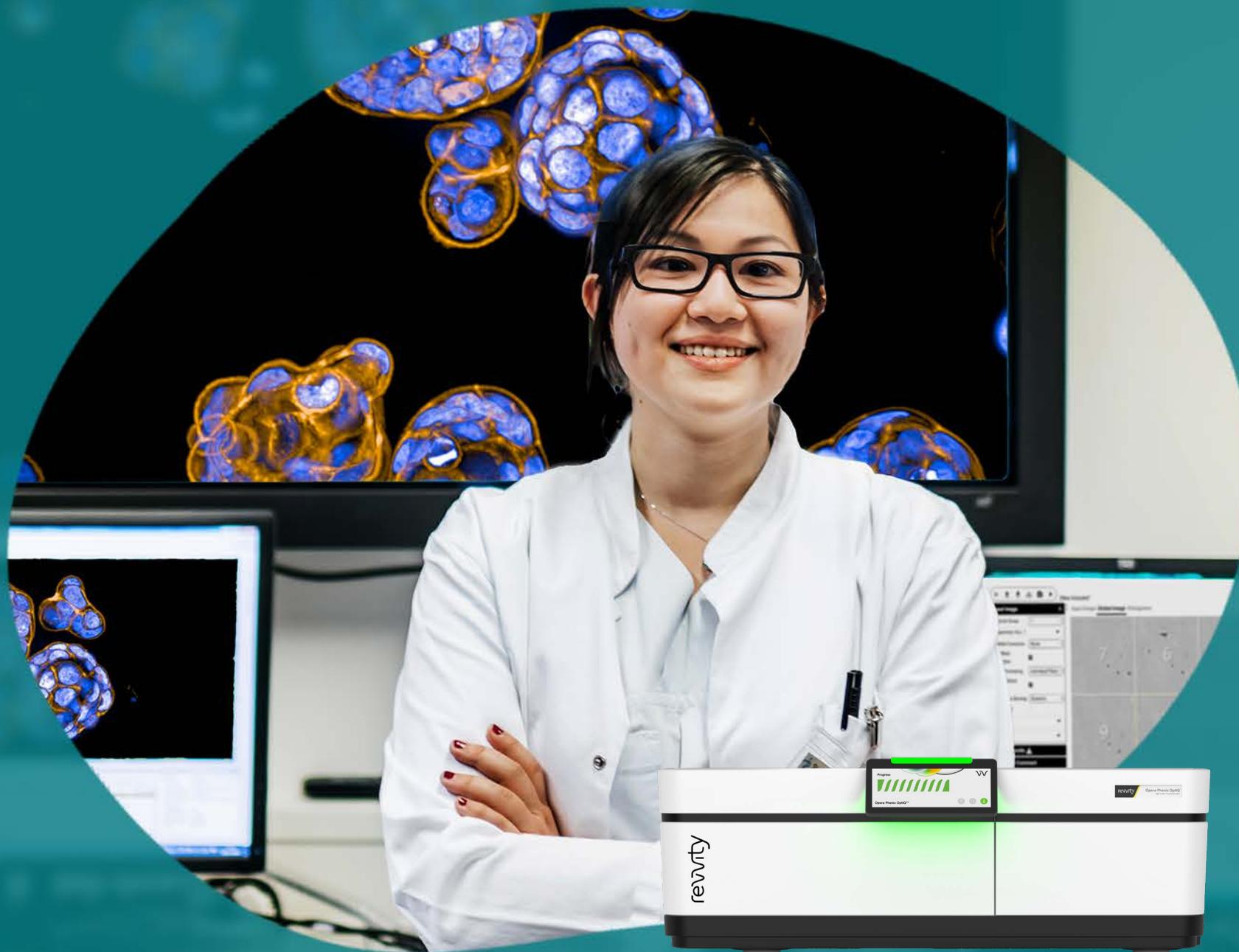# Imaging just got smarter.

revvity

Opera Phenix OptIQ™ high-content screening system

revvity

Faster data. Smarter analysis.

Complex 3D cell models demand more from your imaging system. The Opera Phenix OptIQ™ high-content screening system answers with advanced confocal technology designed with challenging 3D imaging, phenotypic screening and high-throughput applications in mind.

From 3D organoids to organ-on-chip samples, you can image and analyze diverse biological models with confidence using Harmony™ and Phenologic.AI™ imaging and analysis software.

Opera Phenix OptIQ high-content screening system

Boost your high-content IQ

Microlens enhanced spinning disk confocality
A pinhole and a microlens disk spinning in tandem to increase light efficiency. Pinhole distances suited for out-of-focus light suppression in 3D samples.

Proprietary Synchrony™ Optics
Reduced spectral crosstalk during simultaneous acquisition of multiple colors by separating adjacent fluorescence excitation and emission patterns, providing greater speed and higher sensitivity.

Multiple cameras
Increase imaging speed by using up to four high quantum efficiency cameras (>95% QE) and simultaneous multi-color acquisition, especially for extensive 3D stack imaging.

Automated water-immersion objectives
Improve image quality and get better data by enhancing the signal-to-noise ratio and improving the resolution while capturing more light.

