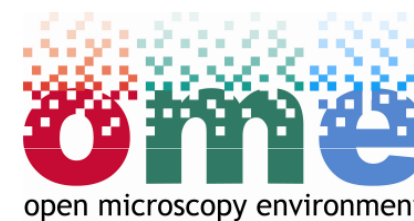


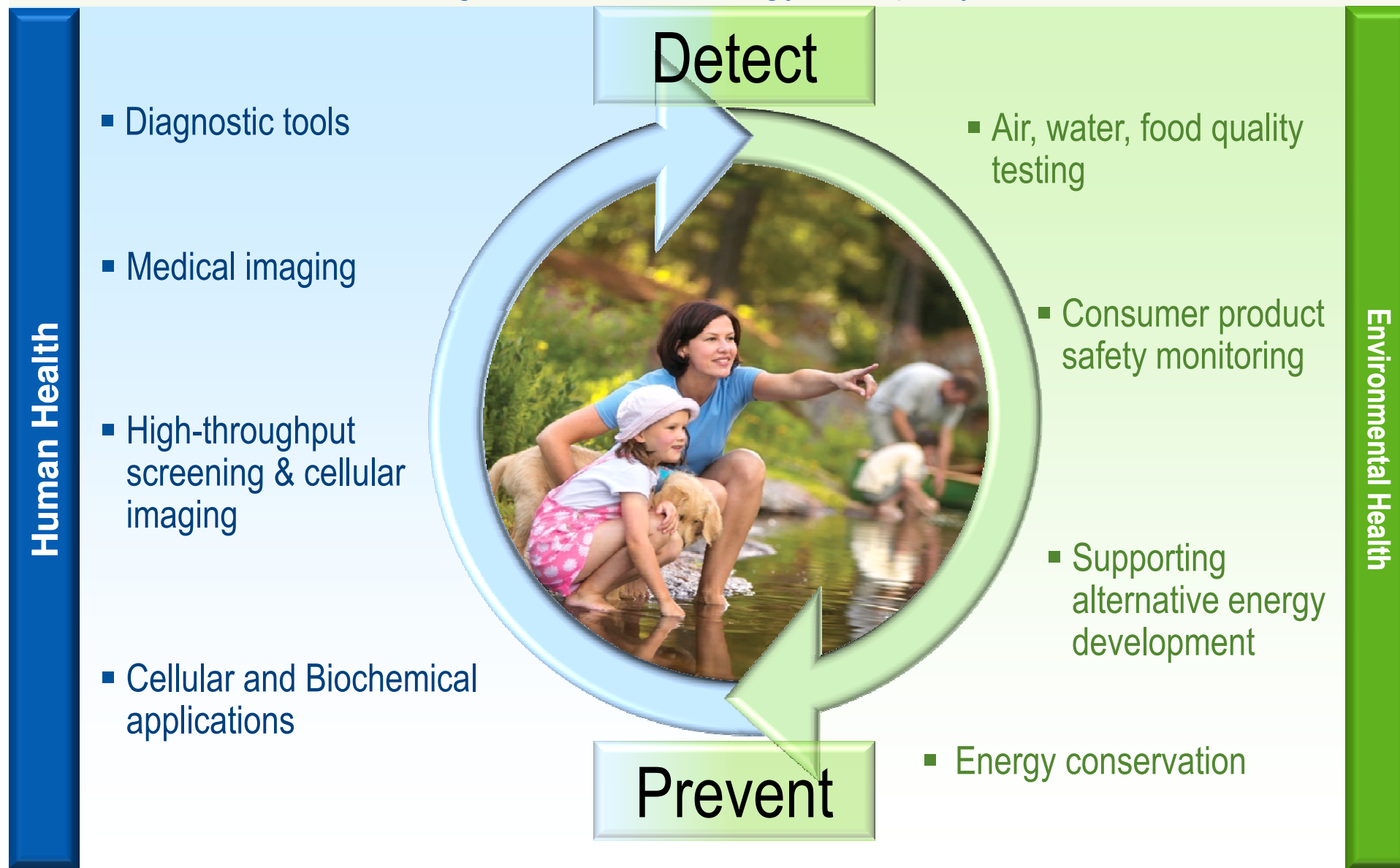
$$\frac{dC_{nuc}(t)}{dt} = k_{in}C_{cyto} - k_{out}C_{nuc}(t)$$

$$k_{out} = k_{export} + k_{degradation} = \frac{1}{\tau},$$

## Population Selection based on Cellular Fingerprints

Martin Daffertshofer,  
OME User's Meeting  
Institut Pasteur Paris  
June 2011





# IDT Software in Drug Discovery

Biological  
Research

Target Ident.  
Validation

Lead  
Generation

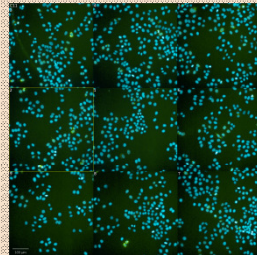
Lead  
Optimization

Pre. Clinic.  
Development

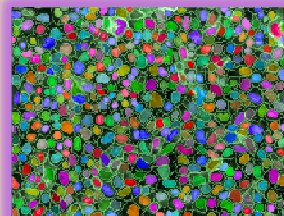
3d Microscopy



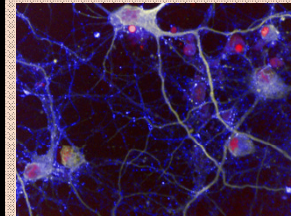
Functional  
Screening



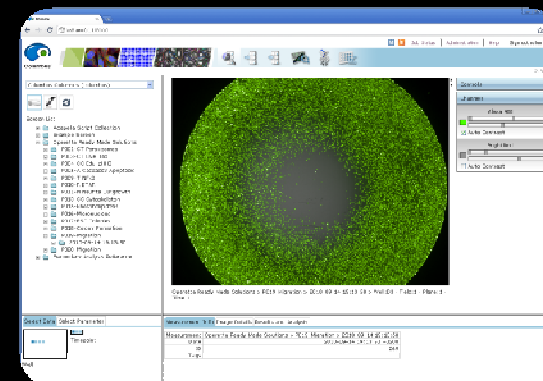
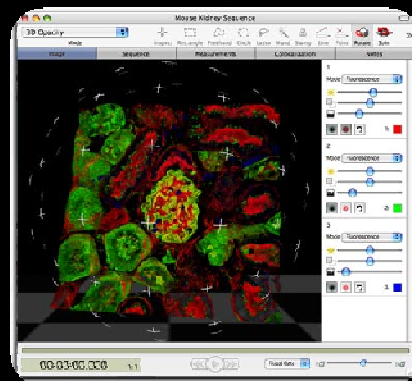
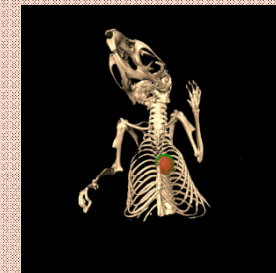
High Content  
Screening



