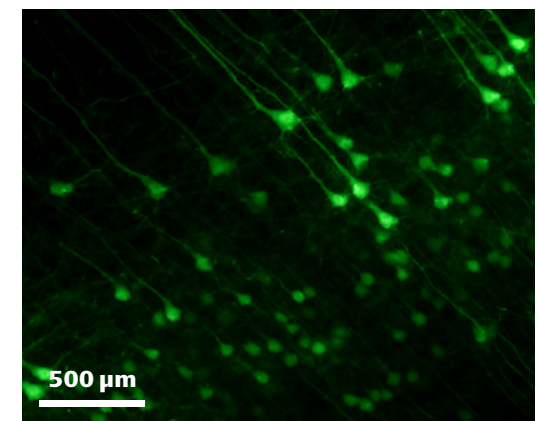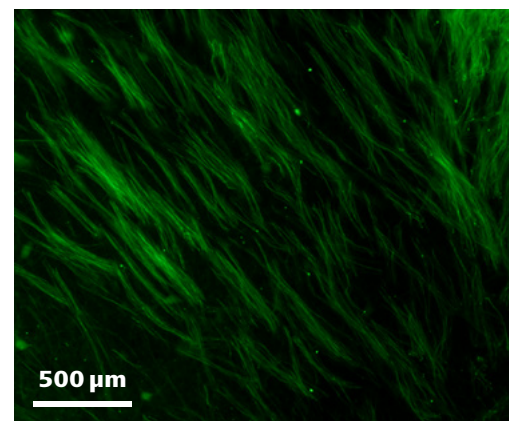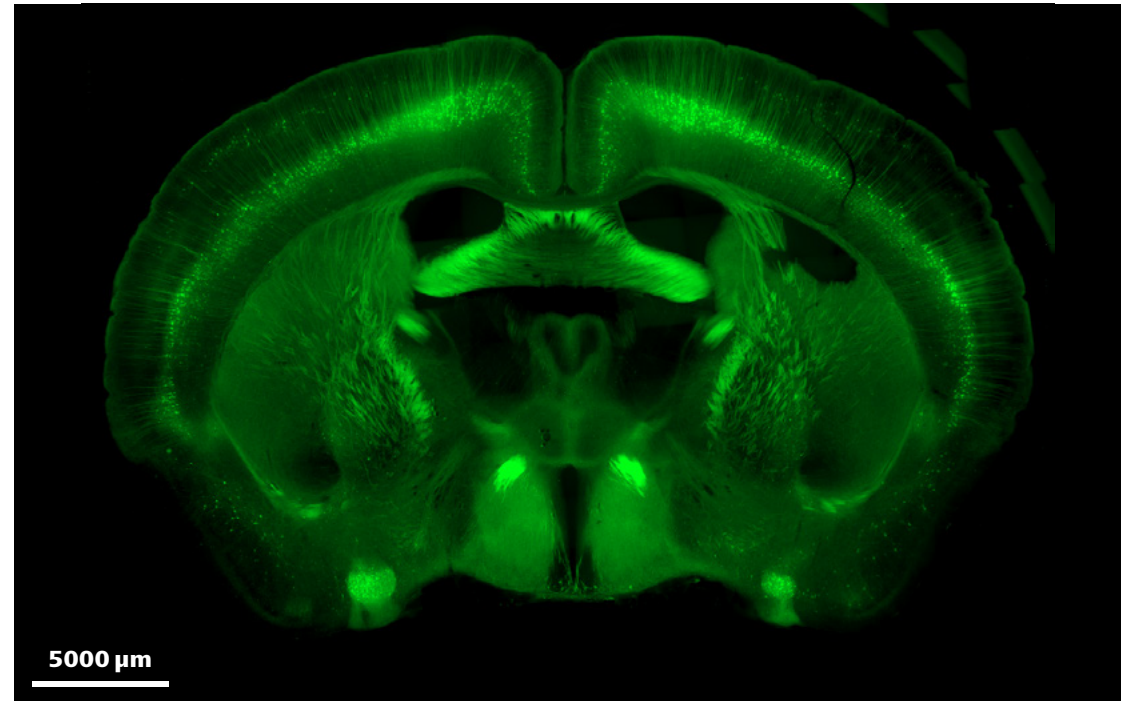
Sample courtesy of S. Asano, Boyden lab, MIT, Cambridge, USA

5000 μm

500 μm

500 μm

ZEISS Celldiscoverer 7 at Work

200 µm

200 µm

200 µm

Autofluorescence Imaging of Arachnids

Small Arachnids were collected from tropical leaves in South America. Imaging with Celldiscoverer 7 saves time, since the low magnification objectives (5×/0.35 and 20×/0.7) deliver finest details in large fields of view.

A combination of several wavelengths was used to observe autofluorescence. The images shown here are extended-depth-of-focus images created from Z-stacks.

Left: Genital of the third leg of Huitaca sp. imaged with a 20× magnification.
Center: Same as before but excited with a different combination of wavelengths.
Right: *Microgavia oviformis* imaged with 2.5× magnification.

Sample courtesy of L. Benavides, Giribet Lab, Harvard University, Cambridge, USA

ZEISS Celldiscoverer 7 at Work

Label-Free Measurement of Cell Proliferation

The growth of cultured cells has been imaged in long-term time-lapse movies over 72 hours using phase gradient contrast (image 1).

To quantify proliferation, cell region (image 2, red overlay) was detected automatically using supervised machine learning (random forests) in each time frame.
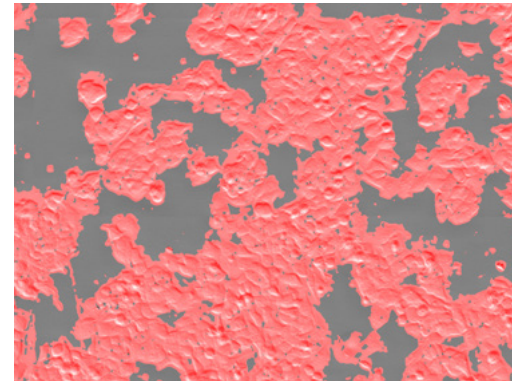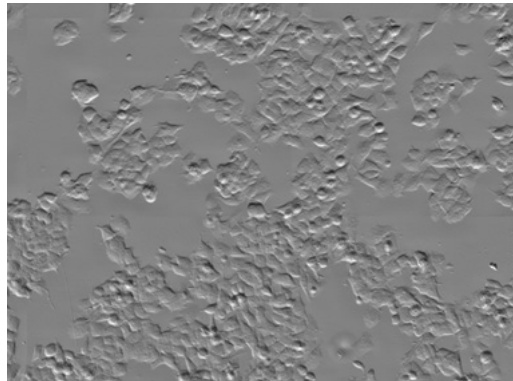
The growth curve (image 3) shows the relative cell coverage over time, averaged for all images in one well. The assay allows image-based cell proliferation measurements.

By using label-free imaging in phase gradient contrast, cell growth is not affected by phototoxicity or any further sample processing.

This approach offers several advantages:

- Very low disturbance, non-invasive monitoring of cells.
- Kinetic live cell data, no single end point.
- Compatible to standard micro-well plates (e.g. 96well or 384well).
- Applicable for screening cell-based applications.
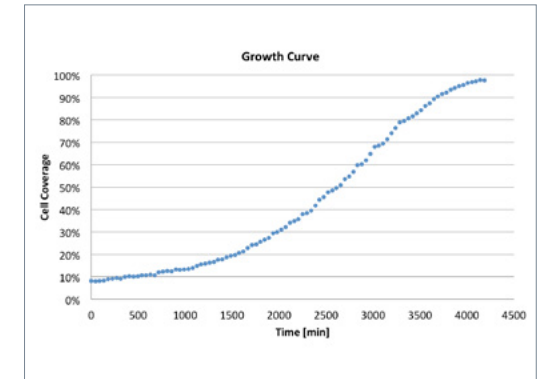
Sample and assay courtesy of P. Denner, Core Research Facilities, German Center of Neurodegenerative Diseases (DZNE), Bonn, Germany.

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ZEISS Celldiscoverer 7 at Work

Mixed Mode: Camera-Based Transmitted Light and Fluorescence Confocal Imaging
Primary lung fibroblasts stained with mitotracker red (mitochondria) and a DNA marker (nuclei).

The acquisition with the unique Mixed Mode seemlessly combines two imaging modes – the fluorescent channels where captured in confocal mode using highly sensitive GaAsP detectors while the Phase Gradient Contrast is camera based.

A timelapse of 2.5 h was acquired using a 40× magnification with a numerical aperture of 0.95.

