Cellular Imaging Solutions

Imaging with a vision
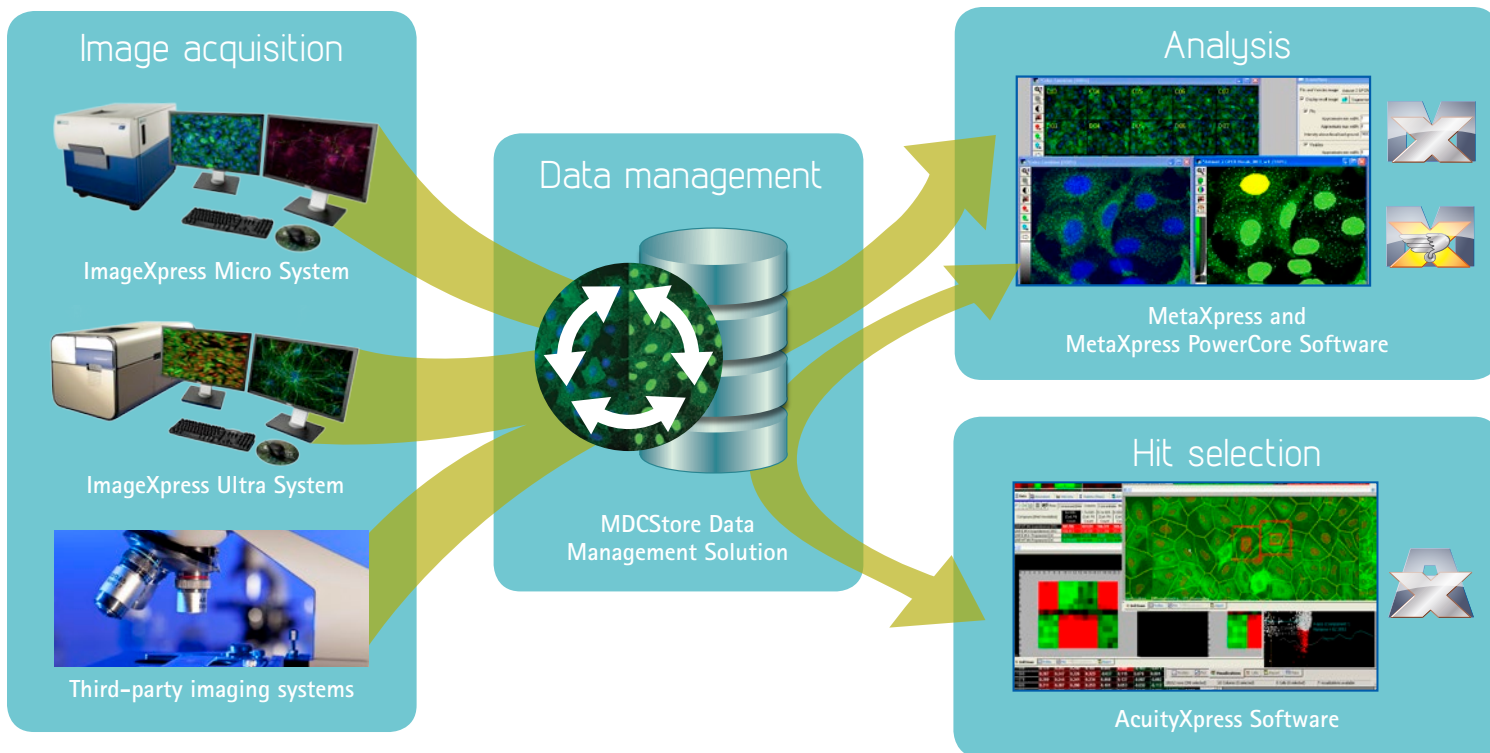
Molecular Devices
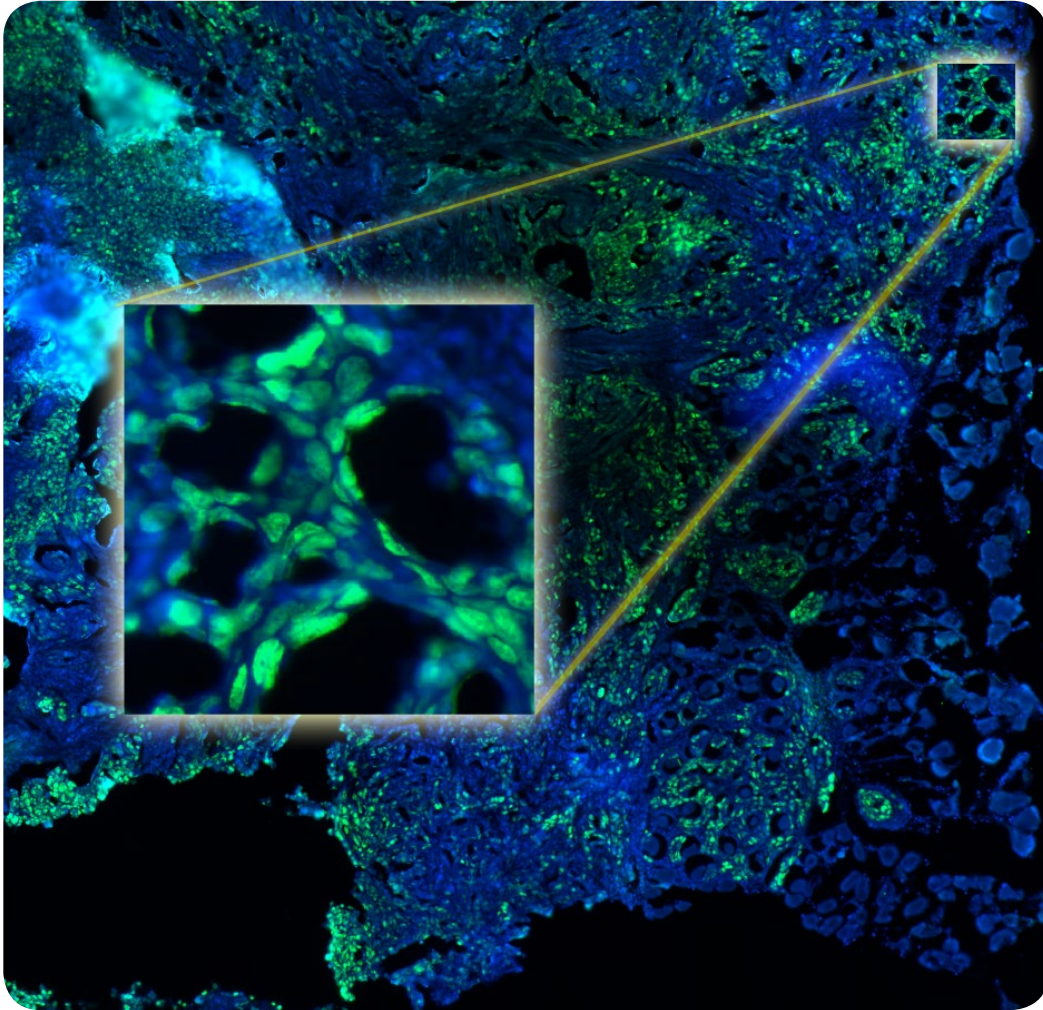
High content screening (HCS) utilizes automated, high-resolution microscopy systems to assay and visualize phenotypic responses in cells. Cells plated on slides or in wells are imaged at high speed, then morphological information is extracted from fluorescent or brightfield images by robust analysis software.