Improved laser-based autofocus
Easier and more robust imaging of organoids, spheroids, and complex cell carriers (organ-on-chip and multi-layered sample carriers) provided by a new plate set-up wizard and advanced laser-based autofocus technology.
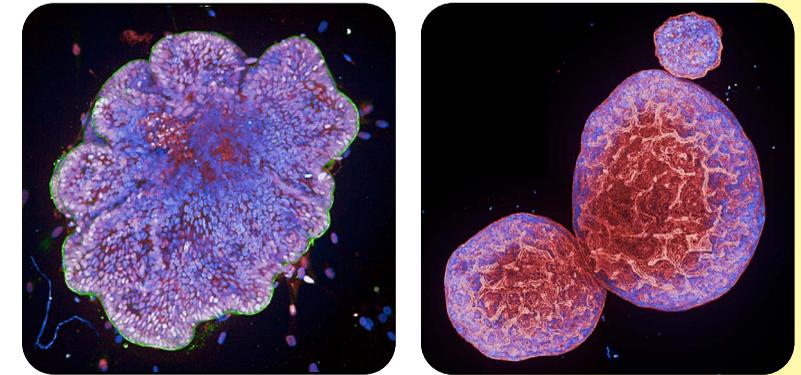
*Images courtesy of Romain Dautreppe and Nicolas Gatimel, Hopitaux de Toulouse.*

An integrated, high resolution status display elevates the user experience with the Opera Phenix OptIQ system

Smart software, powerful results

Harmony™ high-content imaging and analysis software facilitates rapid image analysis configuration to drive productivity with ready-made templates and clear steps to a custom analysis.

Key features:

AI-based image analysis

Using pre-trained deep-learning image-analysis models, Phenologic.AI allows for segmentation and classification of cells in brightfield and fluorescent images for easier analysis of live and fixed cell assays.

Machine learning based image analysis

Easily create segmentation and classification tools by clicking into images to train the software. No need to be an image analysis expert, with our Phenologic proprietary machine-learning technology.
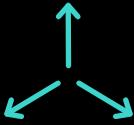
Individual plane or z-projection analysis

Analyze single focal planes or create z-projections using maximum, minimum, amplitude, mean, and other projection methods for comprehensive 3D data evaluation.
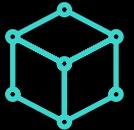
3D analysis

Explore your cell models by visualizing them in a 3D- and an XYZ-viewer and quantify volumetric and other 3D related phenotypic readouts.

Kinetic imaging and analysis

Perform time-lapse imaging with integrated movie generation, image viewing, and analysis including single cell tracking for dynamic live cell applications.

APPLICATIONS

From the everyday to the extraordinary

From basic assays to the most demanding applications, the Opera Phenix OptIQ system delivers the right combination of advanced optics and powerful image analysis tools to help you extract more physiologically relevant information from your assays.
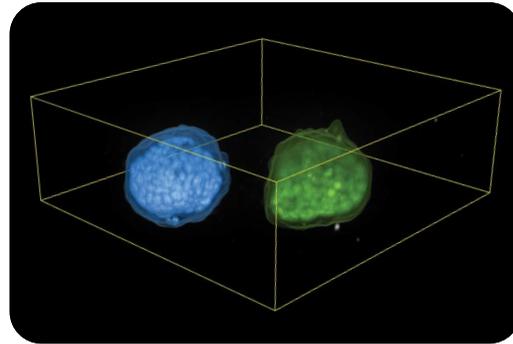

MPS models

Organoids, spheroids or organ-on-chip platforms provide more physiologically relevant research insights, however, pose unique challenges for imaging. The Opera Phenix OptIQ system's microlens-enhanced spinning disk with wider pinhole distance, combined with simultaneous multi-color acquisition facilitates sensitive and fast imaging deep into the sample.
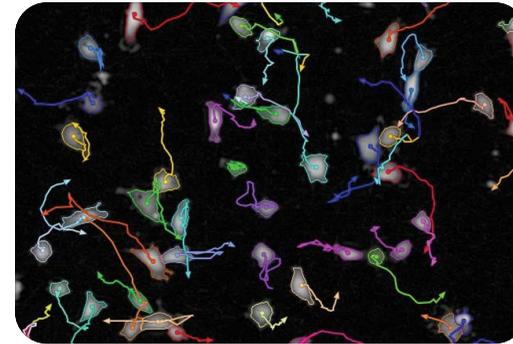
Live-cell assays

Meaningful live-cell assays require minimal photodamage. Spinning-disk confocal optics and >95% QE cameras minimize phototoxicity and bleaching when measuring fluorescent dyes. To analyze live cells without any fluorescent labels, you can utilize AI-based segmentation of brightfield images or analyze AI-based digital-phase contrast images. Single-cell tracking allows deep insights into individual cell behavior over time.
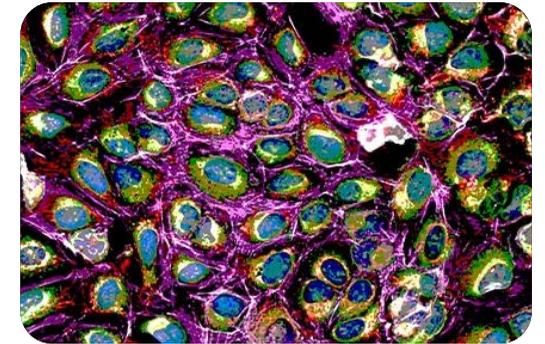
Cell painting