Toxicology



Small Animal  
Imaging

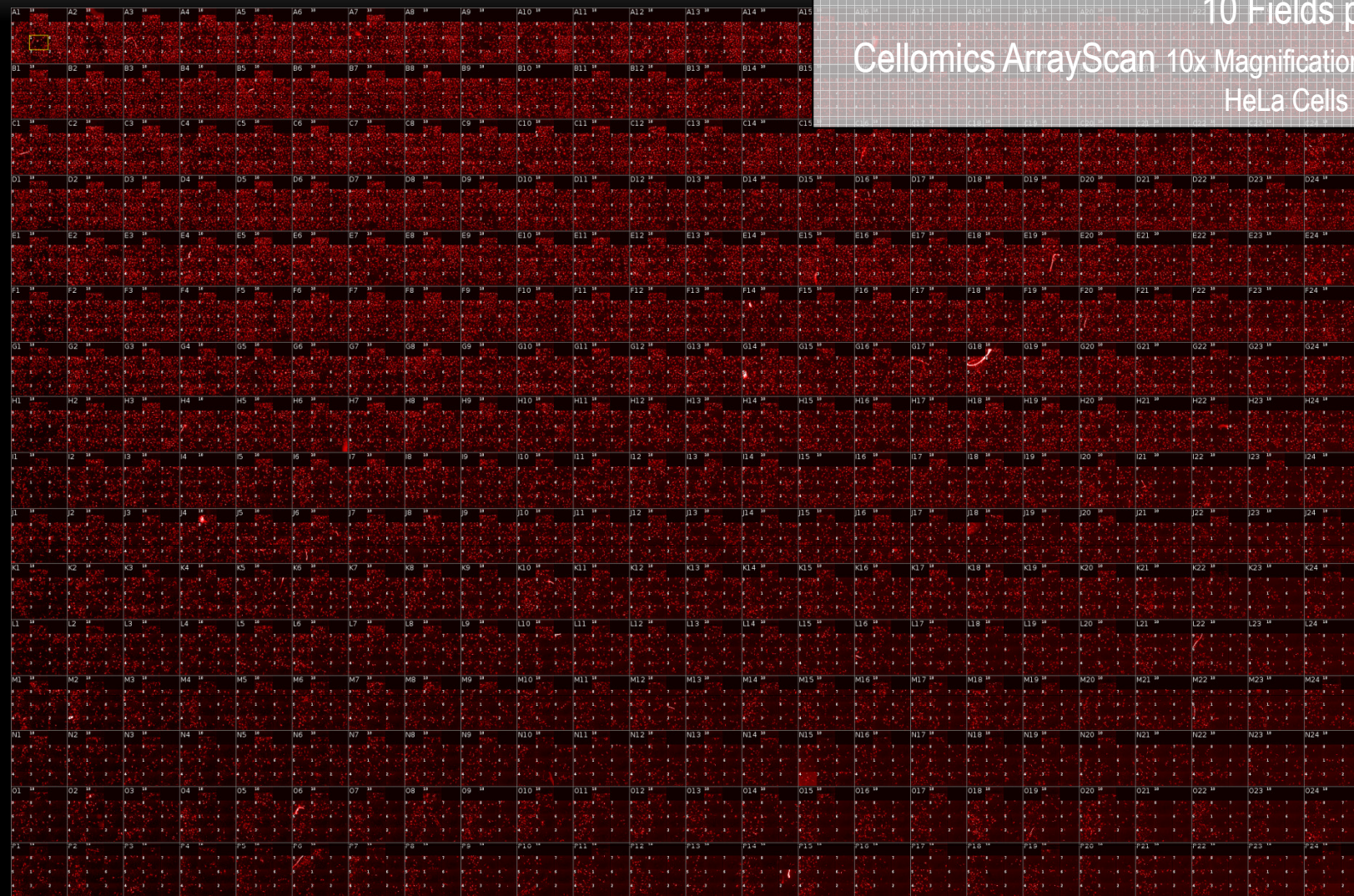


Velocity and Columbus - Image Analysis, Visualization and Management from Biological Research to Drug Discovery



# Columbus – Visualization of High Content Data

## Plate-Montage Display



384 MicroTiterPlate  
10 Fields per Well

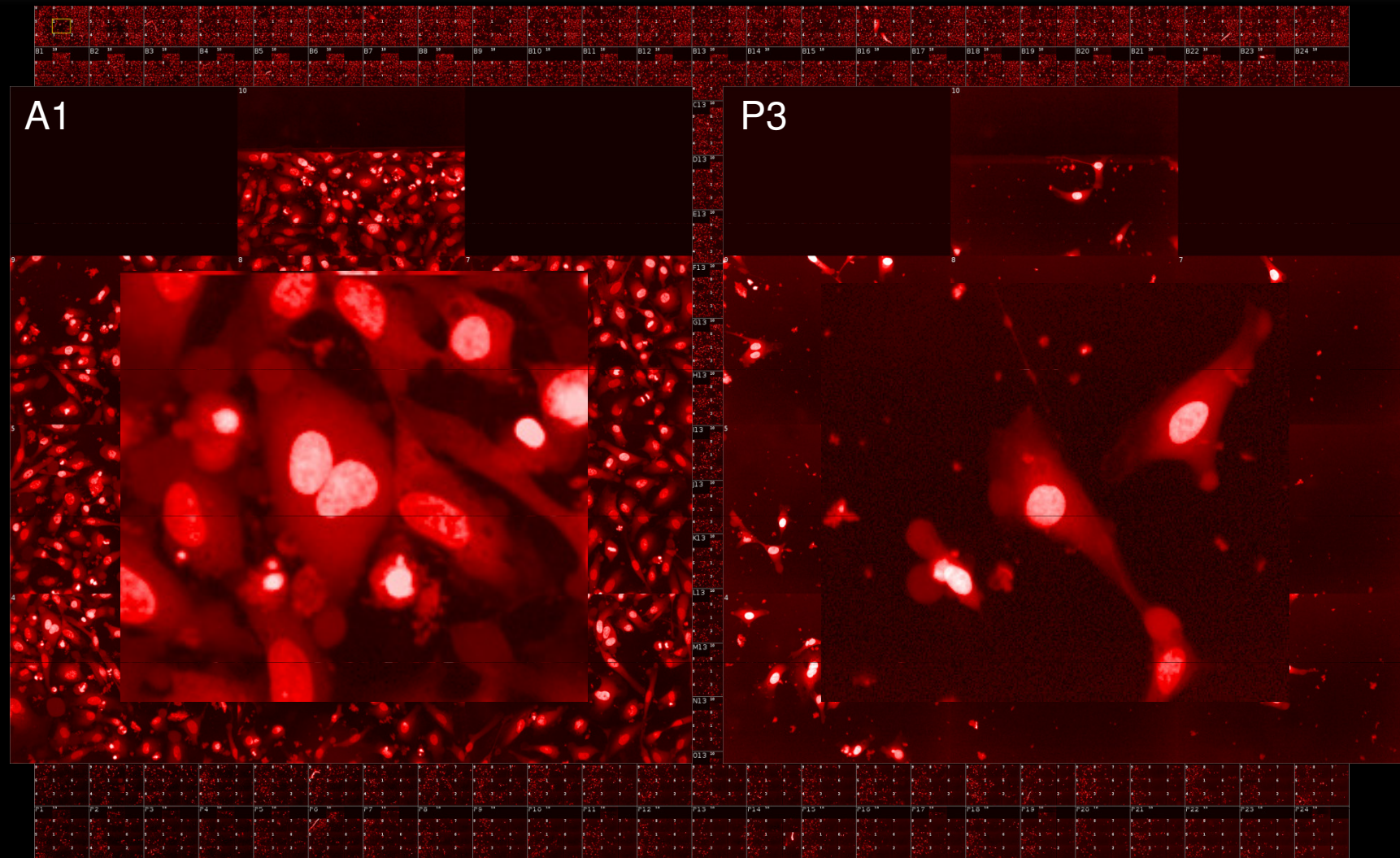
Cellomics ArrayScan 10x Magnification, 405 nm  
HeLa Cells / Hoechst