50 µm

▶ Click here to view this video
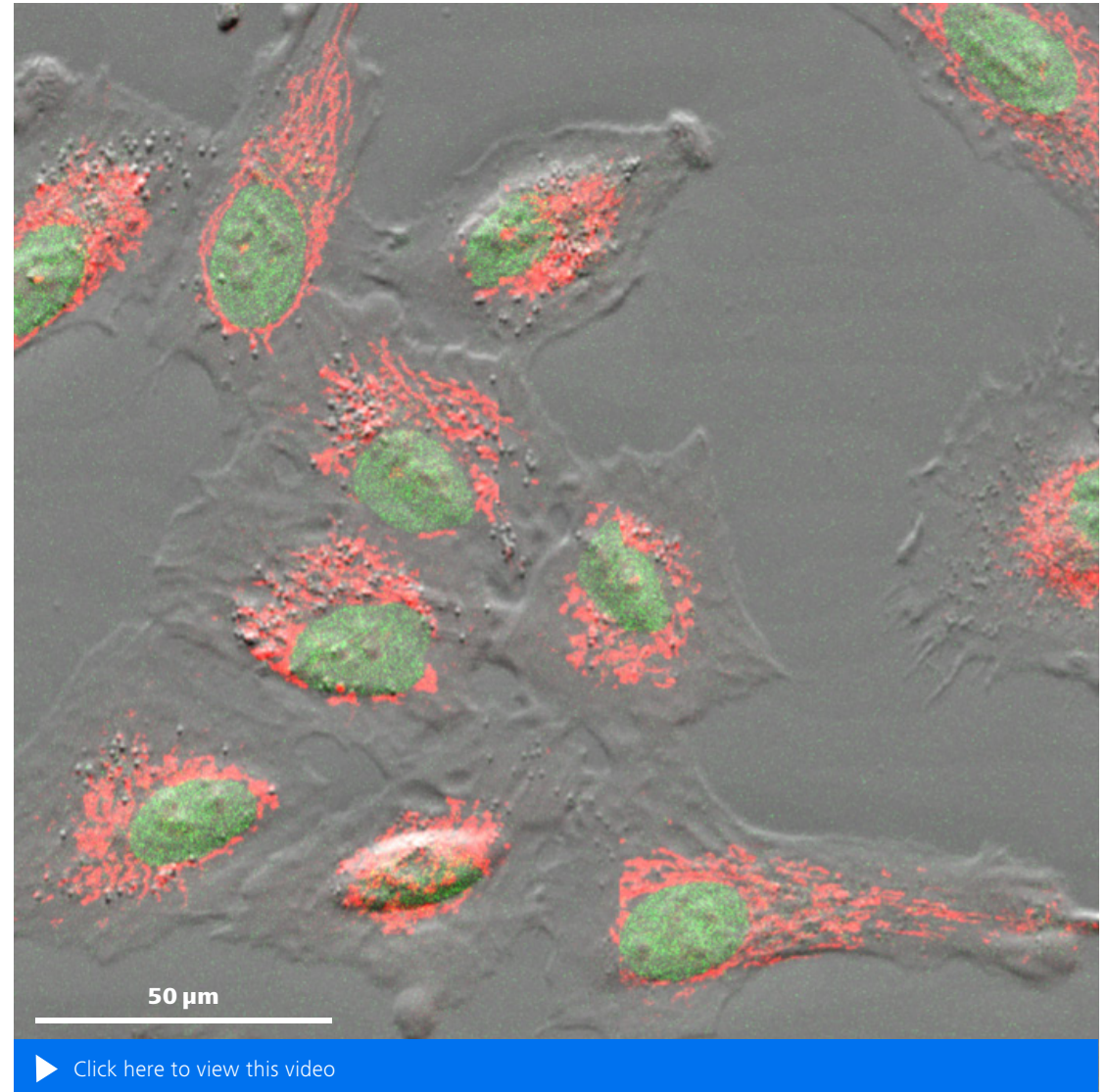
Sample courtesy of A.C. Hocke, Charité, Berlin, Germany

ZEISS Celldiscoverer 7 at Work

Cell Division of LLC-PK1 (Porcine Kidney)
To minimize photobleaching and damage to a live sample, it is useful to reduce acquisition time and to use minimal laser power. LSM Plus helps to improve the signal-to-noise ratio as well as the resolution of structures such as spindle fibers.

In this example, 100 Z-stacks were acquired with LSM 900 on Celldiscoverer 7 over 29 minutes. The images show a maximum intensity projection of 38 Z-planes. Cells expressing H2B-mCherry (red) and α-Tubulin-mEGFP (cyan).
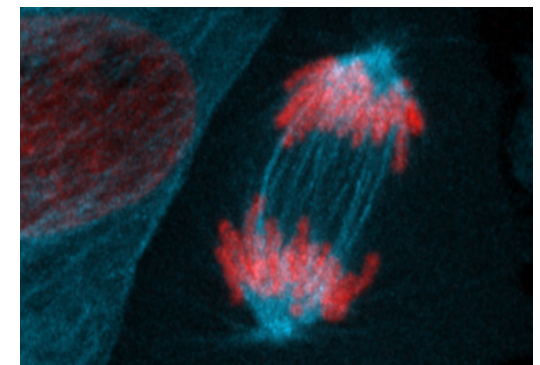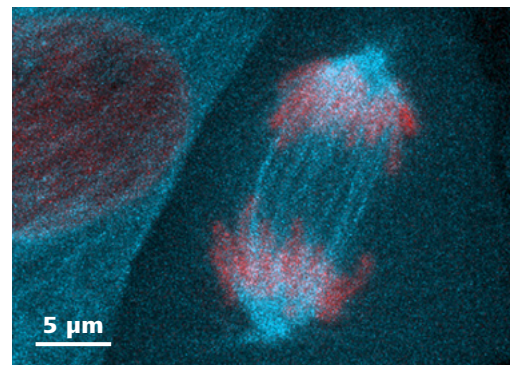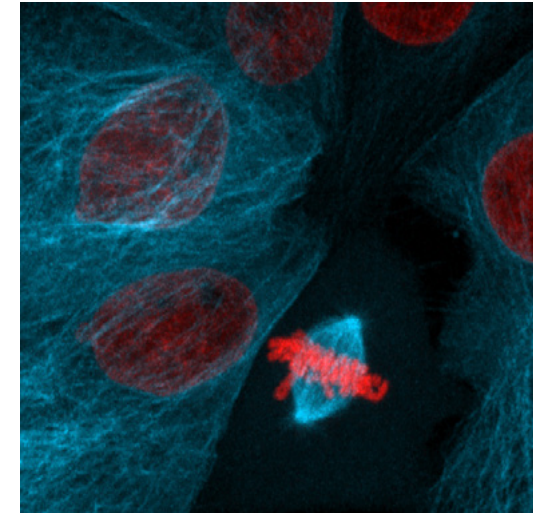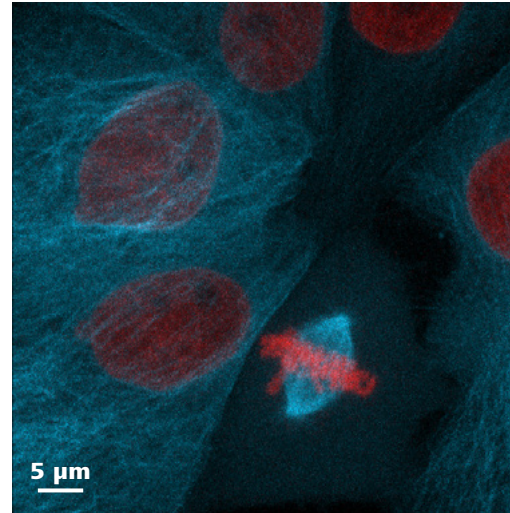
▶ Click here to view this video

ZEISS Celldiscoverer 7 at Work

Cos7 cells stained for mitochondrial outer membrane protein Tom20 (Green, Alexa Fluor-488) and mitochondrial inner membrane protein ATP5a (Magenta, Alexa Fluor-647).

Images were acquired with LSM 900 on ZEISS Celldiscoverer 7 using confocal GaAsP detectors (top row) and Airyscan 2 in HS mode (bottom row). Confocal images with LSM Plus (top, right) enhancing SNR and improving resolution of mitochondrial structures. Airyscan Joint Deconvolution (bottom, right) resolves the inner and outer membrane architecture even better compared to Airyscan HS (bottom left).
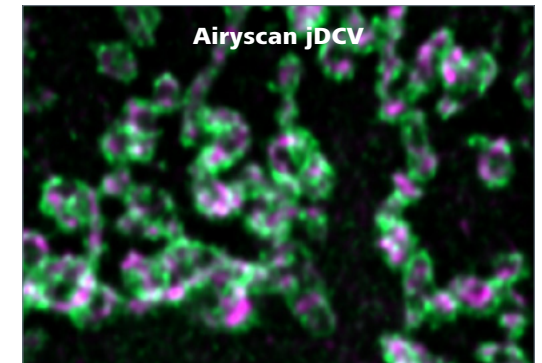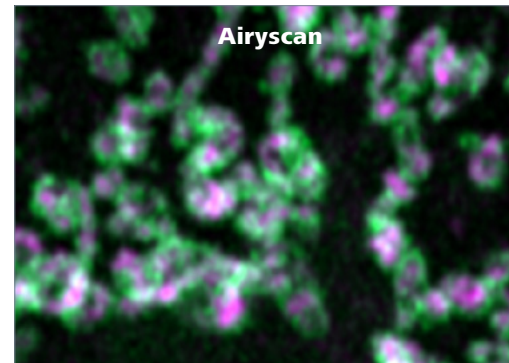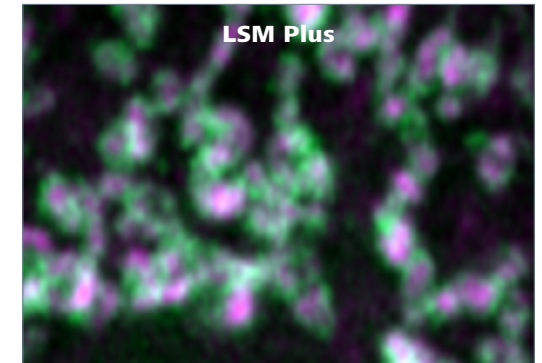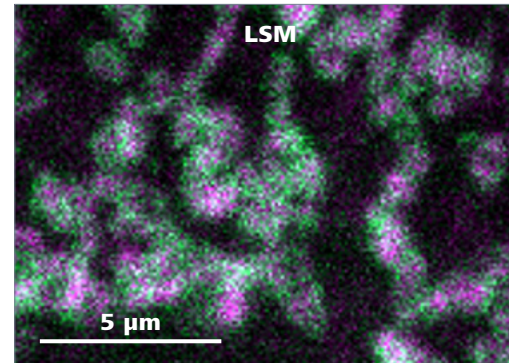
Sample courtesy of Zhang Y, University of Science and Technology of China, China

ZEISS Celldiscoverer 7 at Work

Caenorhabditis elegans germline. Decapitated nematodes where localized in widefield mode using a low magnification of 2.5× (transmitted light and fluorescence, DAPI; left). This allowed for an easy and convenient automated workflow (Guided Acquisition) to identify areas of interest for subsequent fast high-resolution imaging in Multiplex mode for ZEISS Celldiscoverer 7 with LSM 900 and Airyscan 2 (right). A 25× magnification with water immersion and NA 1.2 was used to generate a z-stack of 62 planes.

Individual chromosomes in different meiotic cells are clearly distinguishable – see magnified box.