Cells are "painted" by staining specific cellular compartments with different fluorescent dyes simultaneously, followed by imaging and analysis to extract phenotypic profiles. The Opera Phenix OptIQ system combines confocal image quality with high-throughput capabilities to capture the multiplexed fluorescent signals across cellular compartments with clarity and speed. A turnkey cell painting image analysis tool facilitates robust phenotypic profiling at scale.

revvity
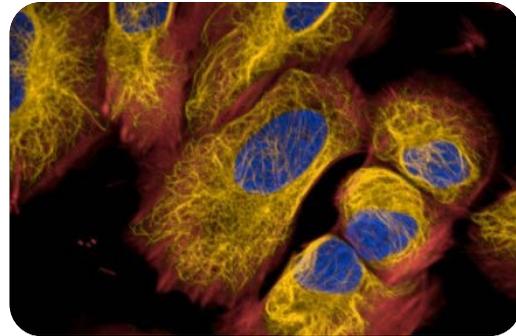
Hypoxia applications

The Opera Phenix OptIQ system allows for capturing cellular images under hypoxic or normoxic conditions (1-21% oxygen) using the onboard environmental control chamber. These conditions are closer to oxygen concentrations in vivo and provide greater physiological relevance.
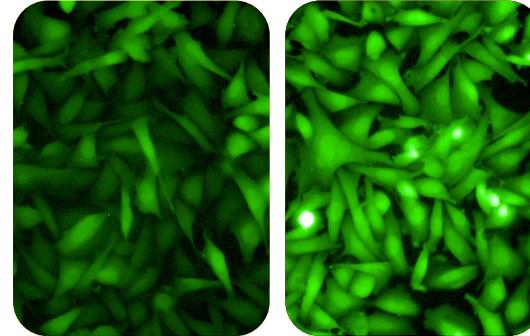
Fast-response assays

For assays to measure fast responses, the Opera Phenix OptIQ system can be equipped with a liquid handling module that measures cellular responses promptly after compound addition. Also, fast frame-rate imaging enables you to measure rapid cellular changes such as cardiomyocyte beating frequency.
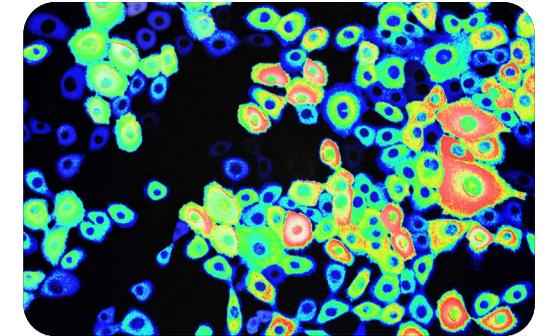
Protein-protein interactions

These types of interactions are pivotal for cellular function and are a major target for drug discovery. CFP-YFP fluorescence resonance energy transfer (FRET) is a powerful tool for investigating protein-protein interactions in living cells. The system has built-in image analysis tools for ratiometric imaging, simplifying data extraction and quantification.

INSTRUMENT FEATURES

Multi-camera imaging:
Elevating high-content screening speed

The Opera Phenix OptIQ high-content screening system uses its unique Synchrony Optics lightpath to get the most out of your high-content imaging applications. With up to four high quantum efficiency cameras (>95% QE) capturing simultaneous multi-color images, you'll experience significantly increased imaging speed, particularly valuable for extensive 3D stack imaging workflows.