Data kindly provided by Hind Azegrouz and Maria Montoya at CNIC Madrid



# Columbus – Visualization of High Content Data

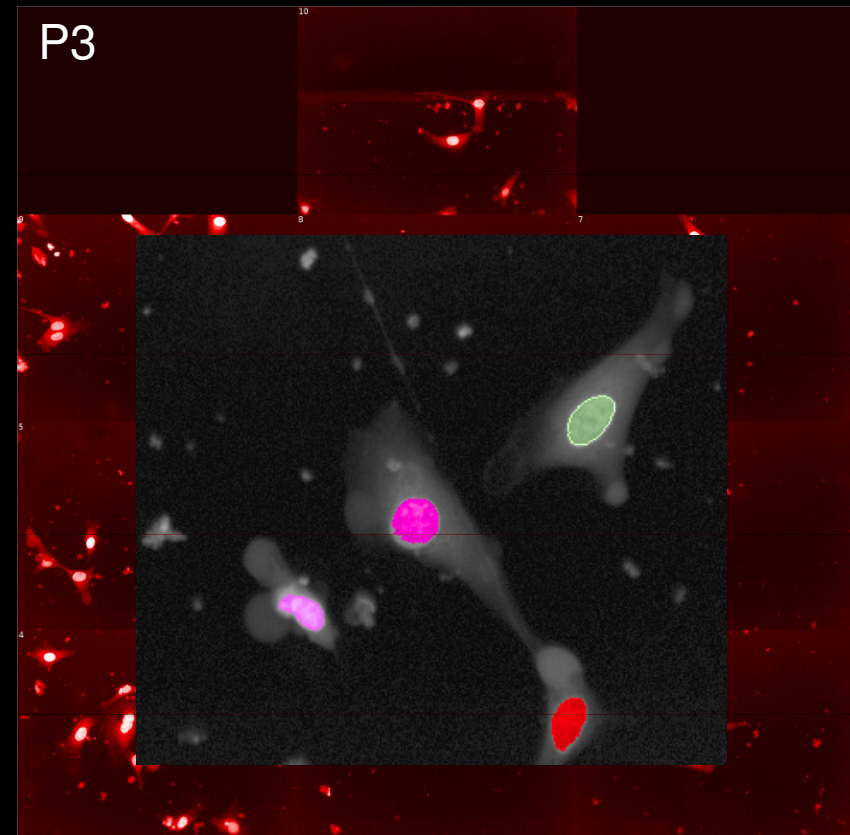
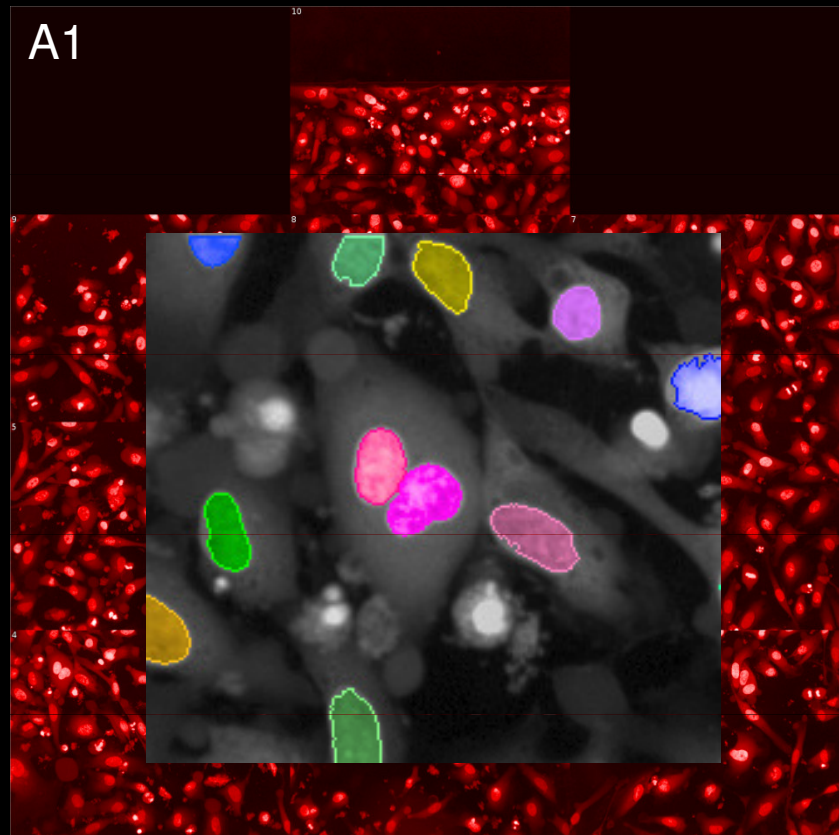
## Well-Montage Display