The complete high content imaging portfolio from Molecular Devices® aims to provide the ultimate flexibility and performance to help researchers perform tailored assays and shorten time to result. From robust imaging systems packaged with intelligent analysis software to integrated data management and visual informatics, our complete solution addresses an expansive set of applications from basic imaging research through drug discovery.

A complete cellular imaging solution

Image acquisition

ImageXpress Micro System

ImageXpress Ultra System

Third-party imaging systems

Data management

MDCStore Data
Management Solution

Analysis

MetaXpress and
MetaXpress PowerCore Software

Hit selection

AcuityXpress Software

MetaXpress Software is a key component of the Molecular Devices imaging solution, ensuring image acquisition and analysis can be tailored to your HCS workflow.

## A complete and flexible acquisition and analysis platform

Enjoy the benefits of a streamlined HCS workflow in a fully integrated environment with Molecular Devices' complete imaging solution. Regardless of the acquisition system used, images taken can be stored in the secure MDCStore™ Data Management Solution and be made accessible for sophisticated analysis by the MetaXpress® High Content Image Acquisition and Analysis Software. When incorporated with AcuityXpress™ Informatics Software, data visualization, mining and hit selection are ready to use upon system installation. Our complete solution avoids bottlenecks in image analysis and data processing that are common to the HCS workflow. If integration with third-party imaging systems or analysis tools are required, the MDCStore™ Data Management Solution provides a portal for data migration to external host databases or third-party applications and from third-party imaging systems.
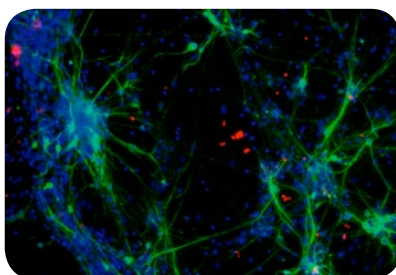
ImageXpress Micro Widefield System

The ImageXpress Micro System base unit; available options include standard and XLS models. **Inset:** ImageXpress Micro System with environmental control and fluidics (top) and transmitted light (bottom) options.
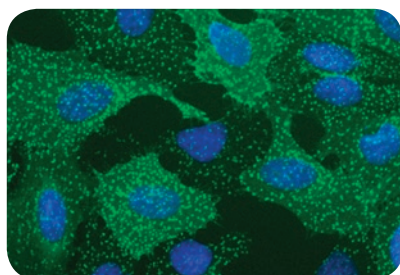
Transfluor® Assay captured by the ImageXpress Micro System.