Blue: DAPI (DNA);

Green: Alexa 488 (cross-over sites);

Orange: Alexa 546 (synaptonemal complex);

Red: Alexa 647 (chromosome axis).
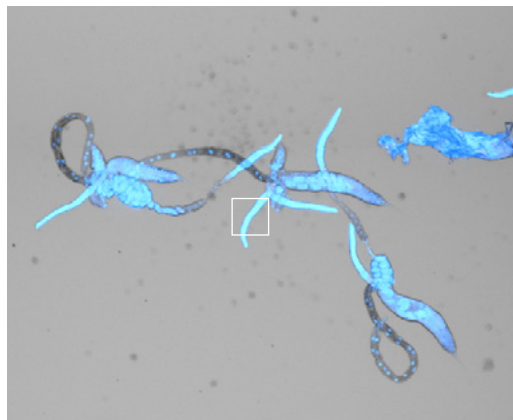
Sample courtesy of S. Köhler, EMBL, Heidelberg, Germany
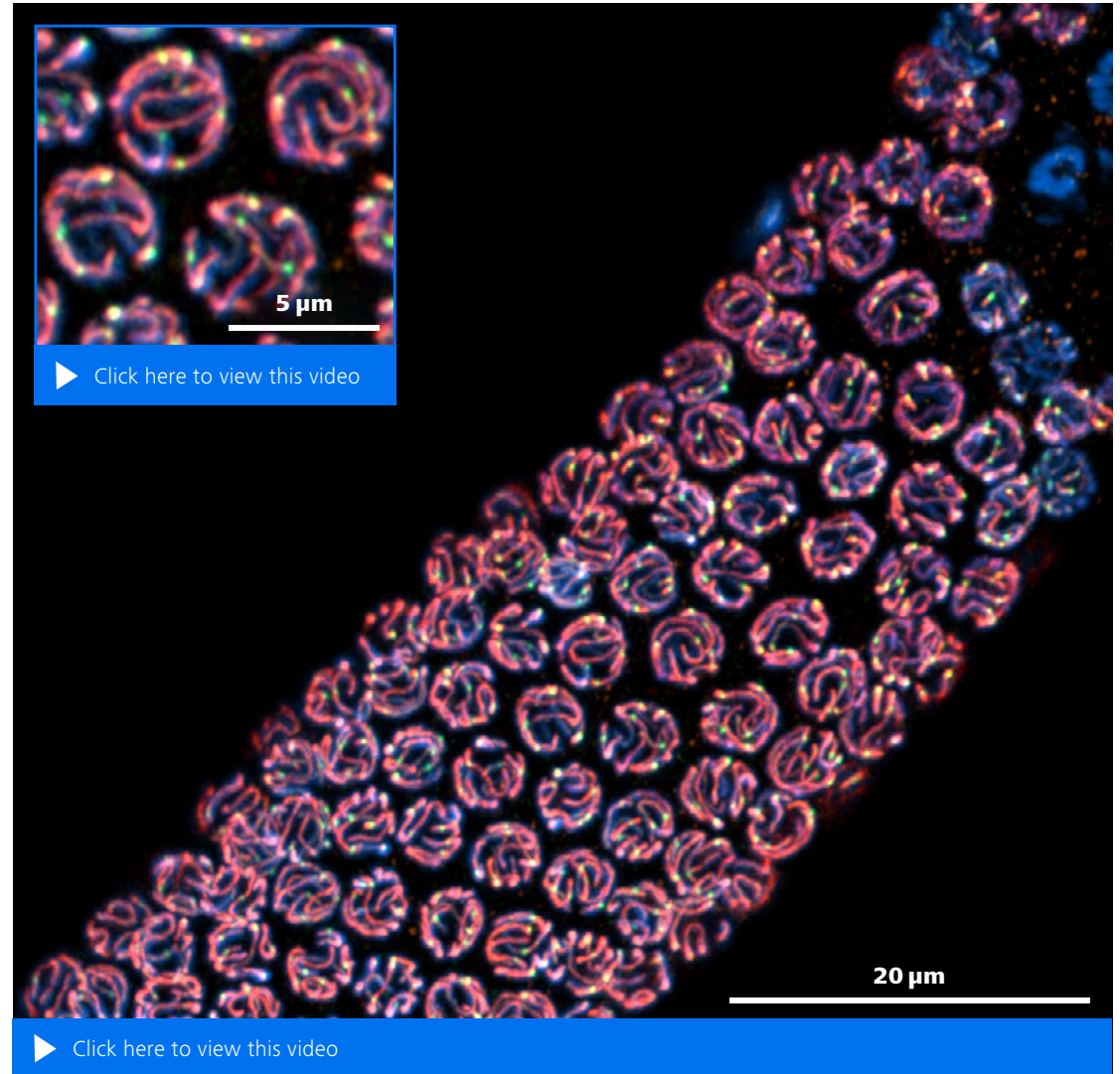
5 µm

▶ Click here to view this video

20 µm

▶ Click here to view this video

ZEISS Celldiscoverer 7 at Work

Guided Acquisition

The Guided Acquisition module was used to auto-matically identify and image a subset from a group of fixed drosophila embryos prepared on a stan-dard microscope glass slide. Longitudinal visceral muscles (one type of gut muscles) were labeled with Alexa 488, and Cut (one type of homeodo-main transcription factor) with Cy3. The overview scan was acquired with a 2.5× magnification (Plan-Apochromat 5×/0.35 objective, 0.5× magnification changer) and the Axiocam 506 mono; the detailed acquisition was performed with a 10× magnifica-tion (Plan-Apochromat 20×/0.95 objective, 0.5× magnification changer) Airyscan MPLX HS mode, and Z-stacks (figure shows maximum intensity projection of the detected embryo). Image analysis was performed on the gut structure, where green positive embryos were detected first by mean intensity, then filtered by geometric features to identify those with preferred lateral orientation.

▶ Click here to view this video
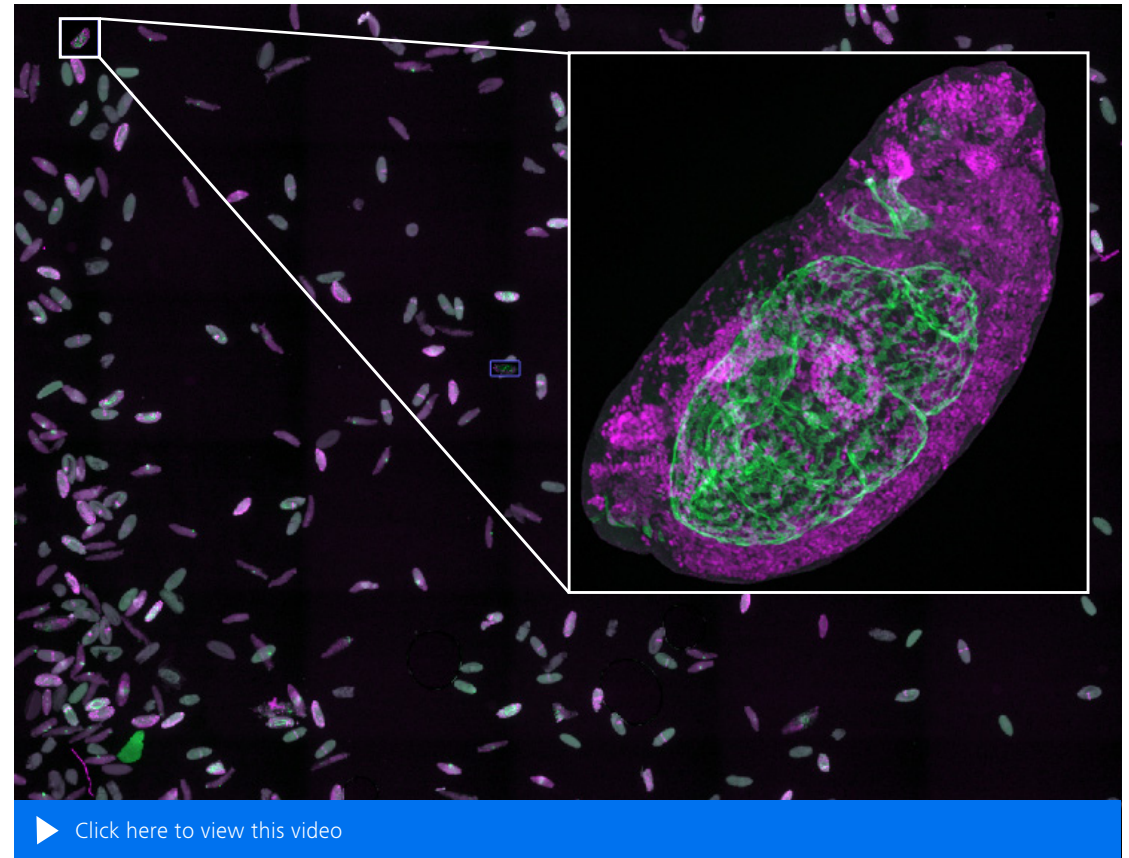
Sample courtesy of Dr. G. Wolfstetter, University of Gothenburg, Germany