Data kindly provided by Hind Azegrouz and Maria Montoya at CNIC Madrid

## Columbus – Image Segmentation / Find Nuclei

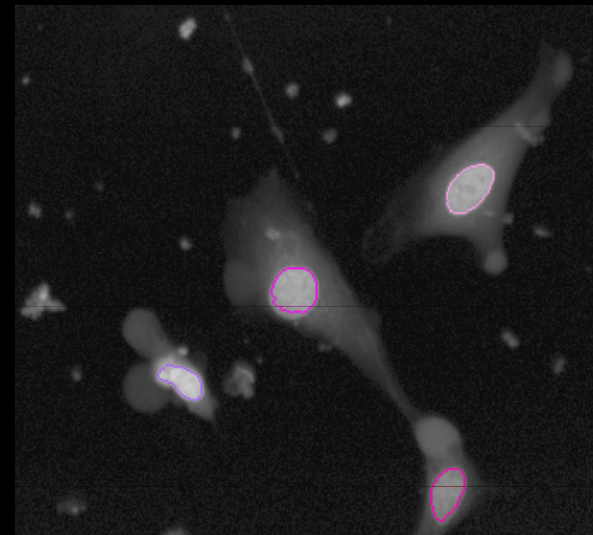
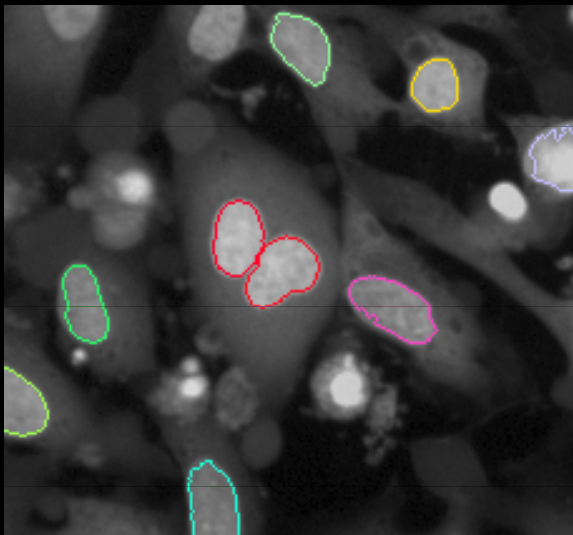
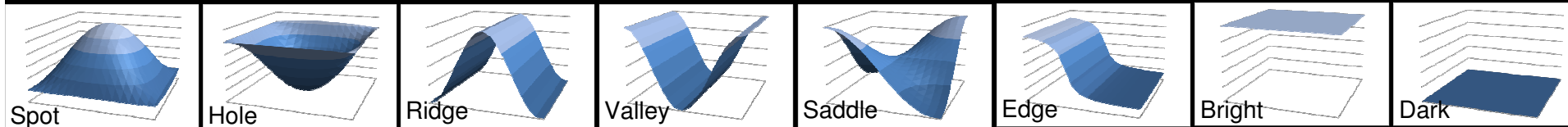
Robust segmentation utilizing OMERO provided metadata



Data kindly provided by Hind Azegrouz and Maria Montoya at CNIC Madrid

# Columbus – SER (Saddle-Edge-Ridge) Texture Analysis

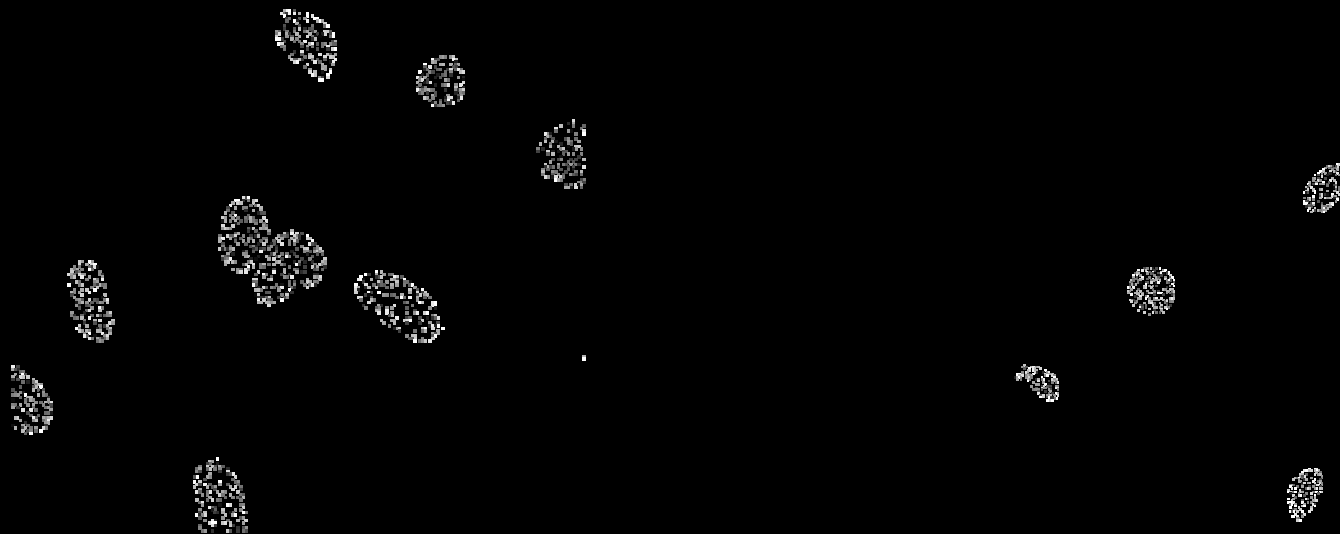
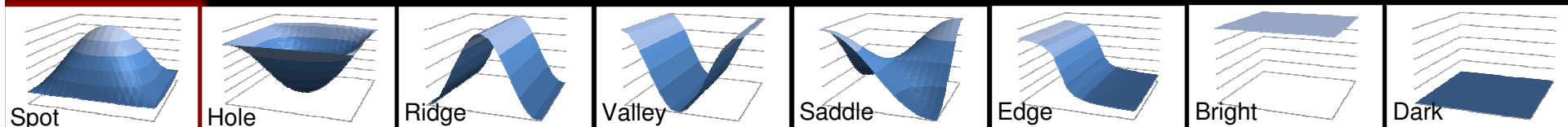
## Texture analysis in segmented nuclei



Data kindly provided by Hind Azegrouz and Maria Montoya at CNIC Madrid

# Columbus – SER (Saddle-Edge-Ridge) Texture Analysis

## Spots

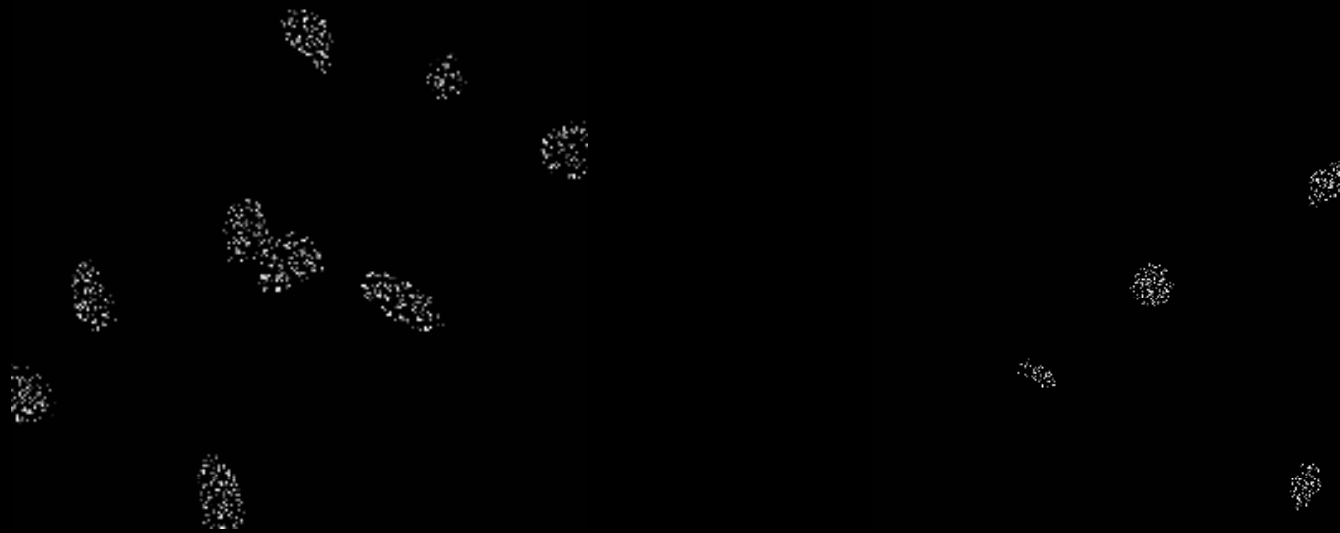
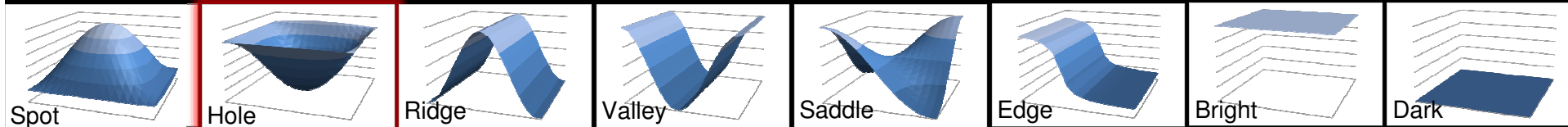