Three-color overlay of motor neurons in culture captured on the ImageXpress Micro System.

Exceptional image acquisition platforms

Capturing low- to high-resolution is easy with the ImageXpress® Micro and ImageXpress® Ultra Systems, which support up to 100X objective lenses and generate research-quality images at high speed. These systems provide premiere X, Y and Z positioning using voice coil motor movement with 100 nm resolution to precisely locate and identify sub-cellular features. Pinpoint positioning simplifies multi-site, time-lapse experiments and tiling for large multi-image experiments. Rapid positioning, in combination with the laser and image autofocus, plus an easy-to-use interface, further improve the high content analysis workflow.

Robust widefield imaging

The ImageXpress Micro System is a versatile instrument offering an inverted widefield microscope that comes in standard or XLS models. The XLS model is equipped with a large field-of-view and an on-demand solid state light engine, providing greater throughput at a speed of > 50,000 wells per day. Supported by MetaXpress Software, the ImageXpress Micro System provides a fast and robust platform to translate new discoveries into scientific breakthroughs.* Features and options of the ImageXpress Micro System include:

- Environmental control and fluidics options for live cell assays and time-lapse experiments
- High-phase contrast transmitted light option to avoid toxic staining
- Software digital confocal option to enhance image contrast while maintaining throughput.

With so many possibilities, the ImageXpress Micro System is able to automate any fluorescent, brightfield or phase contrast microscopy application and is a robust imaging system ideal for high throughput screening workflow.

ImageXpress Ultra Confocal System
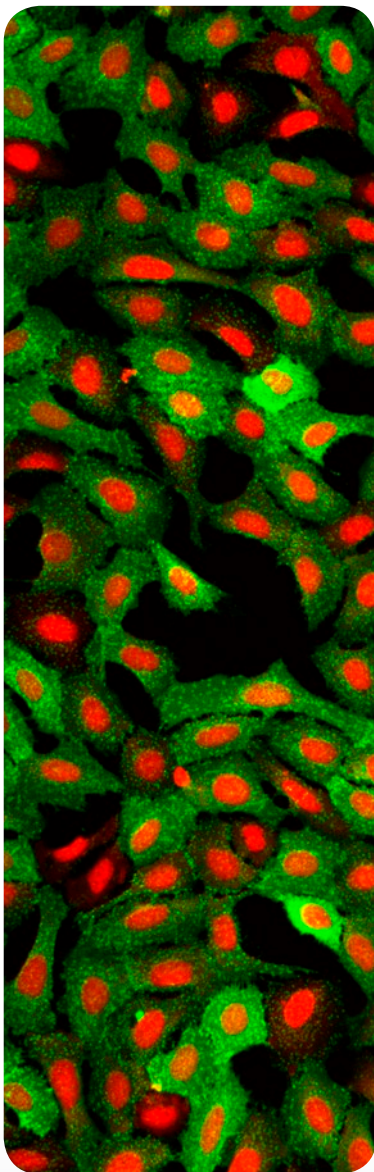
The ImageXpress Ultra System is a four-channel confocal imager available with the following lasers: 405, 488, 532, 561, and 635 nm.
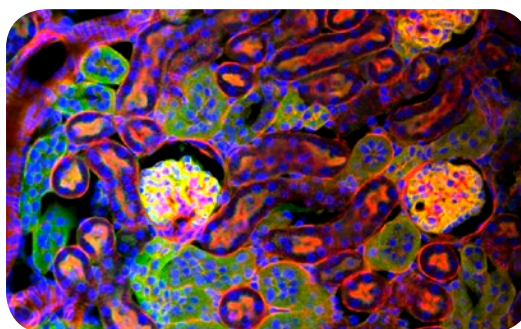
Imaging on the ImageXpress Ultra System: Mouse kidney section (above) collected with a 40X PA 0.95 NA objective and a long format scan of U2OS cells from a Transfluor Assay (left).

True point-source confocal imaging

The ImageXpress Ultra System is the only true point-source, laser scanning confocal imaging platform configured for 4-color simultaneous HCS. A configurable pinhole provides an advantage over spinning disk confocal systems by allowing fine tuning of z-section thickness and signal strength to achieve the ideal speed and image quality for your assay. The ImageXpress Ultra System features:

- Continuous long scans up to 1:32 aspect ratio to track long and detailed cellular processes
- Sequential and simultaneous scanning
- Small footprint, precise X, Y, Z control, and high-speed laser autofocus technology

The ImageXpress Ultra System is a robust, high-speed, research-quality confocal imaging system for HCS.