The Opera Phenix OptIQ uses up to 4 cameras to capture images simultaneously

Camera 1

Camera 2

Camera 3

Camera 4

Single camera instruments capture one image at a time.
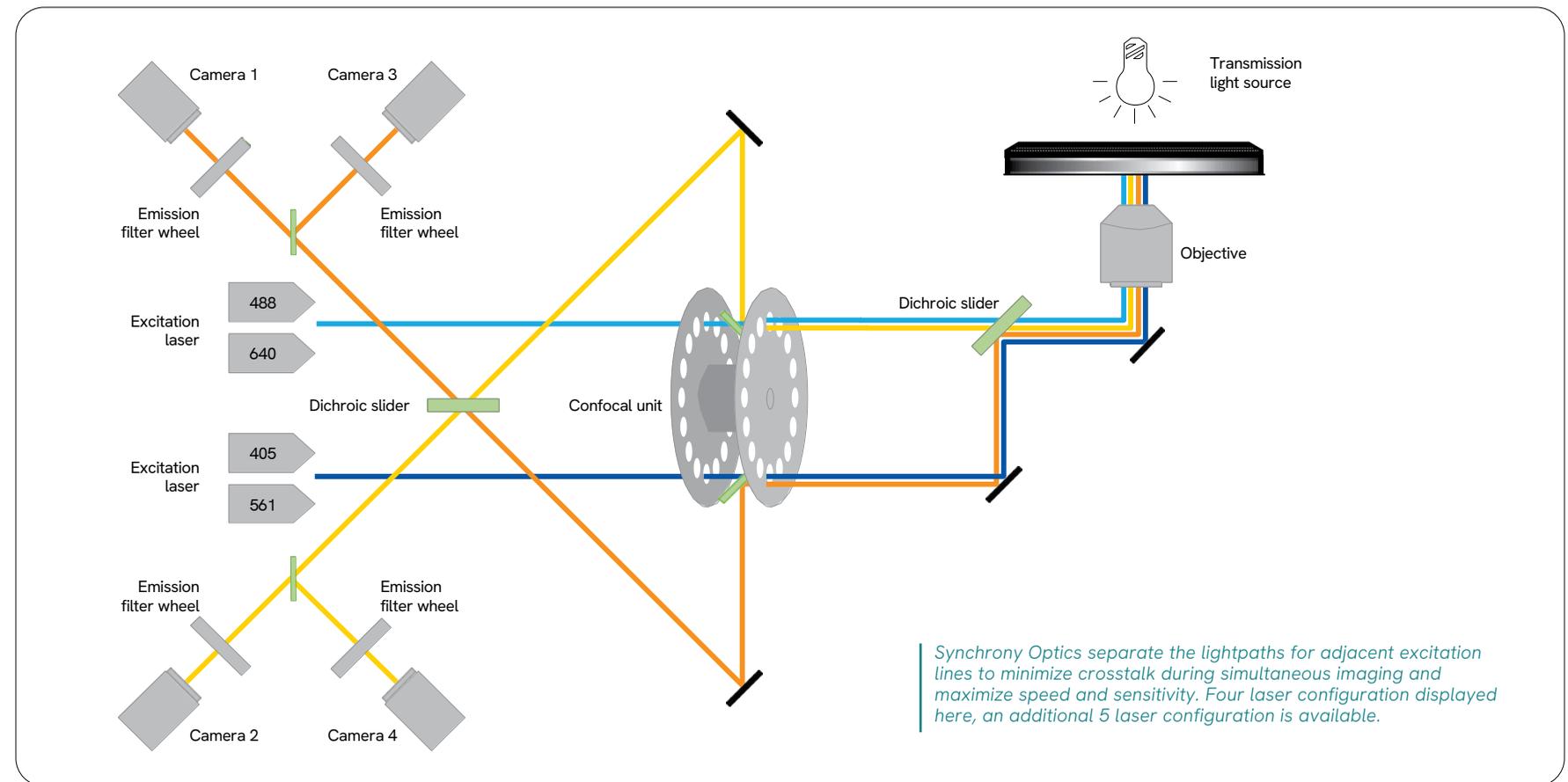
Camera 1   Camera 1   Camera 1   Camera 1

Time

At the heart of the Opera Phenix OptIQ system, patented Synchrony Optics make the trade-off between speed and sensitivity, delivering more light to the sample and capturing more light from it. A microlens-enhanced Nipkow disk with high transmission rates enables fast, sensitive true-multipoint confocal imaging. The dual-view design creates nonoverlapping pinhole patterns in the sample to minimize crosstalk between adjacent channels by up to 98% when performing simultaneous multi-color measurements with up to four cameras.* You can simultaneously acquire images of the nuclei (labeled with Hoechst) and of the cytoplasm (labeled with GFP) and up to two more markers – with minimal crosstalk.

*TECH NOTE

Opera Phenix system technical performance: Crosstalk suppression

Read now

Synchrony Optics separate the lightpaths for adjacent excitation lines to minimize crosstalk during simultaneous imaging and maximize speed and sensitivity. Four laser configuration displayed here, an additional 5 laser configuration is available.

INSTRUMENT FEATURES

Capture fast cellular responses

With its fast frame rate imaging capability and on-board liquid-handling option, the Opera Phenix OptIQ system supports assays that measure very fast cellular responses.

The system's imaging frame rate of 100 fps is designed to characterize fast cellular movements such as the beat-rate of cardiomyocytes, as often used in cardiotoxicity studies. And the fast frame rate, together with the dispense and read capabilities of the optional pipettor module, facilitates fast response assays in which cell responses occur within milliseconds to seconds – ideal for research applications such as calcium flux assays.

On-board liquid handling option at a glance	
Tip-based pipettor	Compatible with Revvity 20 µL and 200 µL tips, 1-200 µL in 1 µL increments
Compound addition	One compound plate and one reservoir, up to 2 additions per well
Sample plates	96- and 384-well microplates
Environmental control	Temperature, CO_2, and humidity
Automation compatibility	Compatible with automated exchange of sample plate, tip racks and compound plate
Imaging compatibility	Liquid handling module is compatible with brightfield imaging

HARMONY SOFTWARE

Everything you need, from acquisition to analysis

A Harmony's workflow-based interface makes the whole process of high-content analysis straightforward, from setup, to image analysis and data evaluation.

B Analyze common assays with more than 30 ready-made solutions, or create your own analysis sequence with simple image-analysis building blocks.

C Clear plate and well navigation and intuitive plate wizard for easy setup of new plate types.

D Results summary with immediate numerical output for fast insights.