Data kindly provided by Hind Azegrouz and Maria Montoya at CNIC Madrid



# Columbus – SER (Saddle-Edge-Ridge) Texture Analysis

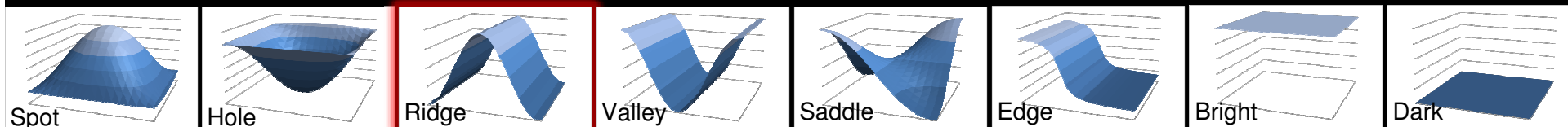
## Holes



Data kindly provided by Hind Azegrouz and Maria Montoya at CNIC Madrid

# Columbus – SER (Saddle-Edge-Ridge) Texture Analysis

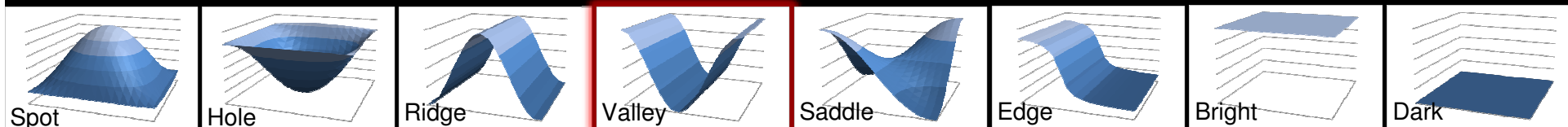
## Ridges



Data kindly provided by Hind Azegrouz and Maria Montoya at CNIC Madrid

# Columbus – SER (Saddle-Edge-Ridge) Texture Analysis

## Valleys

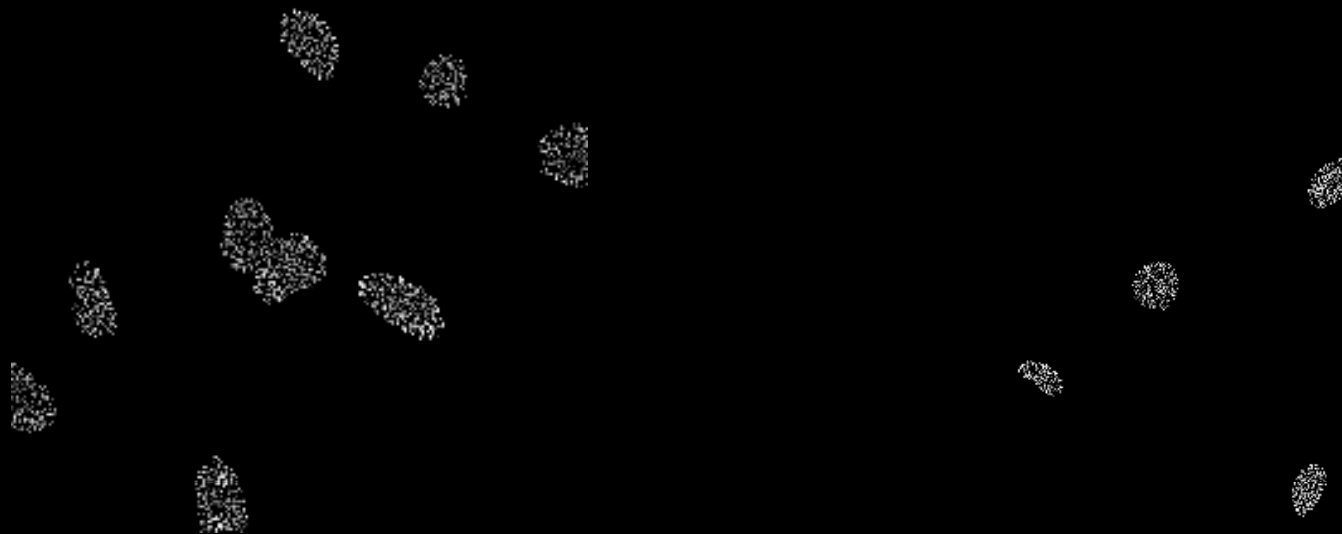
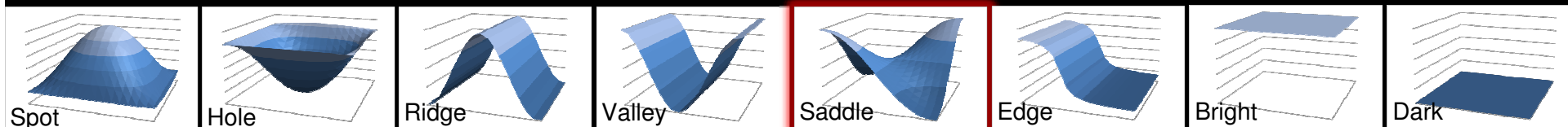