Powerful and flexible software

Built upon the well-established MetaMorph® Microscopy Automation and Image Analysis Software, MetaXpress Software is the image acquisition and analysis platform for ImageXpress Systems. MetaXpress software includes a set of dynamic functions specifically designed to facilitate configuration of image acquisition and analysis for any HCS workflow. A single interface for setting plate types, image capture protocols, and automated image analysis, including time-lapse data, is intuitive and simple. MetaXpress Software provides integration with MDCStore Data Management Solution and facilitates processing of large datasets. Instrument settings, analysis configurations, images and analyzed data are seamlessly managed in a database to ensure an integrated workflow.
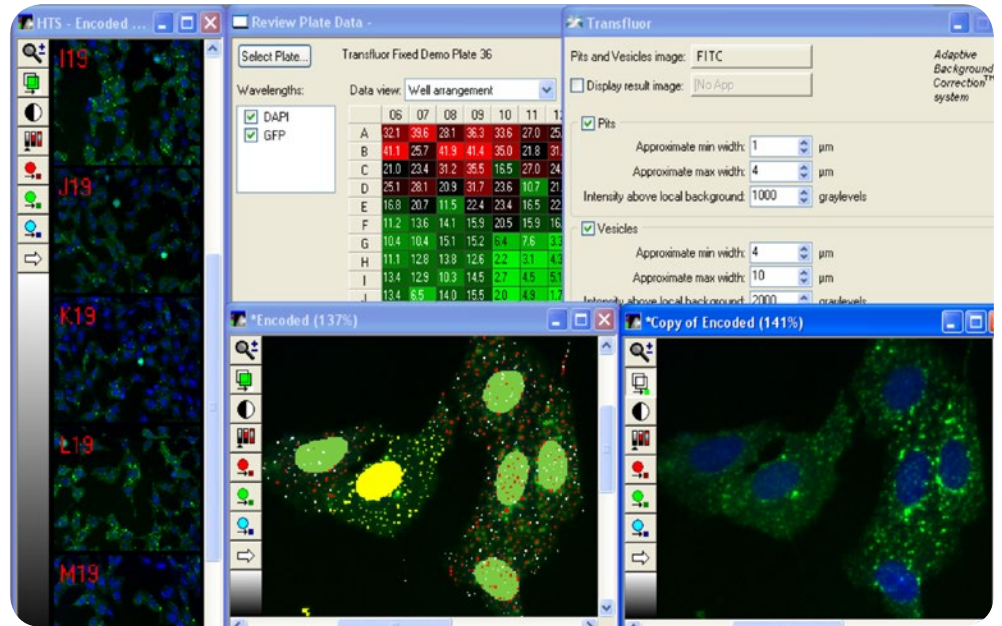

The MetaXpress Software interface showing a well-based gallery (left) and individual images from a Transfluor Assay in their raw (right) and analyzed (middle) states.

Comprehensive analysis toolbox

The power of the MetaMorph Software backbone complements the turnkey application modules for novel or custom work where user-configured analysis modules can be put to use with ease.

MetaXpress Software offers an intuitive and flexible set of analysis tools to address a wide range of imaging experiments. Whether users have little or advanced knowledge of image processing, the software provides an analysis continuum suitable for all experience levels.

Application module continuum

Application modules
Turnkey

Custom modules
Flexible

Journal macros
Powerful
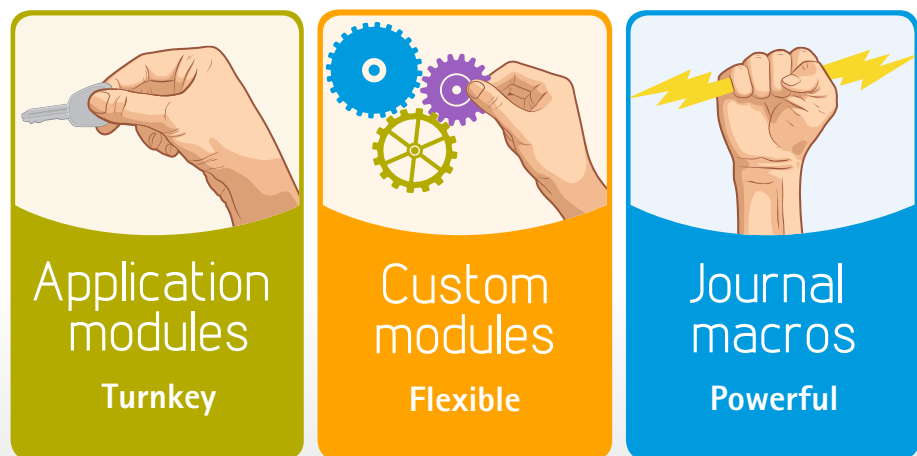
Analysis continuum with increasing flexibility and complexity

