THE SPEED AND SENSITIVITY TO SEE THINGS DIFFERENTLY

Opera Phenix™
High-Content Screening System

For research use only. Not for use in diagnostic procedures.
Speed and sensitivity like you’ve never seen before

Today’s labs are moving beyond classic, target-based high-content screening and embracing phenotypic screening approaches with increasingly complex cellular models that yield unbiased, predictive results – and accelerating the translation of those results from in vitro to in vivo.

But to really benefit from phenotypic screening approaches and complex cellular models such as spheroids and 3D microtissues, you need more sensitivity to capture more information. And to generate robust results, you need the speed to image numerous cells under varying conditions and measure multiple parameters.

The problem is, researchers have had to choose between speed and sensitivity. Until now.

With the Opera Phenix high-content screening system, simultaneous multicolor confocal image acquisition delivers speed without compromising sensitivity, because spectral crosstalk is reduced to a minimum. That means higher throughput than ever – and richer content, too. Making it the ideal high-content screening system for discriminating phenotypes and studying complex disease models, such as primary cells and 3D microtissues.

The Opera Phenix system. All the speed and sensitivity you need. No compromise.
For the applications you're focused on

From everyday assays to the most demanding imaging and high-throughput screening applications, the Opera Phenix high-content screening system delivers the right combination of advanced optics and software features to help you glean more physiologically relevant information from your assays.

**Fixed-cell assays**

For assay development and common applications such as translocation assays, the Opera Phenix system has a choice of brightfield, digital-phase contrast, widefield, and spinning-disk confocal fluorescent imaging. Intuitive software with ready-to-go protocols get you productive fast.

**Live-cell assays**

Meaningful live-cell assays require minimal photodamage. Spinning-disk confocal optics and synchronized illumination minimize phototoxicity and bleaching when measuring fluorescent dyes. To analyze live cells without any fluorescent dye labels, you can choose the digital-phase contrast imaging mode.

**Complex cellular models**

3D cell culture models hold the promise of greater physiological relevance, but pose unique challenges for imaging. That’s why the Opera Phenix system’s spinning disk has an increased pinhole-to-pinhole distance to reduce out-of-focus noise in thick samples such as microtissues, while water immersion objectives provide high resolution even deep in the sample.

**Protein-protein interactions**

These types of interactions are pivotal for cellular function and are a major target for drug discovery. CFP-YFP fluorescent resonance energy transfer (FRET) is a powerful tool for investigating protein-protein interactions in living cells. With dedicated image analysis tools for ratiometric imaging, it’s easy to turn images into statistically significant results.

**High-throughput phenotyping**

When screening large libraries with 100,000 compounds or more, speed and sensitivity are crucial. Combine advanced optics with up to four large-format cameras and lasers that deliver up to three times more excitation power than standard lasers for sensitive high-throughput imaging.
The Opera Phenix high-content screening system is our top-of-the-line imaging instrument, drawing on more than a decade of experience in HCS applications. Its unique lightpath and advanced optics can take your high-content imaging applications to a new level.

No need to choose between speed and sensitivity

With other HCS systems, you have to sacrifice speed, as a single camera can acquire only one color at a time, or sensitivity, as spectral crosstalk artifacts limit sensitivity when imaging multiple fluorophores simultaneously. When using fluorophores with broad blue emission bands, such as DAPI and Hoechst DNA stains, the overlap with the green fluorescein protein-emission band can be pronounced, limiting the sensitivity for assays such as nuclear translocation. You can capture the blue and green channels sequentially, but that defeats the primary purpose of parallel detection – speed.

Synchrony Optics separate the lightpaths for adjacent excitation lines to minimize crosstalk during simultaneous imaging and maximize speed and sensitivity.
See your cells, not the crosstalk

Synchrony™ Optics make the tradeoff between speed and sensitivity unnecessary. At the heart of the Opera Phenix, the patented Synchrony Optics deliver more light to the sample and capture 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 98% when performing simultaneous multicolor measurements with up to four cameras.

So now you can simultaneously acquire images of the nuclei (labeled with Hoechst) and of the cytoplasm (labeled with GFP, for example) and up to two more markers – with minimal crosstalk. Confocal Synchrony Optics enable simultaneous multicolor HCS experiments faster than ever before, without losing sensitivity due to crosstalk.

Hela cells stained with Hoechst (DNA) and Alexa488 labeled anti-tubulin antibodies and imaged with traditional simultaneous acquisition. The Alexa488 channel shows pronounced crosstalk from the Hoechst stain in the nuclear region.

Make every photon count

From effectively controlling excitation and collecting fluorescence emission to detecting photons with the highest levels of sensitivity, the Opera Phenix system is designed to maximize performance:

• Spinning-disk optics and careful synchronization of laser excitation and camera exposure minimize bleaching and phototoxicity.

• Proprietary automated water-immersion objectives with very high numerical aperture deliver and capture more photons and provide higher resolution in XYZ than conventional air objectives.

• Up to four large-format sCMOS cameras deliver low noise, wide dynamic range, and high resolution – perfect for sensitive and quantitative measurements at short exposure times.

Together, these features make the Opera Phenix system the ideal choice for live-cell and other high-content screening applications.