Linked image and data table - Click on objects in the image and jump to corresponding data in the table quickly.

E Scalable storage, open data format, powerful search and fast data transfer to Image Artist Data Storage and Analysis software.

HARMONY SOFTWARE

Image analysis that's intuitive

Harmony's building block approach simplyfies image analysis complexity, empowering users to quickly turn data into meaningful research insights.

With modular image analysis building blocks you can:

- **Find Objects** such as nuclei and cytoplasm, or larger structures like spheroids or regions of interest.

- **Calculate Properties** to measure biological responses such as changes in morphology, intensity, texture, positions and more.

- **Classify Objects** to distinguish cell classes like live and dead, cell cycle phases or cells characterized by a combination of different features.

- **Report the final results** as heatmaps or graphs and easily generate dose response curves with EC50/IC50 and z-prime calculations for assay validation.

1.
Find objects

2.
Calculate properties

3.
Classify

4.
Report
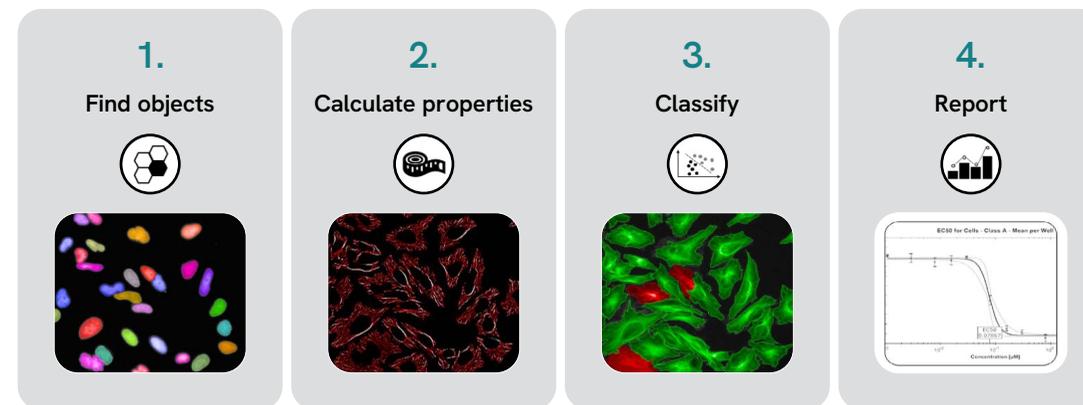
PRODUCT SPOTLIGHT

Find Organoids

A building block to detect organoids in brightfield stacks using 2D or 3D detection methods.

Minimum intensity projection images

| *Segmentation*

| *Border region*

Key features:

- Uses minimum intensity projection

- Improves object splitting in dense cultures

- Compatible with different organoid culture formats (single, multiple, domes) and morphologies (cyst-like, dark, dark rim)
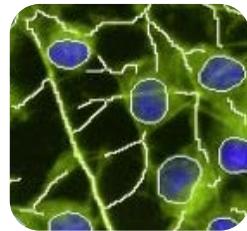
HARMONY SOFTWARE

Find and measure more in 2D

Find objects:
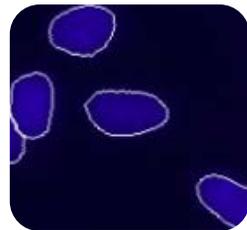
| Nuclei
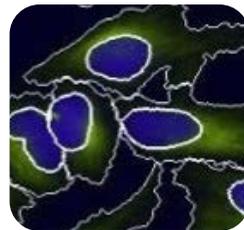
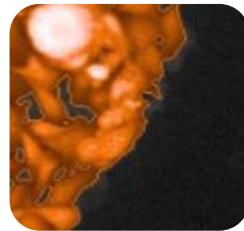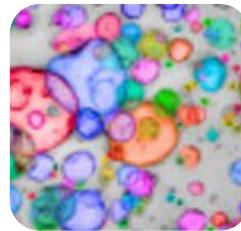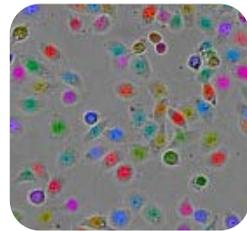| Cytoplasm
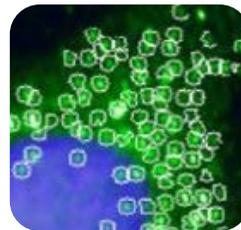
| Spots

| Neurites

| Regions

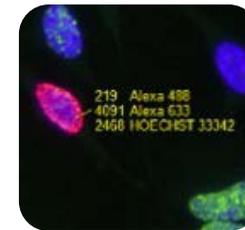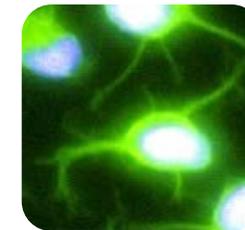| Organoids in BF *(NEW)*