Legend
- ■ Applications
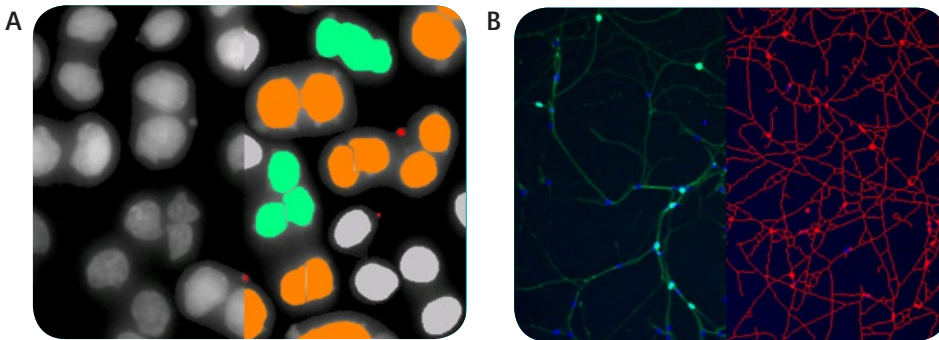- ■ Application Modules

Process Extension
Neurite Outgrowth
Punctae in Neurite (custom module) **NEW!**

Fatty Acid Uptake
Cell Scoring

Receptor Internalization and
Punctate Patterns
Granularity, Transfluor Assay

Cell Proliferation
Count Nuclei

Cell Cycle
Mitotic Index, Cell Cycle,
Monopole Detection

Pathway Analysis
and Multiplexing
Multi-Wavelength Cell Scoring

Protein Expression & Modification,
Transient Transfection
Cell Scoring

Cell Viability/Toxicity
Live/Dead,
Multi-Wavelength Cell Scoring

Cell Signalling by Translocation
Translocation (Enhanced)

DNA Damage/Genotoxicity
Cell Scoring, Micronuclei

Mitochondrial Localization
Translocation

Tube Formation
Angiogenesis

Membrane Potential
Cell Health

Intracellular Trafficking
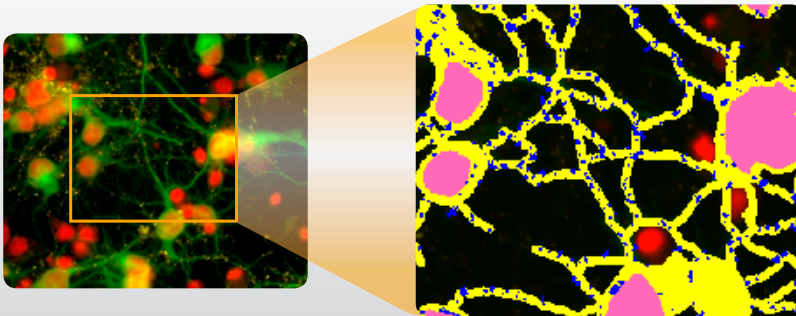Multi-Wavelength Translocation

Segment easily with turnkey application modules

A

B

Analysis of poly- and micro-nucleated cells (**A**) and neurite outgrowth (**B**) with dedicated MetaXpress Software Application Modules showing captured image (left) and processed image (right).

Custom modules in action

Pictured above is a custom module that counts puncta in neurite outgrowths. Additional parameters recorded were number of nuclei and number of outgrowths per cell. The segmentation overlay shows: yellow: neurites; dark blue dots: synaptic peptides; pink: nuclei. The custom module excluded non-neuronal nuclei from the analysis.

Simple and turnkey

A full suite of pre-designed MetaXpress Software application modules is available for turnkey image segmentation and quantification tasks utilized by common high-content screening assays, such as cell counting, intracellular signaling, cell health, and micronuclei identification.

- Simply set values in pre-configured modules and run
- Perfect for well-defined applications

Flexible and advanced

For increased assay complexity, users can create custom analysis in the Custom Module Editor and view result output at each step easily. The intuitive interface guides users through a step-by-step creation of custom analysis, such as identifying objects within objects, creating morphometric classifiers for shape analysis, and analyzing transmitted light images.

- Create, test, save and share analysis templates with guided interface
- Add analysis flexibility and bridge the gap between pre-designed application modules and advanced scripting
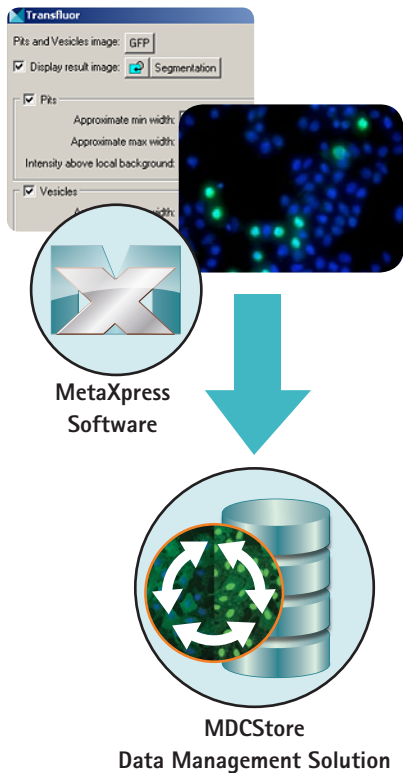
Powerful and expansive