ZEISS Celldiscoverer 7 at Work
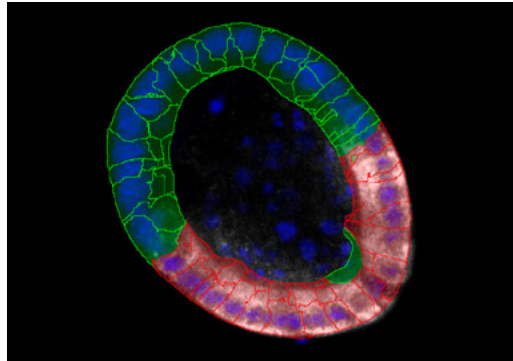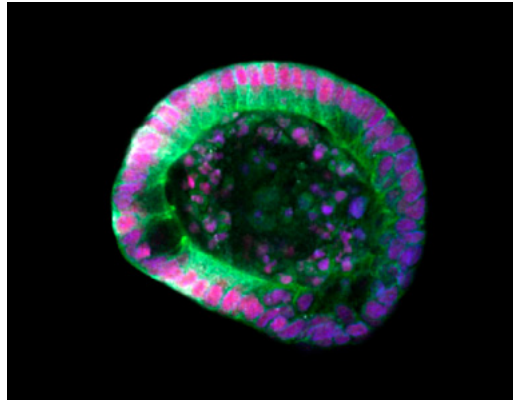
The Guided Acquisition module was used to automatically identify and image murine small intestinal organoids that were grown from isolated single cells and fixed on day 5 of organoid cultures treated with and without a Wnt-inhibiting drug (IWP-2).
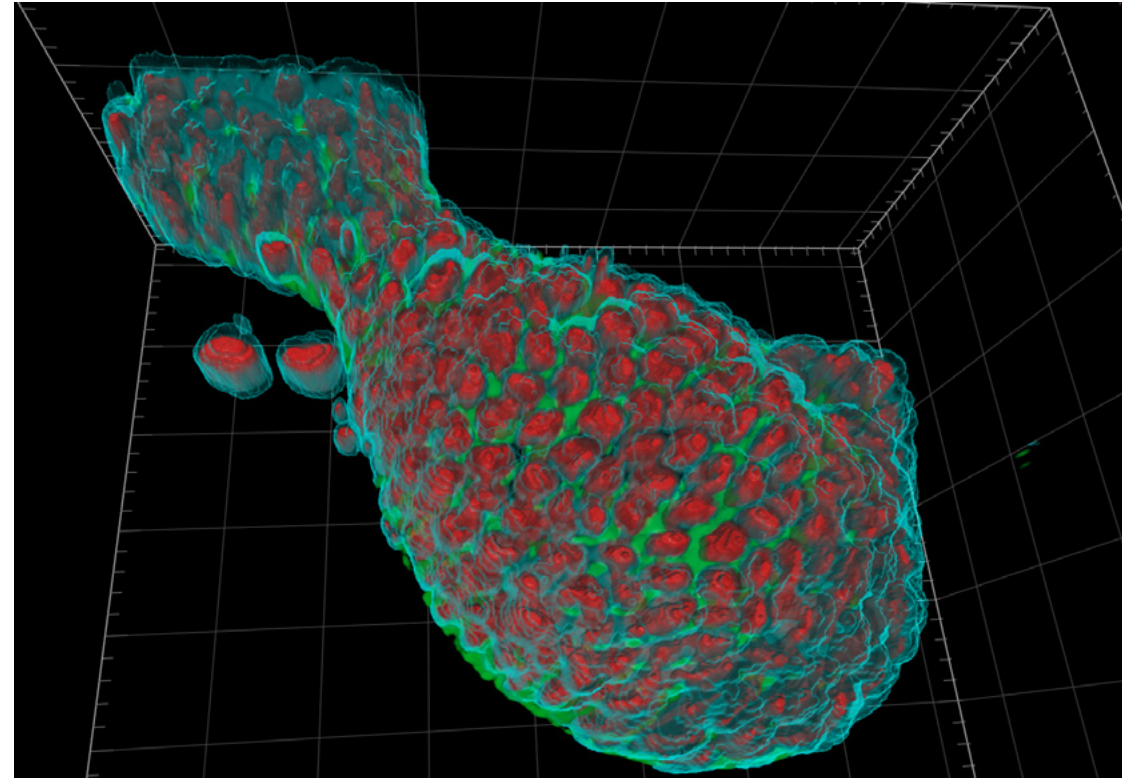
The individual cells expressed a fluorescent membrane protein (mem9-GFP), developed organoids were stained with a fluorescently labeled (Alexa 647) antibody against Aldolase B, which is a marker for differentiated enterocytes and DAPI. The Airyscan MPLX HS mode was used to acquire high resolution Z-stacks of individual organoids with a water immersion lens (50× 1.2, 0.5× magnification changer).

The analysis software arivis Pro allowed for visualization and quantification of sizes and volumes of the organoids and the internal cavities (lumens) as well as morphology: Organoids appeared either spherical or irregular depending on the IWP-2 treatment.

ZEISS Celldiscoverer 7 at Work

Sample courtesy of A. Stokkermans, Ikmi Group, EMBL, Heidelberg, Germany
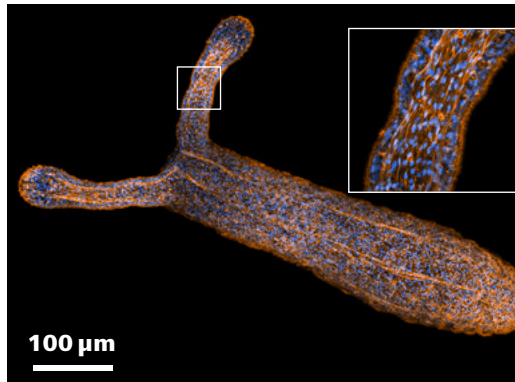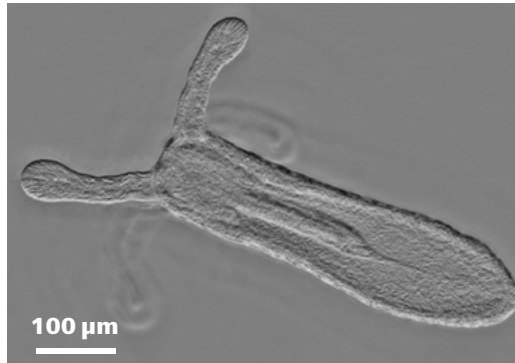
Fixed starlet sea anemone *(Nematostella vectensis)* stained with Hoechst (nuclei) and Phalloidin (actin). Side view imaged with a combination of camera-based phase gradient contrast mode (top) and high sensitivity mode with Airyscan 2 (bottom).

Maximum intensity projection of 19 z-planes. Fine image details and high signal to noise ratio can clearly be seen on the insert in the top right image, showing an enlarged view of a tentacle area.

Video: Top view of a young animal, showing mouth and four tentacle buds. Maximum intensity projection of 69 z planes imaged with Airyscan 2 Multiplex. Images were acquired using the water immersion objective with a total magnication of 25× and a numerical aperture of 1.2.

ZEISS Celldiscoverer 7 at Work

A

B

500 µm

A

20 µm

▶ Click here to view this video

B

20 µm

▶ Click here to view this video
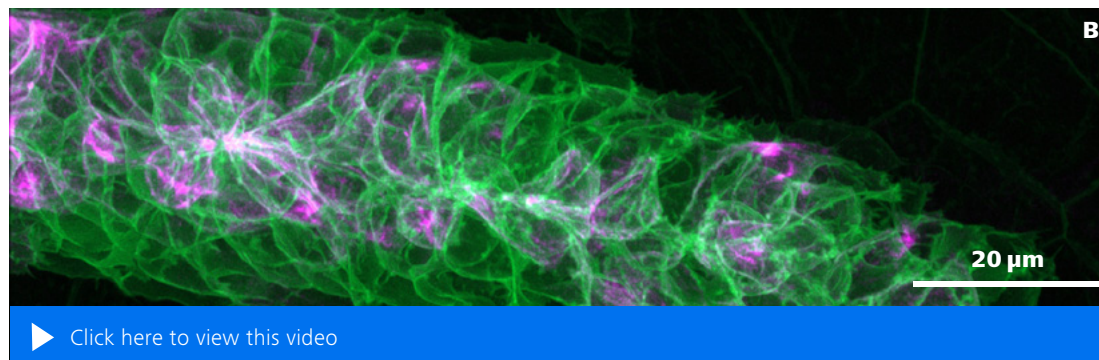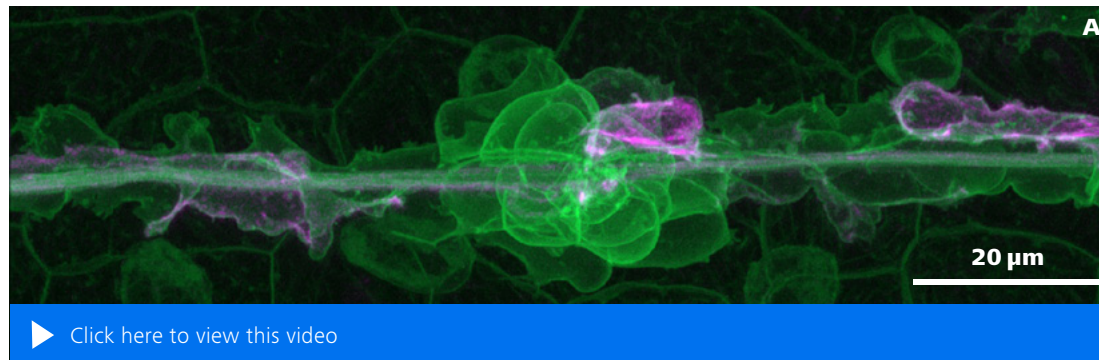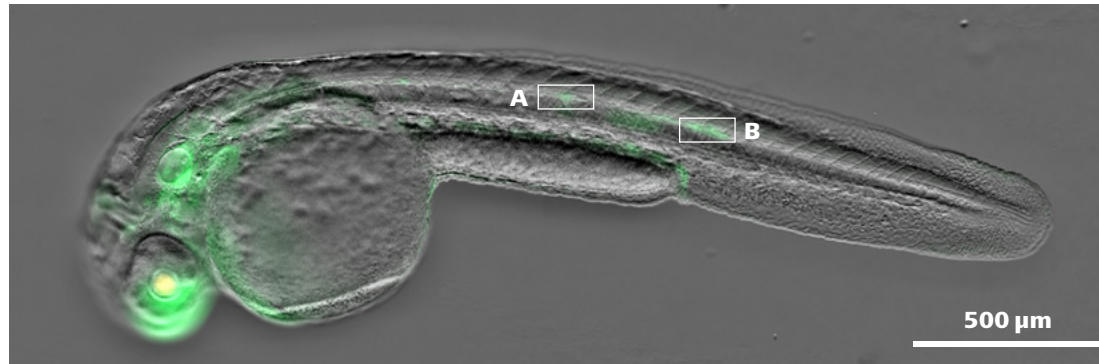
Lateral line primordium migration and deposition of immature neuromasts in a Zebrafish embryo *(Danio rerio)*. Animals were anesthetized and embedded using low concentrated agarose in a glass bottom petridish.

Initial camera-based imaging allowed for a quick and easy sample navigation (top) combining Phase Gradient Contrast with fluorescence acquisition.

Subsequent high-resolution imaging with Airyscan 2 in Multiplex mode was done on individual positions identified in the widefield image (white boxes).

A) Maximum intensity projections of an immature neuromast (127 z planes).

B) Maximum intensity projections of the lateral line primordium tip migrating through the animal (155 z-planes).

Green: LYN-eGFP (mebranes);

Red: tagRFP-T-UTRCH (actin).

The gentle and fast image acquisition that is inherent to the Airyscan 2 Multiplex mode is very benificial for this kind of application. The animal is unperturbed by the imaging while images with a very high signal to noise ratio as well as level of detail can be acquired at the same time.

Sample courtesy of J. Hartmann and D. Gilmour, EMBL, Heidelberg, Germany

ZEISS Celldiscoverer 7 at Work

Organoid from a human breast cancer cell line. The cells express GFP-labeled H2B (nucelei) and mCherry (cytoplasmic staining depicted here in grey for better visualization).

Several organoids were grown in a multiwell plate with Matrigel. Initial sample navigation was performed using the transmitted light at a low magnification of 2.5× to identify interesting organoids.

Subsequently, high resolution images were acquired using the water immersion objective with a total magnification of 50×. 61 z-planes were acquired using ZEISS Celldiscoverer 7 with LSM 900 and Airyscan 2 in Multiplex mode.