Data kindly provided by Hind Azegrouz and Maria Montoya at CNIC Madrid



# Columbus – SER (Saddle-Edge-Ridge) Texture Analysis

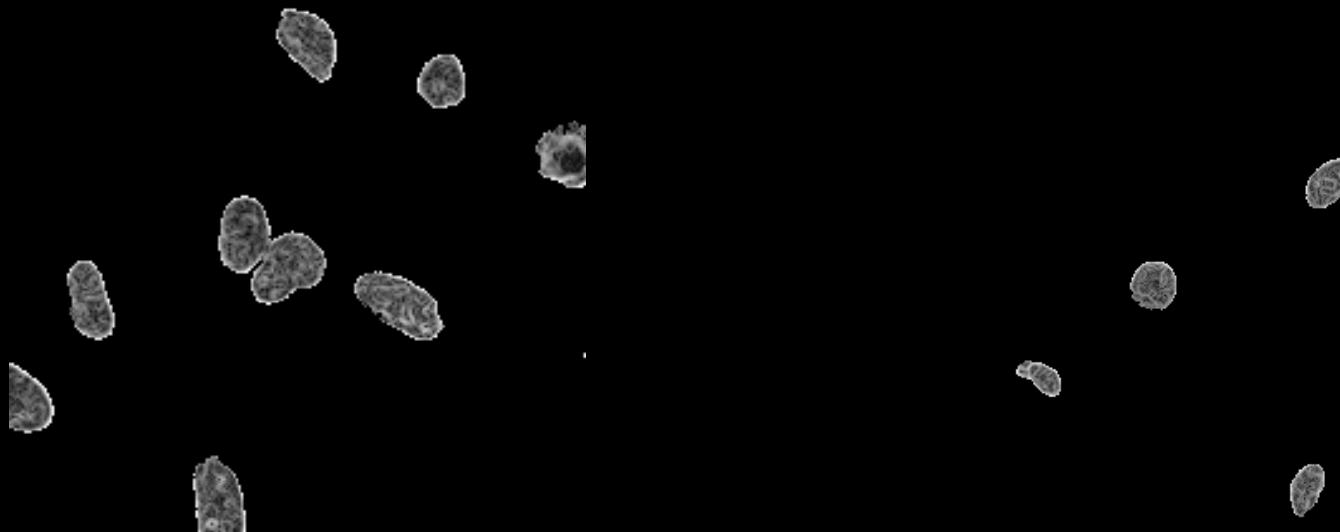
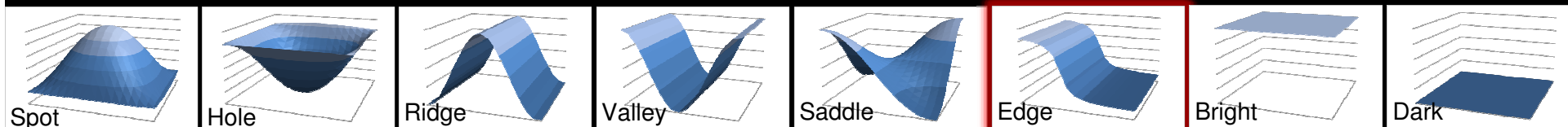
## Saddles



Data kindly provided by Hind Azegrouz and Maria Montoya at CNIC Madrid

# Columbus – SER (Saddle-Edge-Ridge) Texture Analysis

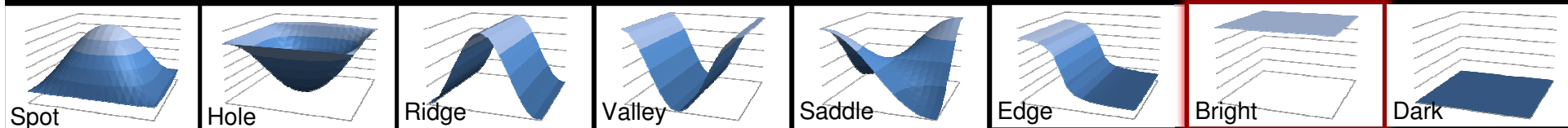
## Edges



Data kindly provided by Hind Azegrouz and Maria Montoya at CNIC Madrid

# Columbus – SER (Saddle-Edge-Ridge) Texture Analysis

## Brights

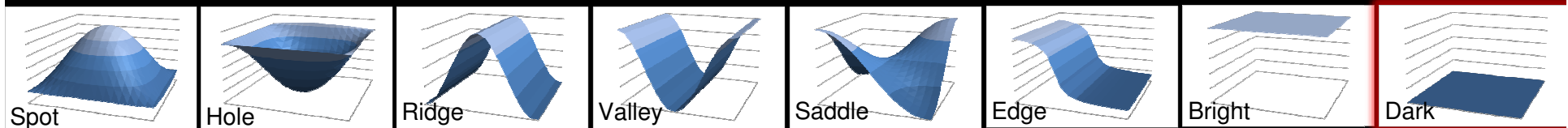


Data kindly provided by Hind Azegrouz and Maria Montoya at CNIC Madrid

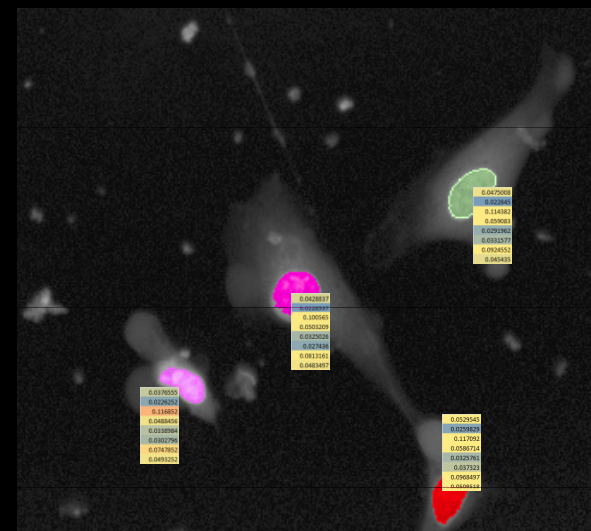
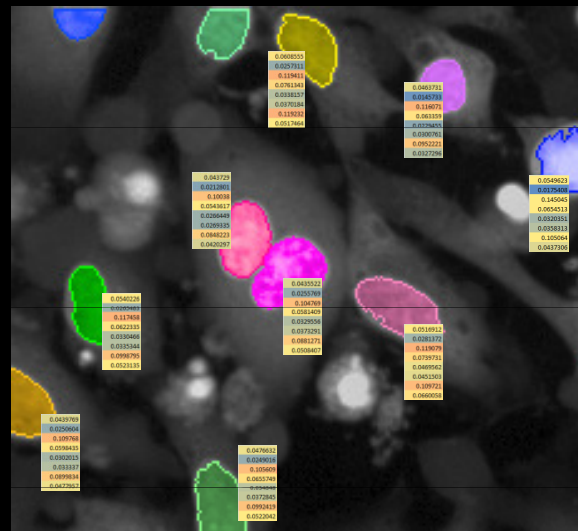