⊕Phenologic.**AI**
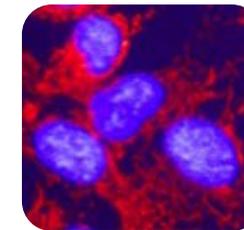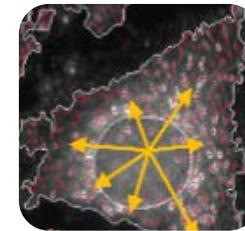

| Nuclei in BF

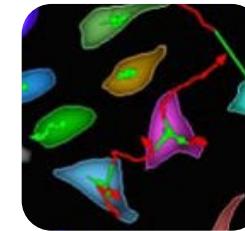⊕Phenologic.**AI**

| Cytoplasm in BF *(NEW)*

Measure objects:
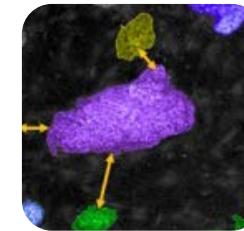
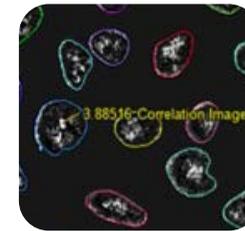

| Intensity

| Morphology
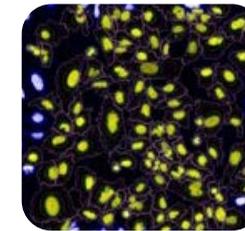

| Texture

| Intensity distribution

| Kinetic cell tracks


| Positions

| Correlation *(NEW)*

| Cell painting

HARMONY SOFTWARE

3D cell analysis, simplified

Organoids, spheroids, and organ-on-chip platforms deliver more physiologically relevant insights but present unique imaging and analysis challenges. Harmony imaging and analysis software provides dedicated 3D image acquisition, visualization and image analysis tools to make your journey smoother.

With Harmony you can:

- Utilize the PreciScan intelligent image acquisition workflow. With a low magnification pre-scan, image analysis and higher magnification re-scan you can center your objects of interest within the FOV in XYZ dimensions.

- Better understand your cell models by exploring them in the 3D viewer and XYZ viewer.

- Produce 3D renderings and movies such as rotational or z-stack movies.

- Calculate a range of stack projections (maximum, minimum, amplitude, median etc.) for fast and efficient feature extraction from stack measurements.

- Find objects in 3D and calculate 3D volumetric features including intensity, morphology, positions and 3D textures.

PreciScan 3D image acquisition:
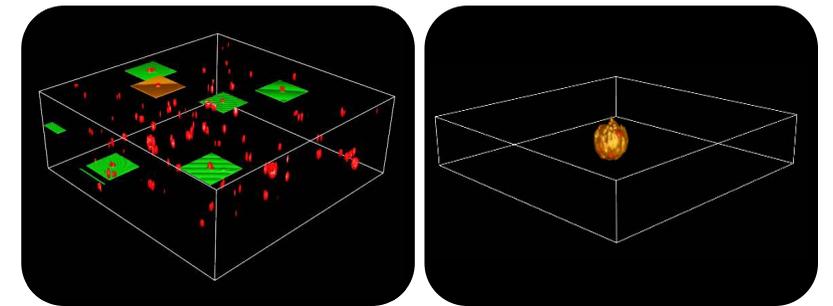
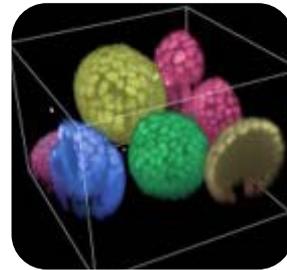*10x pre-scan in x, y, and z dimensions (left), 63x magnification re-scan (right).*
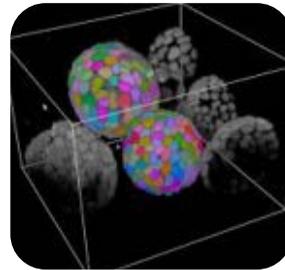
3D image visualization:
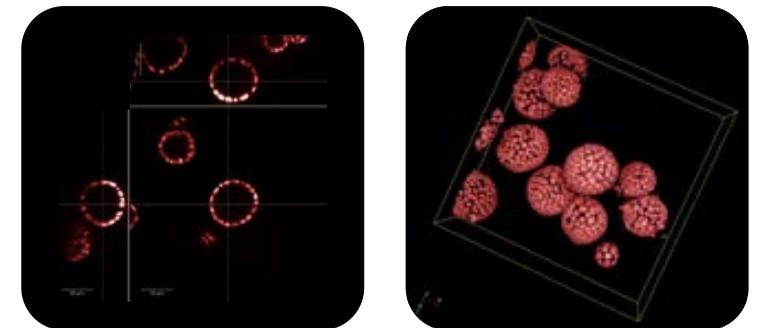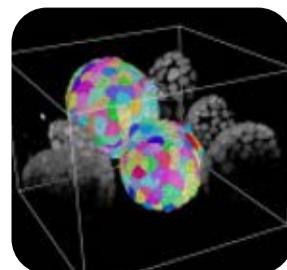

| *XYZ view*

| *3D view*
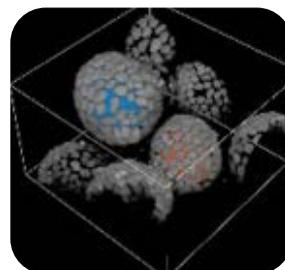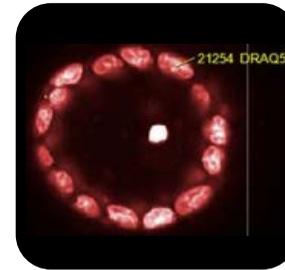
Discover and quantify in 3D