For ultimate customization, a scripting environment supports the development of powerful routines to tackle complex analysis.
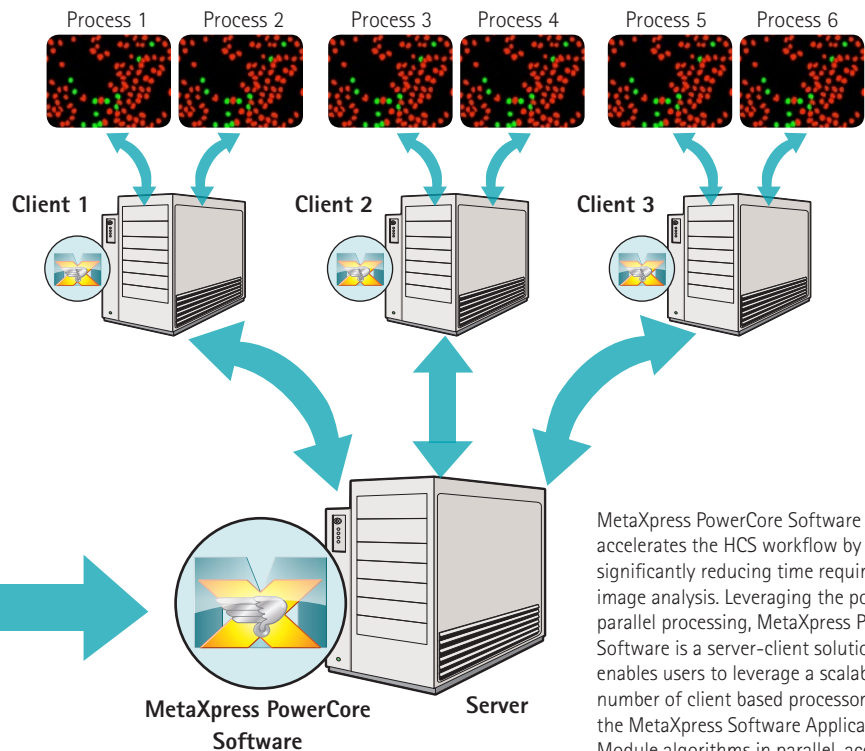
- Tailored hardware control and software analysis for unique and interactive assays
- No programming language experience needed

High speed data and integrated storage

Image analysis

**MetaXpress
Software**

**MDCStore
Data Management Solution**

The power of parallel processing

| Process 1 | Process 2 | Process 3 | Process 4 | Process 5 | Process 6 |

Client 1 **Client 2** **Client 3**

**MetaXpress PowerCore
Software** **Server**

MetaXpress PowerCore Software accelerates the HCS workflow by significantly reducing time required for image analysis. Leveraging the power of parallel processing, MetaXpress PowerCore Software is a server-client solution that enables users to leverage a scalable number of client based processors to run the MetaXpress Software Application Module algorithms in parallel, accelerating analysis 5- to 40-fold.

High-throughput image processing

MetaXpress® PowerCore™ Software is a distributed analysis platform for MetaXpress Software application modules and custom modules, providing revolutionary improvements in analysis speed. Throughput is maximized by simultaneously distributing images to multiple CPUs or processor cores to execute analysis. With processing speed increased by 5- to 40-fold, image analysis bottlenecks are eliminated and do not interfere with optimal image acquisition performance. Using MetaXpress PowerCore Software, multiple ImageXpress Systems can be run in parallel and large datasets can be re-analyzed with no image analysis bottlenecks.