# Columbus – SER (Saddle-Edge-Ridge) Texture Analysis

## Darks



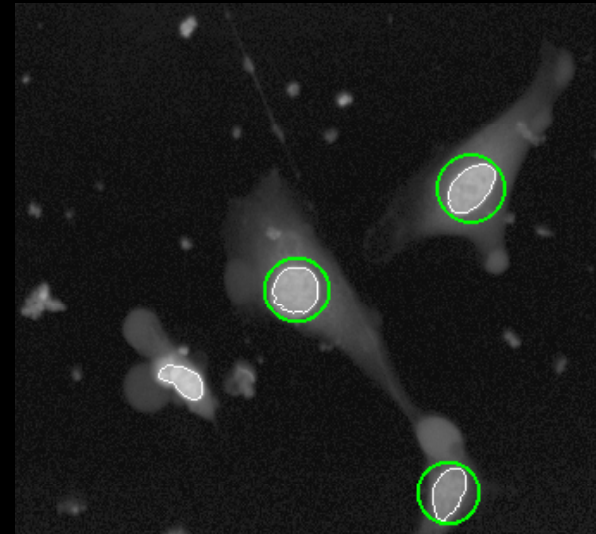
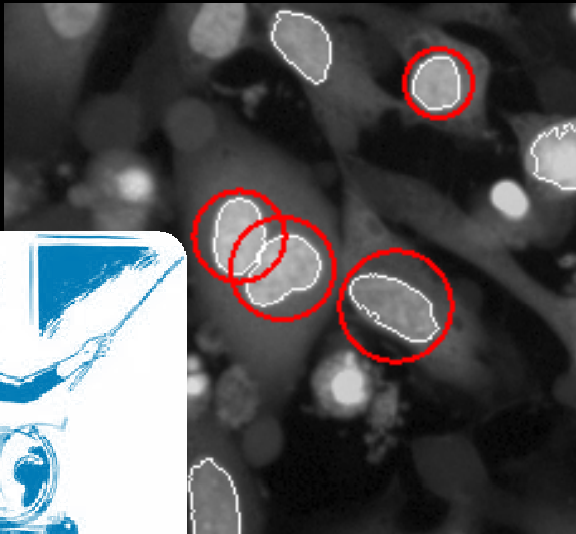
Data kindly provided by Hind Azegrouz and Maria Montoya at CNIC Madrid



Data kindly provided by Hind Azegrouz and Maria Montoya at CNIC Madrid

## Columbus – Population Selection

Scientist train “Artificial Intelligence” – Supervised Learning

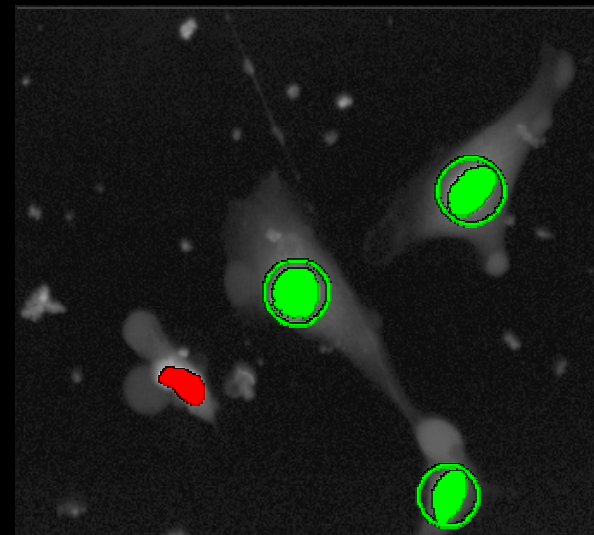
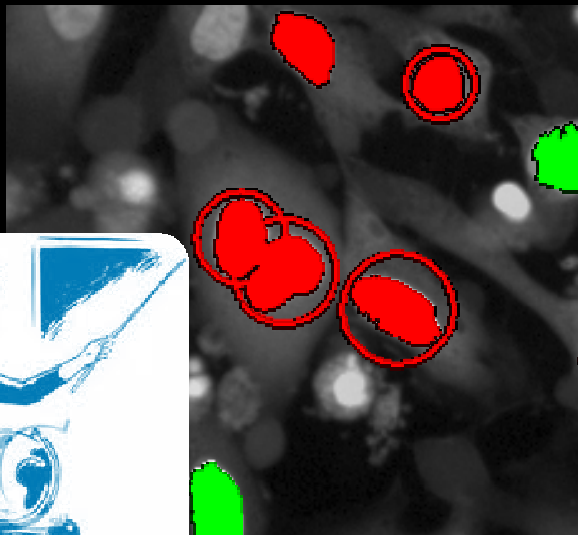
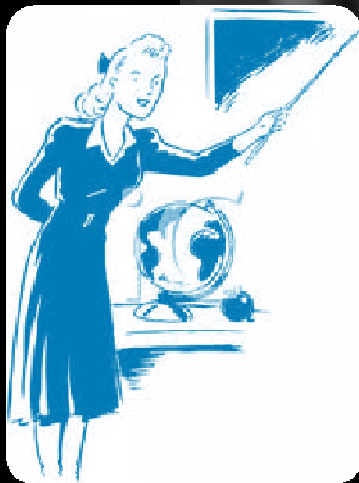
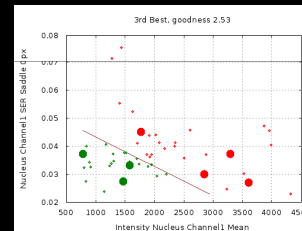
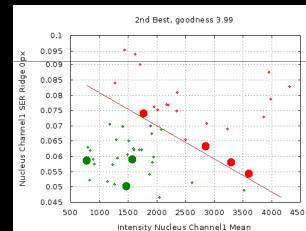
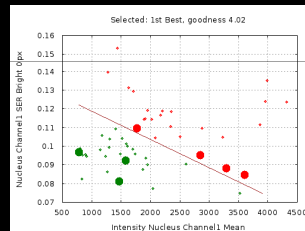


Data kindly provided by Hind Azegrouz and Maria Montoya at CNIC Madrid



# Columbus – Population Selection

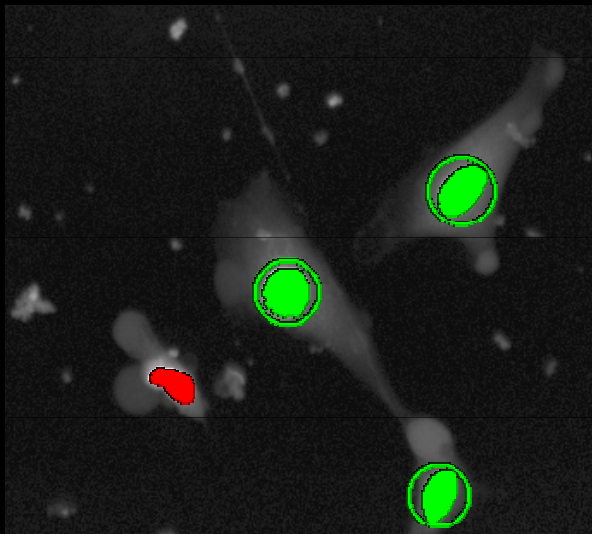
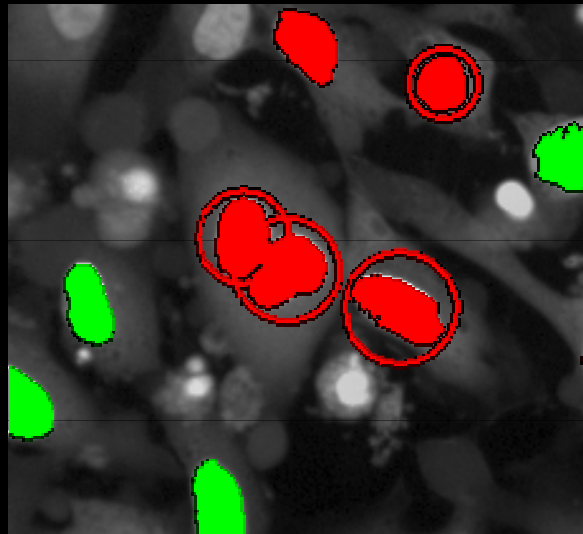
Independent Component Analysis (ICA) is applied for population selection