One can clearly appreciate the robustness of the imaging given that Matrigel is not an ideal optical medium and the organoid was imaged at a distance of several micrometers from the coverglass.

▶ Click here to view this video
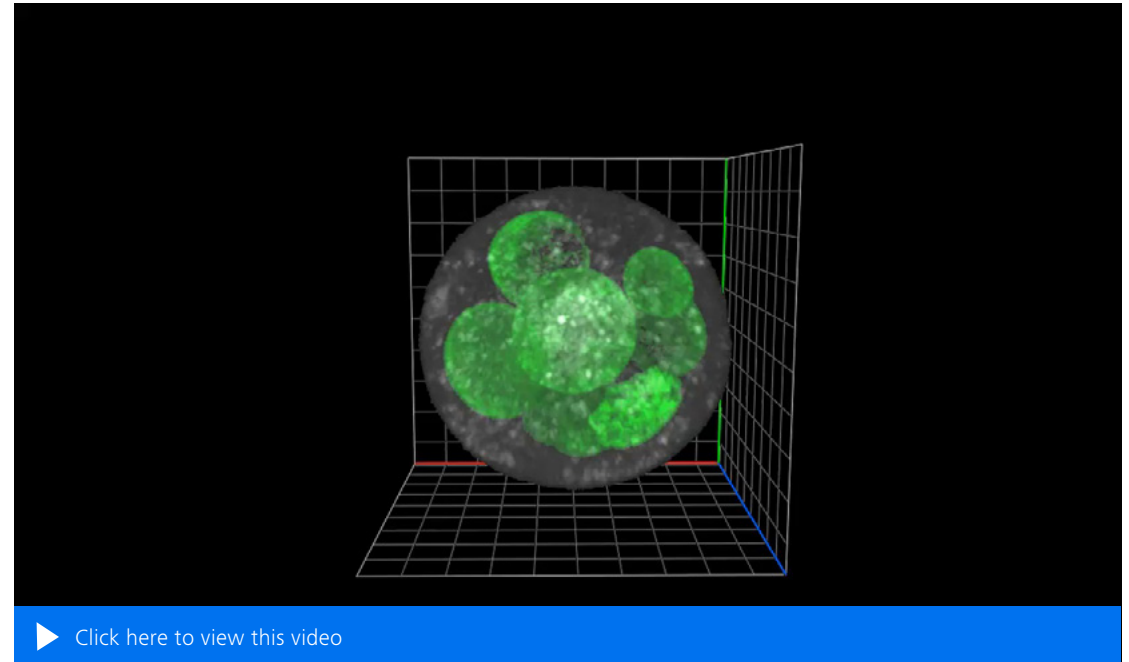
Sample courtesy of S. Gawrzak and M. Jechlinger, EMBL, Heidelberg, Germany

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ZEISS Celldiscoverer 7 at Work

Trypanosoma brucei brucei parasite

The African *Trypanosomas* have a mechanism to evade the mammalian immune system by using variant surface glycoprotein (VSG). There are over 2600 genes for these glycoproteins, but only one is expressed at a time. Once the immune system starts recognizing one form of VSG and attacks parasites expressing it, some parasites within the population will switch to another form of VSG to evade the immune attack. This is a complex and sophisticated mechanism that enables the parasites to survive and reproduce within the host.

Bloodstream form Trypanosoma brucei brucei Lister 427 modified to constitutively express two VSG simultaneously. Celldiscoverer 7 in combination with LSM 900 and Airyscan 2 images those minute parasites (~20 µm length) with ease.

Trypanosoma infection

The 10 µm myocardium sections of *Trypanosoma*-infected C3H/HeN mice were stained using a variety of combinations of anti-mouse IgG (H+L, F(ab')2 fragment), anti-mouse CD19 Alexa Fluor 647 (a B cell marker), and anti-mouse podoplanin Alexa Fluor 488 (a fibroblast marker). The rendering displays a closer look at an infected area of the tissue.
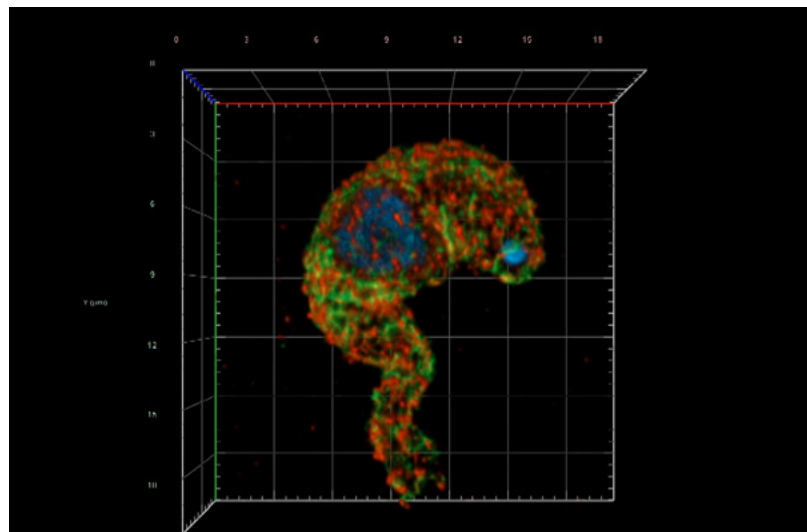
▶ Click here to view this video

Courtesy of Lianne Lansink, Department of Biology, University of York, UK
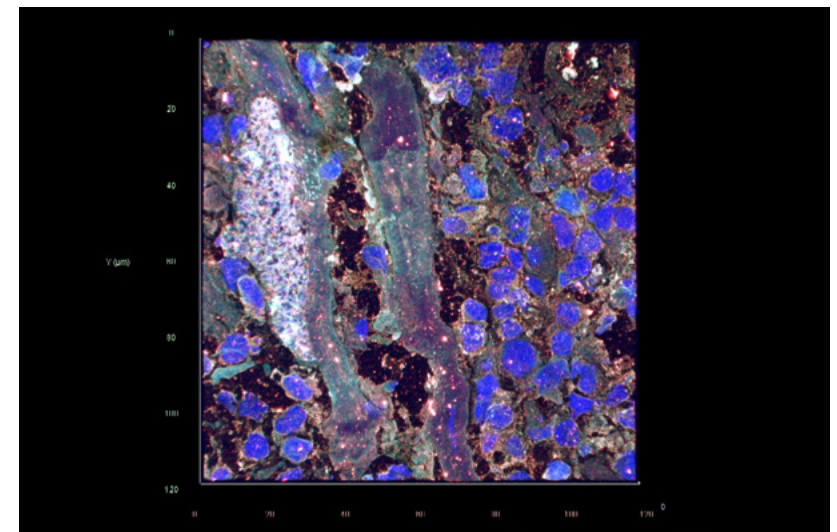
▶ Click here to view this video

Courtesy of Damian Perez Mazliah, HYMS, Department of Biology, University of York, UK

ZEISS Celldiscoverer 7 at Work

***Leishmania donovani* parasite**

The image shows a section of human skin lesion infected with *Leishmania donovani* parasite that was captured using mixed mode acquisition. Different components are visualized: DAPI in blue, T cells in green, and PD-L1 (an immune checkpoint protein) in orange, using the Airyscan Multiplex mode. Additionally, IDO1, a metabolitic enzyme, was imaged using the 735 nm LED (shown in magenta).
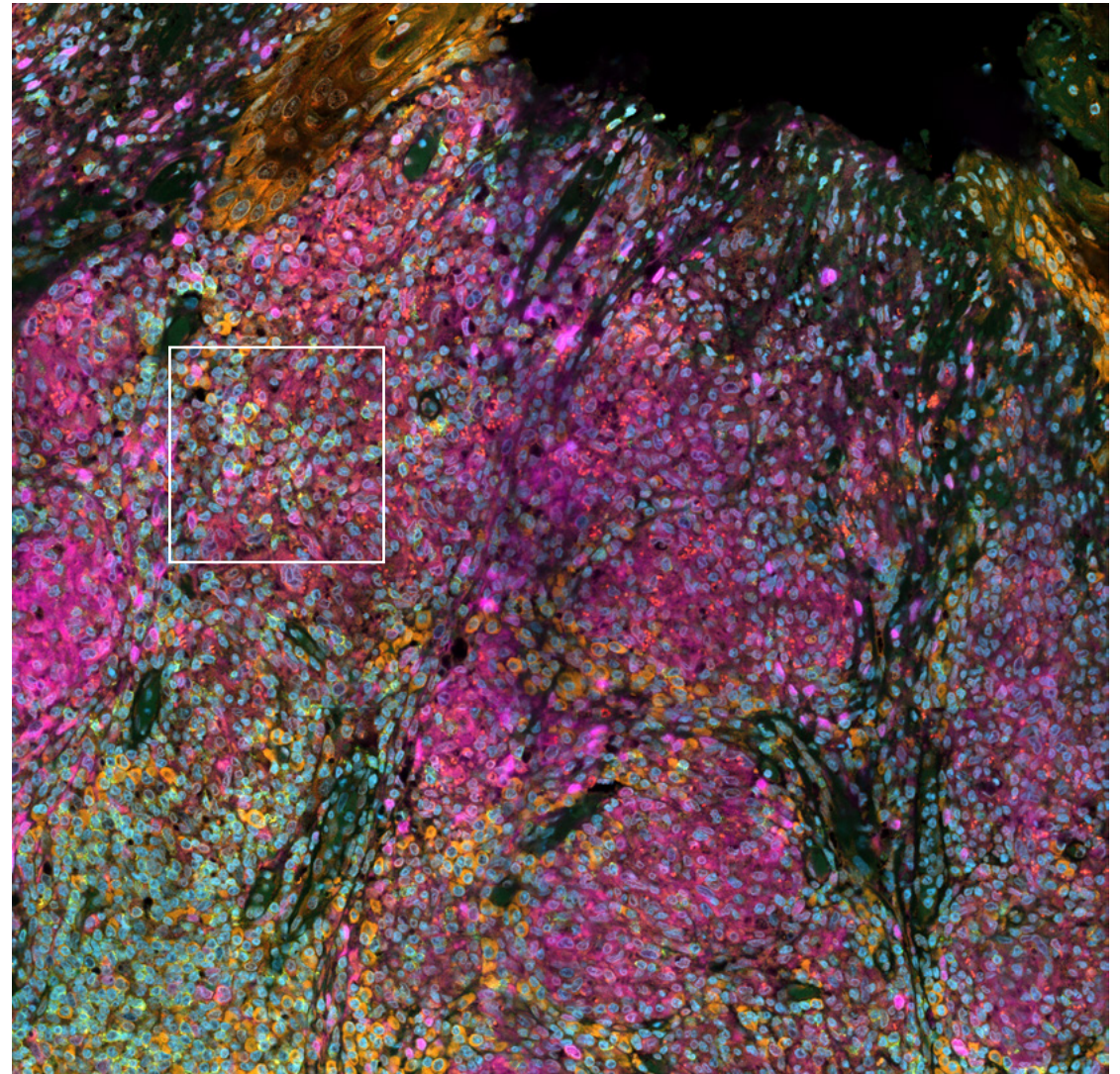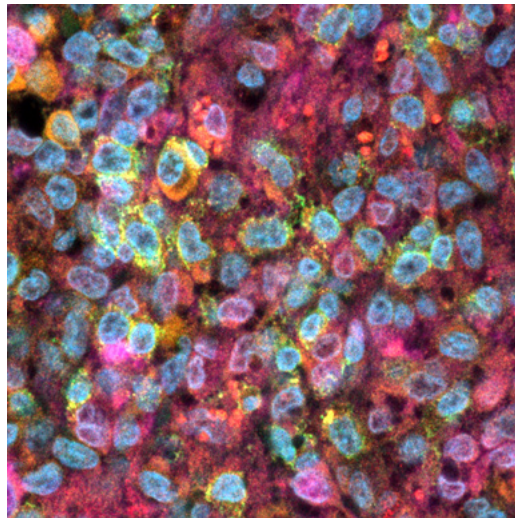
Courtesy of Nidhi S Dey, Kaye lab, YBRI, HYMS, Department of Biology, University of York, USA.