Find objects:

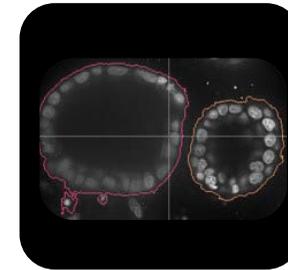| Organoids/cysts

| Nuclei

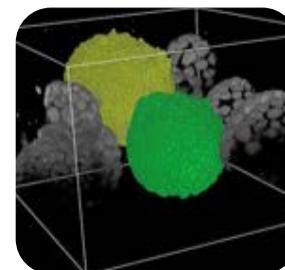| Cytoplasm

| Hollow spaces

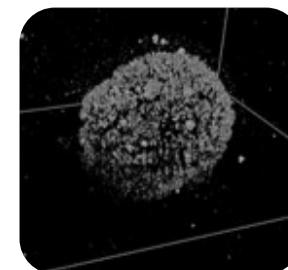### Measure objects:

| Intensity

| Morphology
(volume/ sphericity)

| Position

| Texture

PHENOLOGIC.AI

Phenologic.AI - The power of more

The Phenologic.AI™ module in Harmony™ and Image Artist™ software, harnesses the power of pretrained deep neural networks (DNNs) to provide an efficient and reliable method for identifying cells and cellular nuclei within fluorescent and brightfield images.*

- **Turnkey AI image analysis -** Utilize pre-trained AI models for easy and efficient analysis of both fluorescent and brightfield images.

- **Label-free segmentation** - Simplifies detection of cell nuclei, cytoplasm or whole cells in brightfield images without nuclear staining, saving time in sample preparation.

- **AI-based classification** - Using pretrained deep-learning image-analysis models, Phenologic.AI allows for classification of cells using brightfield and fluorescent images for easier analysis of live and fixed cell assays.

- **AI-based phase contrast** - Provides artifact-reduced phase contrast images.

- **Robust training** - Trained on diverse cell lines and all magnifications available on Revvity high-content systems, it reliably identifies cellular structures across a wide range of experimental conditions.

***WHITE PAPER**

Applications of AI, ML, and DL in cellular imaging

Read now

TECHNICAL NOTE

Nuclei segmentation on brightfield images using a pre-trained AI model

Read now

Object segmentation:

Brightfield — Fluorescence

| Find nuclei (AI)

| Find cells (AI)

| Calculate phase image (AI)

| Find nuclei (AI)

Object classification:

| Classify objects (AI)

Key benefits:

- Improved viability for live cell assays
- Less parameter tuning required
- Increased multiplexing capabilities

Key benefits:

- Simplified analysis sequence
- Robust results faster

CONFIGURATIONS

A solution configured to suit your scientific needs

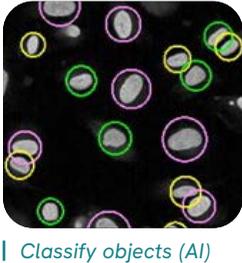To support a wide range of applications, the Opera Phenix OptIQ system can be configured to align with your research requirements.

Single

Single camera system offering the same sensitivity and resolution as the rest of the Opera Phenix family, with the ability to upgrade later with additional cameras.

Simultaneous

Higher speed, dual-camera system for multi-color, simultaneous confocal image acquisition and fast multiplexing.

FRET

With its five lasers and four-camera setup, it supports CFP/ YFP FRET applications to map protein-protein interactions.

Screener

The ultimate in throughput and performance, it delivers four cameras and four higher powered lasers – supporting screening of large libraries.