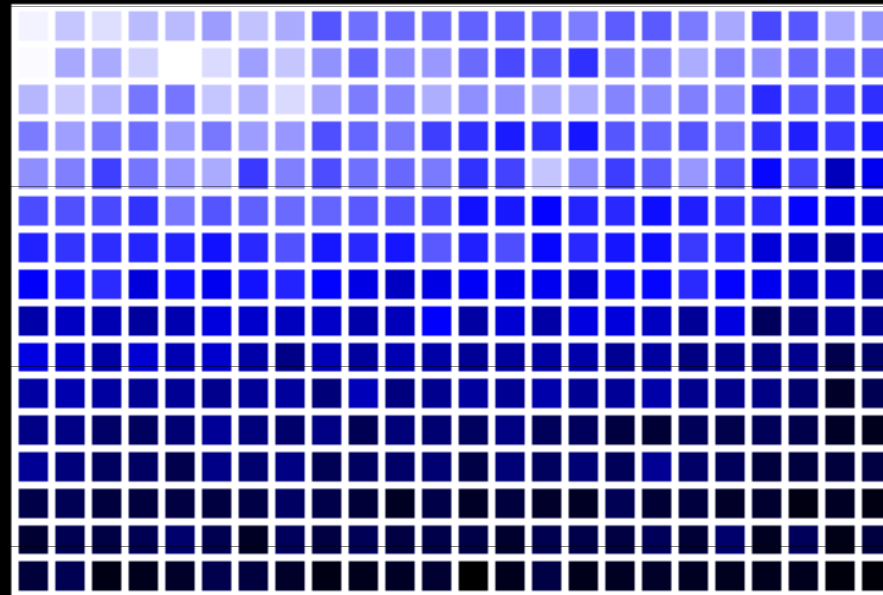
Data kindly provided by Hind Azegrouz and Maria Montoya at CNIC Madrid

## Columbus – Population Selection

### Heat-map representation of image analysis results



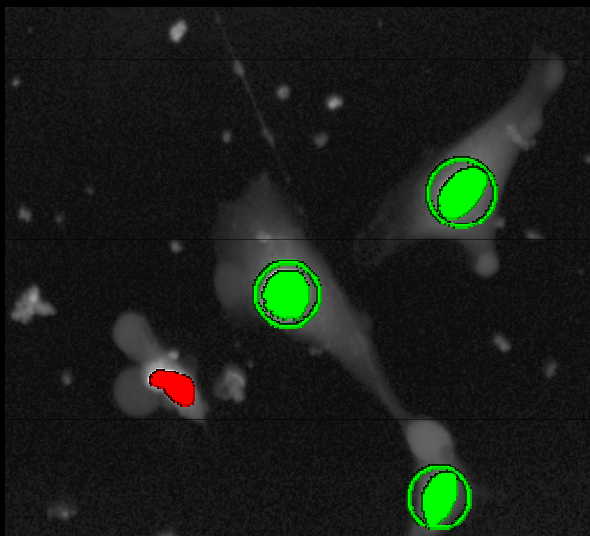
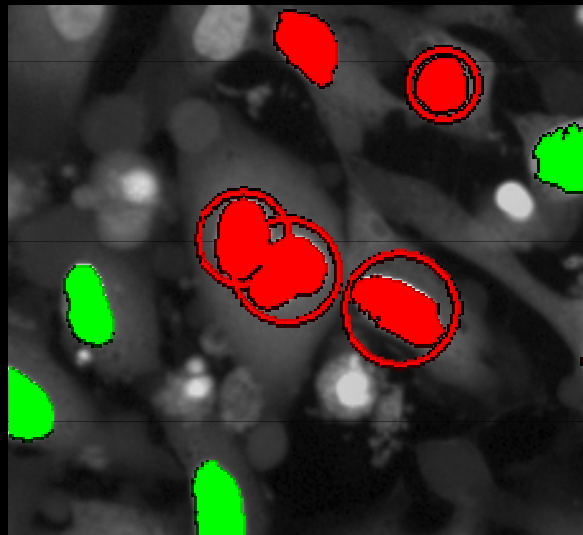
Number of Cells



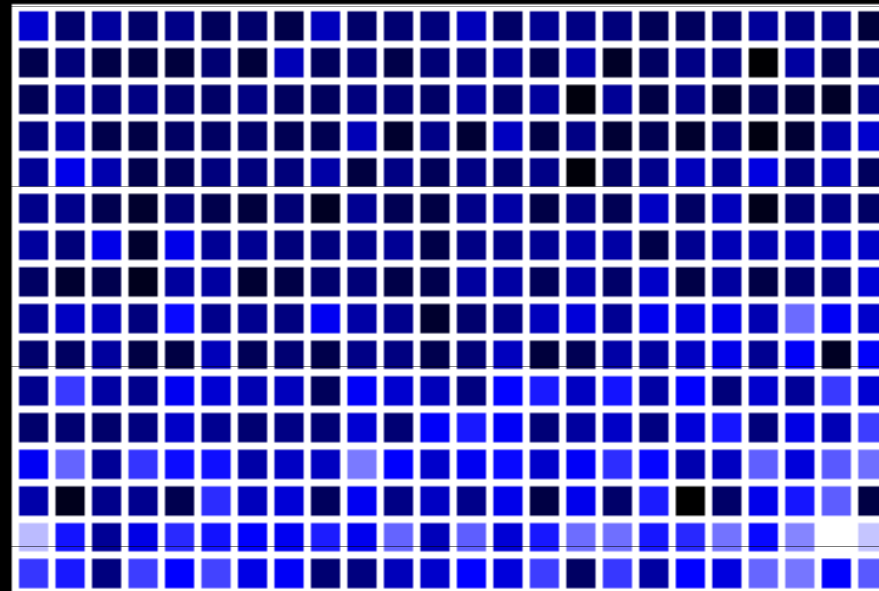
Data kindly provided by Hind Azegrouz and Maria Montoya at CNIC Madrid

## Columbus – Population Selection

### Heat-map representation of image analysis results



% Class b Cells



Data kindly provided by Hind Azegrouz and Maria Montoya at CNIC Madrid

## Summary

- OMERO is the ideal tool to manage all image data in Drug Discovery
- Columbus allows easy and precise analysis of High Content images
- Texture Features are essential parts of Cellular Fingerprints
- Independent Component Analysis enables fast and reliable population selection

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**Paavo Helde**

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