Your Flexible Choice of Components

1 Microscope
- ZEISS Celldiscoverer 7
- Automatic sample carrier recognition
- Barcode reader
- Hardware focus stabilization
- Apochromatic FL beampath with adaptive field stop
- ZEISS Axiocam 712 mono R2, Axiocam 807 mono or Axiocam 820 mono
- Additional camera port
- On-axis access for dispensing
- UV-disinfection

2 Objectives
- Plan-Apochromat 5×/0.35
- Plan-Apochromat 20×/0.7 autocorr
- Plan-Apochromat 20×/0.95 autocorr
- Plan-Apochromat 50×/1.2 W autocorr autoimmersion
- Magnification changer 0.5×/1×/2×

3 Illumination
- Transmitted light unit:
  IR-LED (725 nm) brightfield, oblique contrast, phase gradient contrast
- Fluorescence:
  LEDs 385, 423, 469, 508, 555, 591, 631, 735 nm
  High-efficiency multibandpass filter sets
  Additional emission filter wheel

4 Imaging Systems
- LSM 900 with Airyscan 2
- Option: LSM Plus, Airyscan jDCV

5 Accessories
- Temperature and atmospheric control (heating/cooling; CO_2, O_2)
- Insert plates and perfusion chambers for dishes, multi-chamber slides and standard slides

- Additional recommended cameras
  - Hamamatsu Orca Flash 4.0 V3
  - Photometrics Prime 95B

6 Software
- ZEN microscopy software for advanced and smart multidimensional image acquisition and 2D/3D analysis; recommended toolkits:
  - Connect
  - AI
  - Bio Apps
  - Deconvolution
  - Molecular Quantification
  - Developer
  - LSM Plus, Airyscan jDCV

System Overview

Axiocam 820 mono
Axiocam 807 mono
Axiocam 712 mono R2
Trigger cable
Axiocam 503/506/512/702, LEMO
(required in addition, without fig.)

Hamamatsu
Orca Flash 4.0 V3
supported by
Celldiscoverer 7

Photometrics
Prime 95B
Trigger cable
Prime 95B, LEMO
(required in addition,
without fig.)

Camera Adapter 60N-C 1" 1.0x

Filter set 90 HE
Filter set 91 HE
Filter set 92 HE
Filter set 93 HE
Filter set 110 MBPr
└ **Filter set 110 EmF**
Filter set 112 MBPr
└ **Filter set 112 EmF**

Light Source Viluma 7

Viluma 7 variants:
− **Viluma 7, RGB-UV**
− **Viluma 7, R[G/Y]B-UV**
− **Viluma 7, R[G/Y]CBV-UV**
− **Viluma 7, FR-R[G/Y]BV-UV**

Axiocam 820 mono
Axiocam 807 mono
Axiocam 712 mono R2

Extension housing for
Celldiscoverer 7 system unit

CO$_2$ Module S1 for Celldiscoverer 7

O$_2$ Module S1 for Celldiscoverer 7

TempModule S1 for Celldiscoverer 7

Refrigerated circulator
Corio CP-200F 230 V
(without fig.)

or: **Refrigerated circulator**
Corio CP-200F 230 V GB
(without fig.)

or: **Refrigerated circulator**
Corio CP-200F 115 V
(without fig.)

① ② ③

Celldiscoverer 7 system unit Rev.2
Celldiscoverer 7 LCI system unit Rev.2
Celldiscoverer 7 LCI confocal system unit Rev.2

Scanning module
LSM 900
with:
LSM 900 MA-PMT detection module,
LSM 900 GaAsP-PMT detection module,
2-Channel Deflecting optics,
Additional GaAsP-detector,
Additional MA-PMT detector

LSM 900 adapter kit
Celldiscoverer 7

Component rack
LSM 900

Power supply
unit

LSM 900
Laser module
LM URGB

Airyscan 2 module
(Additional Detector
LSM 900)

①

Objective Plan-Apochromat 5x/0.35
(already 1x included in the delivery of
Celldiscoverer 7 system unit)

Objective
Plan-Apochromat 20x/0.7 autocorr

Objective
Plan-Apochromat 20x/0.95 autocorr

Objective
Plan-Apochromat 50x/1.2 W autocorr
with autoimmersion

②

Calibration sample LSM
for Celldiscoverer 7

Calibration sample 488 nm
for LSM

(without fig.)

Insert plate
for 1 Petri dish 35/60

Insert plate
for 2 slides/Lab-Tek™
chambers 57x26 mm

Insert plate
for perfusion with POC-R2

as an accessory (without fig.):
POC-R2 cell cultivation system
− Perfusion insert, open, with lid
for POC-R2 cell cultivation system

Insert plate for UV disinfection
(already 1x included in the delivery of
Celldiscoverer 7)

Insert plate for 3 slides 76x26 mm
(already 1x included in the delivery of
Celldiscoverer 7)

Insert plate
for 6 Petri dishes 35

③

Monitor TFT 27"
HP Z27q G3 (68 cm)
or:
Monitor TFT 32"
HP Z32k G3 (80 cm)
or:
Monitor TFT 37,5"
HP Z38c (95 cm)

Z8 High-End Workstation

Storage and Data Analysis PC 81 TB w / RTX-A 2000
or:
Storage and Data Analysis PC 81 TB w / RTX-A 5000

System table, small,
air damped,
level regulated,
with breadboard, 900 mm x 750 mm

(for Celldiscoverer 7 system unit
without Extension housing or LSM)
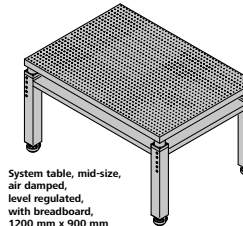
System table, mid-size,
air damped,
level regulated,
with breadboard,
1200 mm x 900 mm

(for Celldiscoverer 7 system unit
with Extension housing or LSM 900)
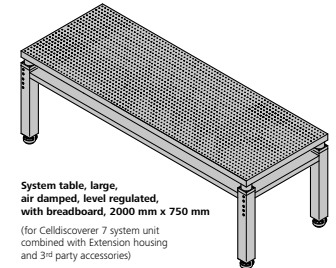
System table, large,
air damped, level regulated,
with breadboard, 2000 mm x 750 mm

(for Celldiscoverer 7 system unit
combined with Extension housing
and 3rd party accessories)

Technical Specifications

Dimensions	Width (approx.)	Depth (approx.)	Height (approx.)	Weight (approx.)
Celldiscoverer 7	710 mm	640 mm	700 mm	136 kg
Footprint Celldiscoverer 7	585 mm	560 mm		
Incl. Extension housing	1270 mm	640 mm	700 mm	187 kg
Footprint incl. Extension housing	1170 mm	560 mm		
Celldiscoverer 7 incl. LSM 900	1310 mm	690 mm	705 mm	199 kg
Component rack	400 mm	550 mm	600 mm	35 kg
Airyscan 2	400 mm	250 mm	145 mm	5 kg
Power Supply	400 mm	250 mm	145 mm	6 kg
Laser module	400 mm	250 mm	145 mm	10 kg

Technical data		
Celldiscoverer 7 and Extension housing	Noise emission	According to EN 55011 class A
	Noise immunity	According to DIN EN 61326-1
	Protection class	1
	Ingress protection rating	IP 20
	Radio interference suppression	To EN 55011 Class A
	Type of operating site	Closed room facility
	Electrical safety	To DIN EN 61010-1 (IEC 61010-1) conforming to CSA and UL regulations
	Degree of pollution	2
	Overvoltage category	II
Celldiscoverer 7	Line input voltage; max. current	100 V to 240 V ± 10 %; 6A~
	Line frequency	50/60 Hz
Celldiscoverer 7 incl. LSM 900 / Extension housing	Input for connection of Celldiscoverer 7	100 V to 240 V ± 10 %, 50/60 Hz, max. 4.0 A~
	Output to internal 6 sockets	100 V to 240 V ± 10 %, 50/60 Hz
	Permissible total current on 6 internal sockets	Max. 4.0 A~
		The extension housing is powered by Celldiscoverer 7

Technical Specifications

Environmental requirements

Storage (in packaging)	Permissible ambient temperature	+5 °C to +40 °C
	Permissible relative air humidity (no condensation)	max. 75 % at +35 °C
Transport (in packaging)	Permissible ambient temperature	−20 °C to +55 °C
	Permissible relative air humidity (no condensation)	max. 75 % at +35 °C
Operation	Permissible ambient temperature	+15 °C to +35 °C
	Recommended ambient temperature (e.g. for incubation)	+18 °C to +25 °C, optimally +22 °C
	Warm-up time	1 h for standard imaging; ≥4 h for high-precision and / or long-term measurements
	Permissible relative air humidity	max. 65 % at 30 °C
	Atmospheric pressure	800 hPa to 1060 hPa