Robust data management

Scalability and integrity are crucial aspects of data management in any automated imaging or screening environment. The MDCStore Data Management Solution is an open, commercially supported platform for managing imaging data, providing users with a validated way to securely access, manage and deploy their automated imaging and HCS. The MDCStore Xchange Service automates image import from a variety of sources and data export to other analysis software packages, with Open Microscopy Environment (OME) and 3rd party imaging hardware-compatible templates.
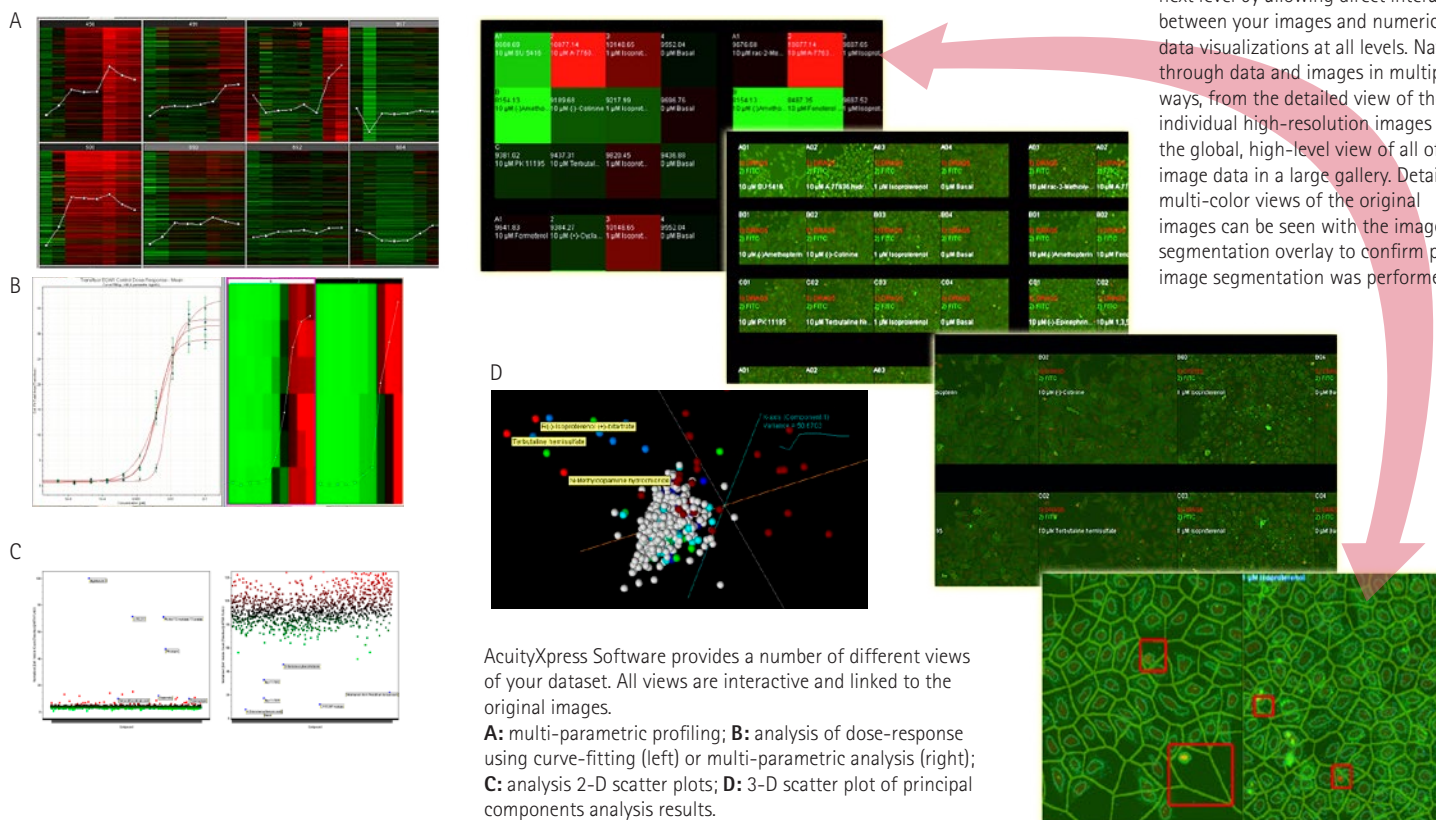
The interactive image viewer brings visualization of high-content data to the next level by allowing direct interaction between your images and numerical data visualizations at all levels. Navigate through data and images in multiple ways, from the detailed view of the individual high-resolution images to the global, high-level view of all of the image data in a large gallery. Detailed multi-color views of the original images can be seen with the image segmentation overlay to confirm proper image segmentation was performed.

AcuityXpress Software provides a number of different views of your dataset. All views are interactive and linked to the original images.
A: multi-parametric profiling; **B:** analysis of dose-response using curve-fitting (left) or multi-parametric analysis (right); **C:** analysis 2-D scatter plots; **D:** 3-D scatter plot of principal components analysis results.

Visual cellular informatics

AcuityXpress Cellular Informatics Software is specifically designed to address large, multi-parametric datasets generated by high-content data analysis. Data are smoothly exchanged between AcuityXpress Software and the MDCStore Data Management Solution to ensure analysis is performed efficiently and that all additional content is funneled back into one central storage location.

The interactive image viewer in AcuityXpress Software brings visualization of high-content data to the next level. This tool allows for direct interaction between images and numerical data at all levels. Drill down from plots, clusters and dose-response curves to the original high-resolution images to validate the results and confirm hits. Multicolor overlays and image segmentation can be viewed during drill down to validate all data points necessary to make an informed decision. Once hits are identified, they can be reviewed at the single-plate level or across multiple screens.

Additional features include:
- Curve-fitting for IC_{50} and EC_{50} calculation with predefined and custom functions.
- Multiple search, minimization and weighting methods, parameter seeding and model comparison.
- K-means, K-medians, hierarchical clustering, self-organizing maps, principal component analysis using cellular phenotypes and compound responses.
- Interactive image viewer to select the image data and analyze specific populations of cells or compounds.
- Statistical data include Z'-factor, p-values correlation coefficients.