The same staining imaged simultaneously on the Opera Phenix system with Synchrony Optics shows only minimal crosstalk in the nucleus.
With Harmony® high-content imaging and analysis software, you can easily quantify more of what you see in your images. Harmony software includes everything you need to analyze the most complex cellular models in 3D, reliably discriminate phenotypes, and turn your biological data into knowledge.

**Everything you need, from acquisition to analysis**

With Harmony software, it’s easy to control every aspect of an Opera Phenix experiment through a single workflow-based user interface. From setting up an acquisition protocol to analyzing images and evaluating results, Harmony software guides you through the entire process and provides instant feedback.

- Analyze common assays with more than 30 ready-made solutions, or create your own with simple image-analysis building blocks
- Easily quantify complex cellular phenotypes based on changes in morphology, fluorescence intensity, intensity distribution, and texture parameters
- Follow phenotypic changes over time and accurately quantify label-free live cell images
- Visualize and analyze your samples in 3D for greater depth of information and insights in a more physiologically relevant context
- Find images, metadata, and results quickly via the integrated sortable database

**EVERYTHING COMES TOGETHER IN HARMONY**

A. Workflow-based interface with easy-to-read icons
B. Analysis building blocks for easy protocol design
C. Clear plate navigation and wizard for easy setup of new plate types
D. Results summary with immediate numerical output for faster insights
Easily quantify cellular phenotypes – even in complex 3D models

Everything you need for 3D image acquisition, visualization, and analysis is right here in Harmony software. You can speed up 3D image acquisition through targeted imaging independent of culture method e.g. plates or hydrogels, and better understand your cell models by exploring them in a 3D viewer and an XYZ viewer. Plus, you can measure morphology, volume, and texture in 3D; count nuclei within spheroids; and calculate XYZ positional properties. You can also quickly analyze your z-stack as maximum intensity projection, with 3D information preserved, using PlaneMap technology.

Accurately target your objects of interest for greater efficiency

High-content screening can capture fine subcellular detail with very high resolution images but high resolution can slow down acquisition times and create large amounts of data. So, ideally, you want to acquire high-resolution data only from your regions or objects of interest.

The PreciScan plug-in for Harmony software enables intelligent image acquisition to let you accurately target your objects of interest in x, y and z dimensions, such as spheroids, stem cell colonies, or rare cell phenotypes. The software delivers a fully automated, integrated workflow of low-magnification prescans, image analysis, and higher magnification rescans to reduce acquisition times and data volume and ultimately speed up analysis significantly.

Become an image analysis expert with machine learning

With the PhenoLOGIC™ software plug-in, you can recognize different cell populations and regions by example – making it easy to create optimized algorithms. Just click on a few cells of each type to show the software what you’re looking for. PhenoLOGIC software then selects the most meaningful combination of parameters to robustly discriminate phenotypes or to segment images based on texture features.

Make better decisions sooner

Export your results automatically into the Columbus™ image data storage and analysis system, so you can access, reanalyze, store, and share image data from Opera Phenix and other HCS systems across your organization. You can also use High-Content Profiler™, powered by TIBCO Spotfire® software, to aggregate your data with data from multiple sources, perform data QC and normalization, perform true multiparametric phenotypic analysis with its machine learning tools, and benefit from its interactive visual dashboards.
A solution configured to suit every need

Whatever your application, there’s an Opera Phenix system configured to meet your requirements. And it’s modular, so it can change with your research demands.

<table>
<thead>
<tr>
<th>BASIC</th>
<th>STANDARD</th>
<th>FRET</th>
<th>SCREEENER</th>
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<tbody>
<tr>
<td>With a single camera and four lasers, this model delivers outstanding sensitivity and resolution, and can accommodate more cameras if needed.</td>
<td>Two cameras and four lasers make this model perfect for simultaneous acquisition, with extraordinary sensitivity and resolution and fast multiplexing.</td>
<td>With its five lasers and four-camera setup, it’s designed for CFP/ YFP FRET applications to map protein-protein interactions.</td>
<td>The ultimate in throughput and performance, it delivers four cameras and four higher powered lasers – perfect for screening large libraries.</td>
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*Other configurations available on request.

It pays to automate

Higher throughput, improved productivity, reduced variability, savings on reagent costs – these benefits and more come from automating your Opera Phenix system. Integrate with the plate::handler™ system for automated plate loading to enable overnight runs, or automate entire high-content screening workflows with cell::explorer™ automated workstations.

The perfect plate for the work you do

For best results, choose the microplates designed specifically for high-end imaging systems. We’ve developed and validated a range of microplates for HCS applications, including CellCarrier™ plates with a unique patented design for high-content imaging readers.

Count on Our Support

Your application needs are as individual as you are. So we take a team-based, consultative approach to every engagement with you – one that addresses your unique set of requirements. Our expert, global service and support teams, comprised of dedicated lab- and field-based applications specialists, can work with you in partnership to overcome the unique challenges your application brings.

For more information please visit our website: www.perkinelmer.com/operaphenix

Acknowledgements:
Pg 3: FRET sample courtesy of Dr. Somponrat Sampattavanich, Department of Pharmacology, Faculty of Medicine Siriraj Hospital, Thailand
Pg 4-5: Image courtesy of Dr. Gabor Foldes, National Heart and Lung Institute, Imperial College London and Dr. Janos Kriston-Vizi, MRC Laboratory for Molecular Cell Biology, University College London

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