XYZ motorization

Motorized xy-scanning stage		Travelling range	300 mm × 140 mm
	●	Reproducibility	± 1 µm
		Absolute precision	± 5 µm
		Resolution	0.1 µm
Motorized z-drive		Reproducibility	± 0.025 µm
	●	Absolute precision	0.14 µm
		Resolution	± 0.01 µm

Optical specifications

Nosepiece	●	■ 4× motorized nosepiece ■ in combination with the 3× magnification changer this offers the functionality of 12 objectives
Magnification changer, afocal	●	■ 0.5×, 1×, 2× magnification, providing three different magnifications for each objective ■ depending on the objective configuration it offers a magnification range from 2.5× − 100× ■ switching between magnifications ~1 sec ■ enables constant working distances for each magnification

● Component always included   O Component optionally available

Technical Specifications

Optical specifications

	Magnification changer			Auto-correction	Auto-immersion	Temperature control	Thick vessel bottom up to 1.2 mm PS[2]	Thin vessel bottom 0.13 – 0.21 mm glass/COC[1] 0.15 – 0.21 mm PS[2]	Working distance	Effective penetration depth (in water)
	0.5×	1×	2×							
Plan-Apochromat 5×/0.35 ●	M = 2.5× NA = 0.12	M = 5× NA = 0.25	M = 10× NA = 0.35	–	–	●	●	●	5.10 mm	3.99 mm @ 0.17 mm thickness; 2.66 mm @ 1 mm thickness
Plan-Apochromat 20×/0.7 autocorr ○	M = 10× NA = 0.35	M = 20× NA = 0.7	M = 40× NA = 0.7	●	–	●	●	●	2.20 mm	1.33 mm @ 0.17 mm thickness; 0.4 mm @ 1 mm thickness
Plan-Apochromat 20×/0.95 autocorr ○	M = 10× NA = 0.5	M = 20× NA = 0.8	M = 40× NA = 0.95	●	–	●	–	●	0.76 mm	0.4 mm @ 0.17 mm thickness
Plan-Apochromat 50×/1.2 W autocorr, autoimm. ○	M = 25× NA = 1.2	M = 50× NA = 1.2	M = 100× NA = 1.2	●	●	●	–	●	0.84 mm	0.4 mm @ 0.17 mm thickness

Adaptive Lens Guard ●
- automatically maximizes scanning area, while protecting the objectives from collisions with other hardware or sample vessels
- scanning range is indicated and updated automatically via control software

Temperature control ○
- all objectives are equipped with heating elements for temperature control
- in combination with the optional heating unit, objective temperature is adjusted automatically, depending on the user-defined sample temperature
- enables stable and homogeneous temperature within the sample chamber

Adaptive Autocorr ○
- automatic correction of aberrations (for high magnification objectives)
- adapts objectives automatically to vessel bottom material and thickness
- enables correction of aberration due to high penetration depths and refractive index mismatch of the sample (5× objective is not sensitive to variations of bottom thickness and material and does not require a correction)

Autoimmersion, water ○
- comes along with the Plan-Apochromat 50×/1.2 W objective
- enables automatic supply and removal of water immersion
- water level is automatically indicated in the control software and on the display
- upgradable in the field

● Component always included   ○ Component optionally available   [1] Cycloolefincopolymer   [2] Polystyrene

Technical Specifications

Objective compatibility with Airyscan 2

Objective	Plan-Apochromat 5×/0.35			Plan-Apochromat 20×/0.7			Plan-Apochromat 20×/0.95			Plan-Apochromat 50×/1.2 W		
Magnification changer	0.5×	1×	2×	0.5×	1×	2×	0.5×	1×	2×	0.5×	1×	2×
Usage with Airyscan MPLX	+	+	+	+	+	-	+	++	++	++	++	-
Usage with Airyscan HS	+	+	+	+	+	+	+	++	++	++	++	+

Focus

Hardware-based focus finder	●	■ automatically focusses on the sample (lower side of sample) ■ a user-defined offset can be used to change the default position ■ enables automatic generation of focus maps for microwell plates ■ compatible with every objective and filter set ■ can be combined with focus stabilization and ZEN blue software autofocus
Hardware-based focus stabillization	●	■ focus stabilization system maintains focus position over long-term ■ compatible with every objective and filter set ■ hardware and software support for multi-position and multi-offset stabilization ■ can be combined with focus finder and ZEN blue software autofocus
Software-based autofocus	●	■ focusses automatically on user-defined structures and regions of interest based on the image content ■ can be combined with focus finder and focus stabilization

Transmitted light and contrasting techniques

Transmitted light unit	●	■ fully compatible with fluorescent applications, environmental control, dispensing and perfusion option ■ enables label-free imaging and provides additional information in combination with fluorescent applications ■ always Koehler illumination adjusted
Lightsource	●	■ high-speed IR-LED (725 nm) offering low phototoxicity
Contrast techniques	●	■ brightfield ■ oblique contrast ■ adaptive phase gradient: adapts automatically to vessel geometry providing excellent contrast to the edges of the vessels

● Component always included ○ Component optionally available

Technical Specifications

Fluorescence illumination

Fluorescence illumination unit	●	■ apochromatic excitation beampath incl. adaptive field stop ■ up to 6 different LEDs for up to 7 different excitation wavelengths (385 / 423 / 469 / 508 / 555 / 591 / 631 / 735 nm) ■ life time of LEDs >15,000 h ■ switching between LEDs <1 ms
LEDs are synchronized with image acquisition	●	Sample is only exposed during image acqusition (acquisition trigger mode) thus reducing phototoxicity.
LEDs are synchronized with the live-window	●	Sample is only exposed during live-window update (live-window trigger mode), significantly reducing phototoxicity during sample navigation.
Automated excitation field stop	●	A motorized field stop adapts automatically to the current field of view thus reducing phototoxicity effectively.
Switching time between FL channels		■ switching between fluorescence channels using high-efficient multi-bandpass filter sets <1 ms ■ switching 5-position beamsplitter wheel <80 ms
5-position beamsplitter wheel	●	■ 5× position beamsplitter wheel ■ switching time <80ms between neighbouring positions
Emission filter wheel	●	■ 7× motorized emission filter wheel ■ user accessible in the widefield variant ■ fits 25 mm emission filters ■ switching emission filter wheel <80 ms between neighbouring positions
Filter sets	●	Filter set 90 HE ■ quad-band filter set for 385 nm, 475 nm, 555 nm, 631 nm LED and IR-TL LED ■ beamsplitter RQFT 405+493+575+653; emission filter QBP 425 / 30+514 / 30+592 / 25+709 / 100 ■ additional band for transmitted light
	○	Filter set 91 HE ■ triple-band filter set for 423 nm, 508 nm, 591 nm LED and IR-TL LED ■ beamsplitter RTFT 450+538+610; emission filter TBP 467 / 24+555 / 25+687 / 145 ■ additional band for transmitted light
	○	Filter set 92 HE ■ triple filter set for 385 nm, 469 nm, 591 nm LED and IR-TL LED ■ beamsplitter RTFT 405+493+610; emission filter TBP 425 / 30+524 / 50+688 / 145 ■ additional band for transmitted light
	○	Filter set 93 HE ■ double bandpass for 469 nm, 555 nm and IR-TL LED ■ beamsplitter RDFT 493+575; emission filter TBP 514 / 32+605 / 50+730 / 60 ■ additional band for transmitted light

● Component always included   ○ Component optionally available

Technical Specifications

Fluorescence illumination

Filter sets		
	O	**Filter set 110 MBPr** ■ quadruple filter set for 385 nm, 470 nm, 590 nm and 735 nm LED ■ beamsplitter RQFT 405+493+611+762, emission filter QBP 425/30+524/51+634/38+785/38
	O	**Filter set 112 MBPr** ■ quintuple filter set for 385 nm, 470 nm, 555 nm, 630 nm and 735 nm LED ■ beamsplitter RPFT 405+493+575+654+761, emission filter MBP 425/30+514/30+592/25+681/45+785/38
	O	**Filter Set 110 EmF DAPI+GFP+AF594+Cy7** ■ four single bandpass emission filters BP 425/30, 525/50, 647/70 and 785/38
	O	**Filter Set 112 EmF DAPI+GFP+DsRed+Cy5+Cy7** ■ five single bandpass emission filters BP 425/30, 514/30, 592/24, 681/45 and 785/38

Available excitation bands for ZEISS Viluma 7

Line	Wavelength/Bandwidth	Recommended dye (examples)
UV	385/30 nm	Hoechst 33342, DAPI, Hoechst 33258, ATTO 390, True Blue, EBFP, T-Sapphire, CellTracker Blue, LysoTracker Blue, wtGFP (uv), Aminocoumarin, Cascade Yellow
V	423/44 nm	Alexa Fluor 430, ECFP, ATTO 425, ATTO 430LS, SpectrumAqua, Cerulean, mCFP, CyPet, Y66W, mKeima-Red, LysoSensor™ Green DND-153, SYTOX Blue, Chromomycin A3, POPO-1, PO-PRO-1, SYTO 40, SYTO 41, SYTO 42, SYTO 43
B	469/38 nm	Fluorescein, Alexa 488, eGFP, Calcein, Fluo-4, Fluo-8, JC-1, mKaede, NBD, TagGFP, LysoTracker Green, ATTO 465, ATTO 490, Oregon Green Bapta, BOBO-1, Cytox Green, MitoTracker Green, YoYo-1, YoPro-1
C	508/20 nm	eYFP, Calcein, Fluo-4, Fluo-8, Bodipy 515, Alexa 514, YoPro-1, YoYo-1, Calcium Green, Syto 23, Thiazole Orange, LysoTracker® Green DND-26, mEos3.2 (green), mEOS2.0, mCitrine, mVenus, Topaz
G	555/30 nm	Cy3, Bodipy TMR, mBanana, mOrange, TurboRFP, tdTomato, TagRFP, DsRed2 ("RFP"), TRITC, PAmCherry, PATagRFP, Alexa Fluor 555, Alexa Fluor 546, DsRed monomer, SNARF, PO-PRO-3, Magnesium Orange, SYTO 82
Y	591/27 nm	Cy3.5, mPlum, mRaspberry, mNeptune, mCherry, Alexa Fluor 594, pa-mRFP1, KFP1, mEos2 (red), mEos3.2 (red), LipidTOX™ Red, Calcein red-orange, CellTracker Red, ER-Tracker Red, CellTrace BODIPY® TR
R	631/33 nm	Cy5, Alexa Fluor 647, Alexa Fluor 635, ATTO 610 to 647N, ATTO Oxa12, ATTO Rho14, Bodipy 630/650-X, Bodipy 650/665-X, CF™620R, CF™633, CF™640R, DyLight 633, DyLight 649, PSmOrange (red), iRFP670
FR	735/40 nm	Cy7, Alexa Fluor 750, ATTO 725, ATTO 740, MQAE, DyLight 800, Cyanin-7-amin