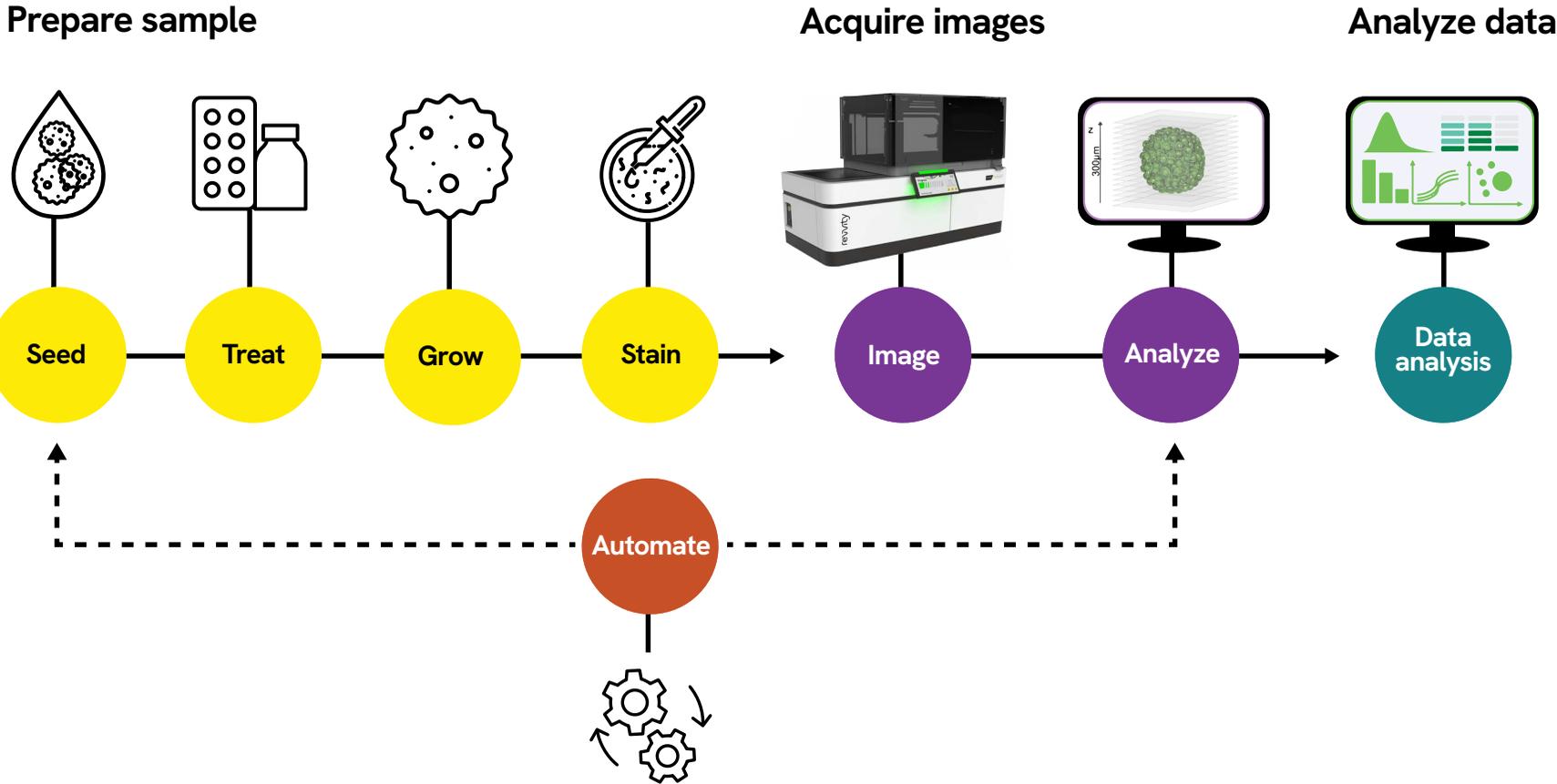All configurations available with on-board liquid handling.
Other configurations available on request.

HCS WORKFLOW

Because reproducible data requires more than a good imager

Prepare sample

Acquire images

Analyze data

ACCESSORIES AND SUPPORT

Integrated solutions from sample to insight

From our Pheno-family of reagents, kits, and microplates to automation and data analysis, our comprehensive portfolio of solutions help support the stages of your high-content screening workflow.

PhenoVue reagents and kits

A growing family of fluorescent dyes and kits. Example kits available are: Cell painting JUMP kit, Multi-organelle kit, Live cell painting kit, Neuronal differentiation staining kit.
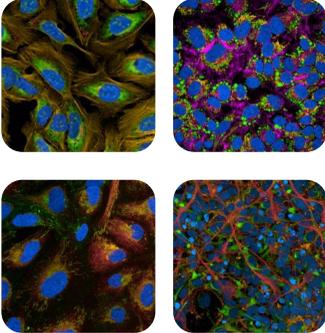
PhenoPlates

Drawing on 20 years of experience in high-content screening, Revvity's expert team has developed the PhenoPlate line of microplates. These microplates have been engineered to facilitate high-resolution imaging and deliver clarity essential for demanding high-content applications.

Automation

Automation solutions designed to maximize system utilization. Our automation solutions are scalable and modular and can grow with your needs.

Image and data analysis software

Don't let data limit your science. Transfer your images to Image Artist to increase accessibility and collaboration, speed up batch processing, and cross-examine data.

Signals One™ provides advanced data visualization and analysis tools.

ACCESSORIES AND SUPPORT

A partner in discovery: Ongoing support and HCS services

Your success doesn't end at the installation of the Opera Phenix OptIQ system, it's where our partnership truly begins.

Our support

We take a team-based, consultative approach to every engagement with you – one designed to align with your unique set of requirements. Our expert, global service and support team members are dedicated lab- and field-based applications specialists. They work in collaboration with you to help navigate the unique challenges your research applications may present.

High-content screening services

At Revvity, our high-content screening (HCS) services are built on a foundation of extensive imaging and screening expertise. Based in Cambridge UK, the team are supported by a global network specializing in every aspect of the imaging workflow. This infrastructure enables us to collaborate with clients to design and execute high-content screens aligned with specific research objectives.

Whether you want to explore how these cellular insights can advance your science, need additional capacity or expertise for a particular project, our preclinical services team are well-placed to support you.

For research use only.
Not for use in diagnostic procedures.

www.revvity.com

revvity