Ordering information

ImageXpress High Content Screening Systems	System configurations	Software	Integration services
ImageXpress Micro Widefield System ImageXpress Micro XLS Widefield System	Phase contrast transmitted light Environmental control Fluidics	MetaXpress Image Acquisition and Analysis Software • Pre-designed Application Modules • Custom Module Editor • Software deconvolution option • MetaXpress PowerCore High Content Distributed Image Analysis Software MDCStore Data Management Solution • MDCStore Xchange Data Conversion Service	Offline analysis workstations, databases and file server systems Plate loading robot and customized robotics solutions
ImageXpress Ultra Confocal System		AcuityXpress Cellular Informatics Software MetaXpress PowerCore Software	

Additional options are available to customize your systems, including objectives, filter sets, software, light sources, robotics, and application modules. Please contact your local sales representative for more information.
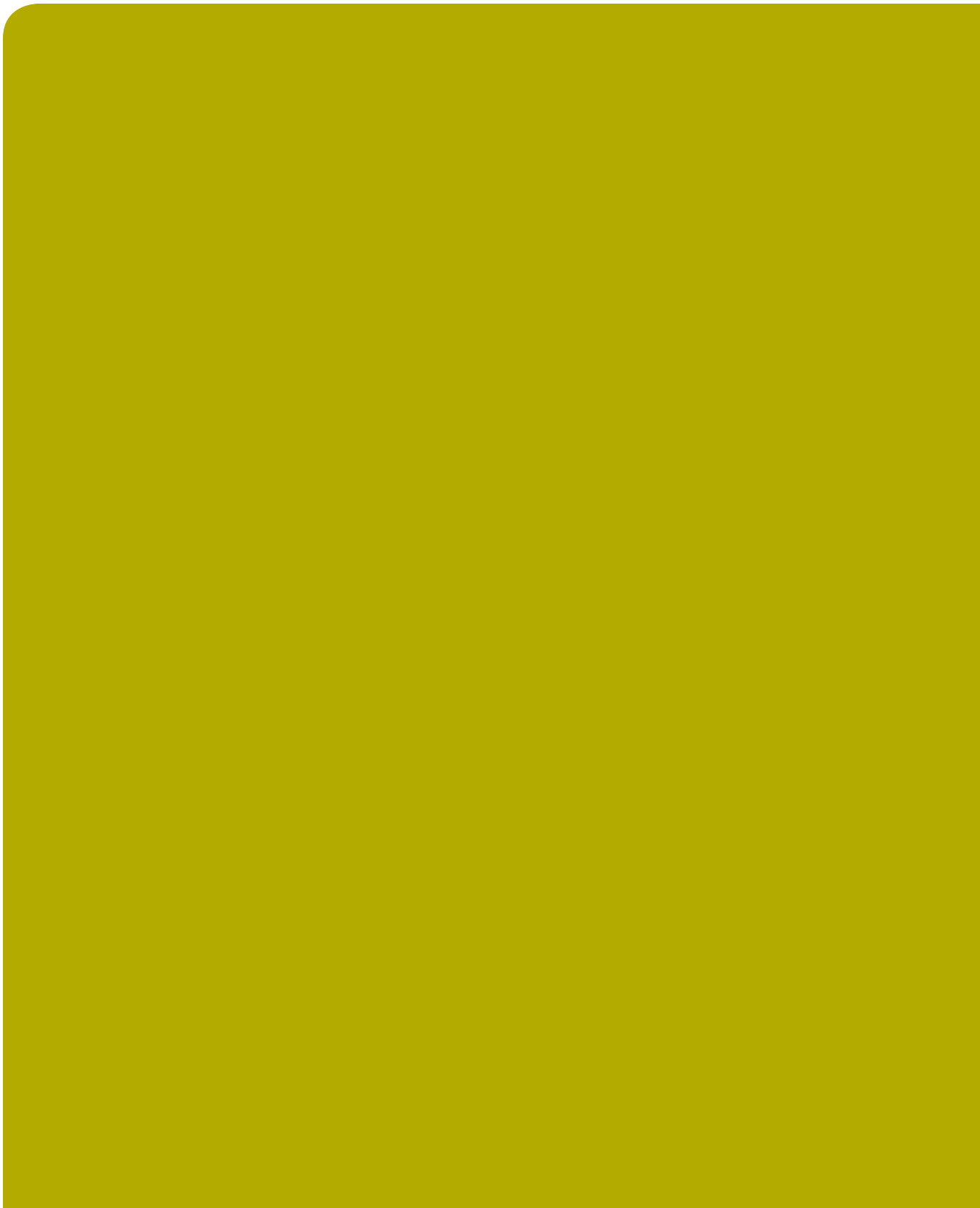
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Check our web site for a current listing
of worldwide distributors.

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China (Shanghai)	+86-21-3372-1088
Germany	00800-665-32860
Japan (Tokyo)	+81-3-6362-5260
Japan (Osaka)	+81-6-7174-8831
South Korea	+82-2-3471-9531
United Kingdom	+44-118-944-8000

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