● Component always included   O Component optionally available

Technical Specifications

ZEISS Viluma 7 variants

Type	LED wavelengths
Solid state light source Viluma 7, type RGB-UV	385, 469, 555, 631 nm
Solid state light source Viluma 7, type R[G/Y]B-UV	385, 469, 555, 591, 631 nm
Solid state light source Viluma 7, type R[G/Y] CBV-UV	385, 423, 469, 508, 555, 591, 631 nm
Solid state light source Viluma 7, type FR-R[G/Y]BV-UV	385, 423, 469, 555, 591, 631, 735 nm

ZEISS Viluma 7 filter sets

Filter set	RGB-UV	RGYB-UV	RGY CBV-UV	FR-R[G/Y]BV-UV
90 HE*	×	×	×	×
91 HE*			×	×
92 HE*		×	×	×
93 HE*	×	×	×	×
110 MBPr				×
112 MBPr				×
110 EmF-Set		×	×	×
112 EmF-Set	×	×	×	×

Lasers for LSM 900

Laser module URGB (pigtailed; 405, 488, 561, 640 nm)		
		Single-mode polarization preserving fiber
		Typical total dynamic range of 10.000:1; direct modulation 500:1
	O	Diode laser (405 nm, 5 mW)
		Diode laser (488 nm, 10 mW)
		Diode (SHG) laser (561 nm, 10 mW)
		Diode laser (640 nm, 5 mW)

● Component always included   O Component optionally available   × Component compatible

* Filter sets offer an IR transmitted light bandpass. This bandpass enables IR-contrast without switching any filter components and without effecting fluorescence efficiency.

Technical Specifications

Sample mounting

Insert plate for 1 Petri dish 35/60	O	▪ for mounting of Petri dishes ▪ fits one Petri dish d = 35 mm or d = 60 mm, autoclavable
Insert plate for 6 Petri dishes 35	O	▪ for mounting of Petri dishes ▪ fits six Petri dishes d = 35 mm, autoclavable
Insert plate for 3 slides 76×26 mm	O	▪ for mounting of slides and chamber slides ▪ fits three slides 76 × 26 mm, autoclavable
Insert plate for 2 slides/Lab-Tek™ chambers 57×26 mm	O	▪ for mounting of chamber slides ▪ fits two Lab-Tek™ chamber slides 57×26 mm, autoclavable
Insert plate for perfusion with POC-R2	O	▪ fits for perfusion with POC-R2

Detection options

Internal camera*	●	Axiocam 820 mono, Axiocam 807 mono, Axiocam 712 mono R2
External camera port **	●	▪ external, user accessible camera port to mount additional cameras ▪ motorized switching between internal and external camera <200 ms
Additional/optional cameras	O	Axiocam 807 mono
	O	Axiocam 820 mono
	O	Axiocam 712 mono R2
	O	Hamamatsu Orca Flash 4.0 V3
	O	Photometrics Prime 95B
LSM 900	O	▪ two spectral detection channels, GaAsP (typical QE 45 %) or multialkali (MA) PMT (typical QE 25 %) ▪ LSM Plus: resolution improvement 1.3× (pinhole at 0.8 AU) up to 1.4× (pinhole at 0.3 AU)
	O	▪ one additional GaAsP PMT, MA PMT, or Airyscan detector
	O	▪ Airyscan 2 with spatial detection (32 channels GaAsP) with up to 1.5× improved resolution and 4−8× improved SNR. ▪ Airyscan Multiplex [HS-2Y]: up to 8 images/sec with 512 × 512 pixels ▪ Airyscan Joint Deconvolution with up to 1.9× improved resolution

● Component always included   O Component optionally available   * Select one internal camera   ** Not available on systems with LSM 900

Technical Specifications

Airyscan 2

	Airyscan HS	Airyscan HS jDCV	Multiplex HS-2Y	Multiplex CO-2Y
Parallelization	1	1	2	2
Resolution improvement factor	1.5×	1.9×	1.4×	1.2x
Max. FPS @512×512	4.3	4.3	8.4 (524×524)	7.4 (532×532)
FPS @ maxFOV	1.7	1.7	3.5	6.4
Antibody labeling, fine structures	+++++	+++++	++++	++
Antibody labeling, tiling	++	++	+++	+++
Live cell imaging	++	++	+++	+++++

Scanning Module

Scanner	Two independent, galvanometric scanning mirrors with ultrashort line and frame flyback
Scanning resolution	32 × 1 to 6,144 × 6,144 pixels (Airyscan 2 max. 4,096 × 4,096 pixels), also for multiple channels, continuously adjustable (for each axis)
Scanning speed	At 512 × 512 pixels confocal – up to 9 fps; Airyscan HS – up to 4.3 fps; Multiplex HS-2Y – 8.4 fps; Multiplex CO-2Y – 7.4 fps
	At 512 × 64 pixels: confocal – up to 64 fps
Scanning zoom	0.5× to 40×; continuously adjustable
Scanning rotation	Can be rotated freely (360°), adjustable in increments of 0.1°, freely adjustable xy offset (not for mixed mode and Airyscan Multiplex)
Scanning field	11 mm diagonal in the intermediate image plane, with full pupil illumination
Pinhole	Master pinhole with preset size and position; can be adjusted as desired for multitracking and short wavelengths (such as 405 nm); automatic alignment
Beam path	One major beam splitter for four laser lines (405, 488, 561 and 640 nm) at 10 degree with excellent laser line suppression. Depending on the system, either one or two patented Variable Secondary Dichroics (VSD) can be used to flexibly divert the respective spectral range of light to chosen channels. Emission filters can be used to clean up the signal when imaging autofluorescent or highly scattering samples

Resolution and speed (examples)

Pixel size	■ depending on the magnification and camera: 　■ 1.38 µm @ 2.5× using Axiocam 712 mono 　■ 0.14 µm @ 25× using Axiocam 712 mono 　■ 1.80 µm @ 2.5× using Axiocam 807 mono 　■ 0.18 µm @ 25× using Axiocam 807 mono 　■ 1.10 µm @ 2.5× using Axiocam 820 mono 　■ 0.11 µm @ 25× using Axiocam 820 mono
Typical scan speeds	■ 96 well plate, four channels, exposure 5 ms per channel, full resolution, one position per well: 1.4 min ■ 96 well plate, LSM 900 with three confocal channels simultaneously (multi-channel track), image size 512×512 px, bidirectional scan at max. speed, one position per well: 1.7 min. ■ 384 well plate, four channel, exposure 5 ms, full resolution, 1 position per well (e.g., whole well single shot): 2.9 min ■ 384 well plate, one whole well (100% coverage) using a high-resolution 20× objective, four channels, exposure 5 ms per channel, full resolution: 0.3 min ■ 384 well plate, LSM 900 with three confocal channels simultaneously (multi-channel track), image size 512×512 px, bidirectional scan at max. speed, one position per well: 6 min

Technical Specifications

Automatic sample recognition

Pre-scan unit (incl. barcode reader)	●	■ automatically detects and classifies sample carrier types using machine learning:
		  ■ slides
		  ■ Petri dishes (35/60 mm)
		  ■ chamber slides (incl. number of wells)
		  ■ microwell plates incl. plate type, e.g., number of wells
		
		■ The following 1D barcodes are detected on slides and wellplates:
		  ■ Code 39
		  ■ Code128 (EAN 128)
		  ■ ITF (Interleaved 2of5)
		  ■ UPC A
		  ■ EAN 8 and EAN 13
		  ■ Codabar
		
		■ on slides the following 2D barcodes are detected:
		  ■ DataMatrix
		  ■ QR-Code

Automatic vessel bottom recognition	●	■ automatic detection of vessel bottom material (glass/COC[1] and PS[2]) ■ automatically adjusts autocorr objectives to the material
		■ automatic detection of vessel bottom thickness ■ automatically adjusts autocorr objectives to the thickness
		■ automatically measures vessel skirt height, e.g., the distance between the support area and the actual sample bottom ■ delivers the skirt height to the Adaptive Lens Guard to update the scanning area
Automatic plate calibration	●	■ automatically calibrates individual plates, e.g., well diameter and distance, plate length, height and rotation

● Component always included   O Component optionally available   [1] Cycloolefincopolymer   [2] Polystyrene

Technical Specifications

Environmental control

TempModule S1	○	■ controls temperature of bottom and top plate of sample chamber ■ temperature range within sample chamber: 30 – 45 °C ■ temperature homogenity across a whole microwell plate: ± 0.6 @ 37 °C ■ operated by ZEN blue control software
CO_2 Module S1	○	■ generates a stable, user defined CO_2 concentration within the sample chamber ■ ensures an optimal and stable pH value in cell culture media over long term ■ a built-in CO_2 sensor permanently monitors the CO_2 concentration ■ operated by ZEN blue control software
O_2 Module S1	○	■ O_2-control device to achieve a stable, controlled decrease of the O_2 concentration by displacement with N_2 within the sample chamber ■ a built-in O_2 sensor permanently monitors the O_2 concentration. ■ operated by ZEN blue control software
Humidifier unit	○	■ prevents evaporation of culture medium during long-term experiments ■ liquid level is indicated automatically
Refrigerated Circulator Corio CP-200F	○	■ cooling unit controls temperature of top plate of sample chamber ■ temperature range = 14 – 28 °C ■ temperature homogeneity (microwell plate) = ± 2 °C available for air objectives only
Dispensing unit	●	■ offers on-axis access to specimen ■ enables pipetting without disturbing environmental conditions ■ allows sequential, semi-automatic pipetting of multi-positions
Insert plate for UV disinfection	●	■ incl. two UV bulbs, 1.0 W each ■ emitting 254 nm ■ fully automated disinfection process takes 23 min ■ can be used on-demand or for preventive maintenance

● Component always included   ○ Component optionally available

Celldiscoverer 7 meets the requirements according to IEC 60825-1:2014 and is a laser class 1 device.
Interlocks on customer interfaces prevent access to the laser radiation.

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