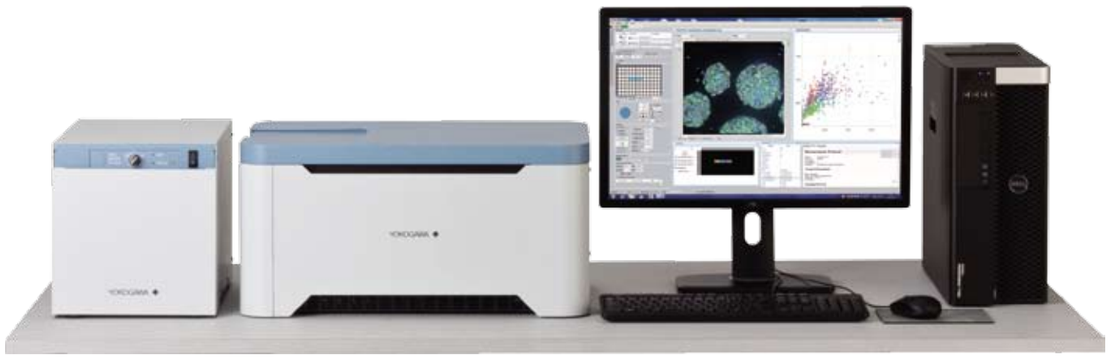


Specifications

Item	Specification
Optics	Microlens enhanced dual wide Nipkow disk confocal
Fluorescence	Laser : Choose Max.4 lasers from 405 / 488 / 561 / 640 nm EM Filter : Max. 10 filters
Transmitted illumination (Option)	Phase contrast, Bright field Light source : LED
Camera	sCMOS 2560×2160 pixel, 16.6×14.0 mm
Objective lens	Max.6 lenses Dry : 2x, 4x, 10x, 20x, 40x Long working distance : 20x, 40x Phase contrast*1 : 10x, 20x
Attachment	All wells imaging type, Chambered type*2
Sample vessel	Microplate (6, 12, 24, 48*3, 96*3, 384*3, 1536*3 well), Slideglass*4*5, Cover glass chamber*4, Dish*4 (35, 60 mm)
XY stage	High-precision XY stage, designated resolution: 0.1 µm
Stage heater (Option)	Stage heater with chamber Controllable temperature range : Room temperature +5 – +17 °C, Max.40 °C Settable temperature resolution: 0.1 °C Humidity keeping time : Over 6 hours
Z focus	Electric Z motor, designated resolution: 0.1 µm
Autofocus	Laser autofocus, Software autofocus
Feature data	Number of cells / cellular granules, Intensity, Volume, Surface area, Area, Perimeter, Diameter, Sphericity, Circularity, Length, etc.
Data format	Captured image : 16 bit TIFF (OME-TIFF) Output image format : TIFF (16 bit, 8 bit) , PNG, JPEG Output movie format : WMV, MP4 Output numerical data format : FCS, CSV, ICE
Workstation	Measurement and analysis workstation
Gas Mixer (Option)	CO_2 concentration : Atmospheric concentration – 7 % O_2 concentration : 3 % – Atmospheric concentration
Size/Weight	Main unit : 600 × 400 × 298 mm, 43 kg (Standard model) , 600 × 400 × 437 mm (With Phase contrast option) Utility box : 275 × 432 × 298 mm, 18 kg Gas Mixer (Option) : 170 × 260 × 280 mm, 5.2 kg
Environment	Main unit and Utility box : 15 – 35 °C, 20 – 70 % RH No condensation Gas Mixer (Option) : 20 – 30 °C, 10 – 85 % RH No condensation
Power consumption	Main unit and Utility box : 100-240 VAC, 800 VAmax Workstation : 100-240 VAC, 650 VAmax Gas Mixer (Option) : 100-240 VAC, 40 VAmax

*1 Phase contrast option is required
*2 Stage heater option is required to use environment keeping function
*3 Phase contrast observation is unavailable
*4 Sample holder option is required
*5 Environment keeping function is unavailable

YOKOGAWA

CLASS 1 LASER PRODUCT
IEC60825-1 : 2007

Safety Precautions
* Read the user's manual carefully in order to use the instrument correctly and safely.
* This product falls under the category of class 1 laser products.

Measurement Business HQ, Life Science Center

Kanazawa 2-3 Hokuyodai, Kanazawa-shi, Ishikawa, 920-0177 Japan
Phone: (81)-76-258-7028, Fax: (81)-76-258-7029

Tokyo 2-9-32 Nakacho, Musashino-shi, Tokyo, 180-8750 Japan
Phone: (81)-422-52-5550, Fax: (81)-422-52-7300

Osaka Breeze Tower, 4-9 Umeda 2, Kita-ku, Osaka, 530-0001 Japan
Phone: (81)-6-6341-1408, Fax: (81)-6-6341-1426

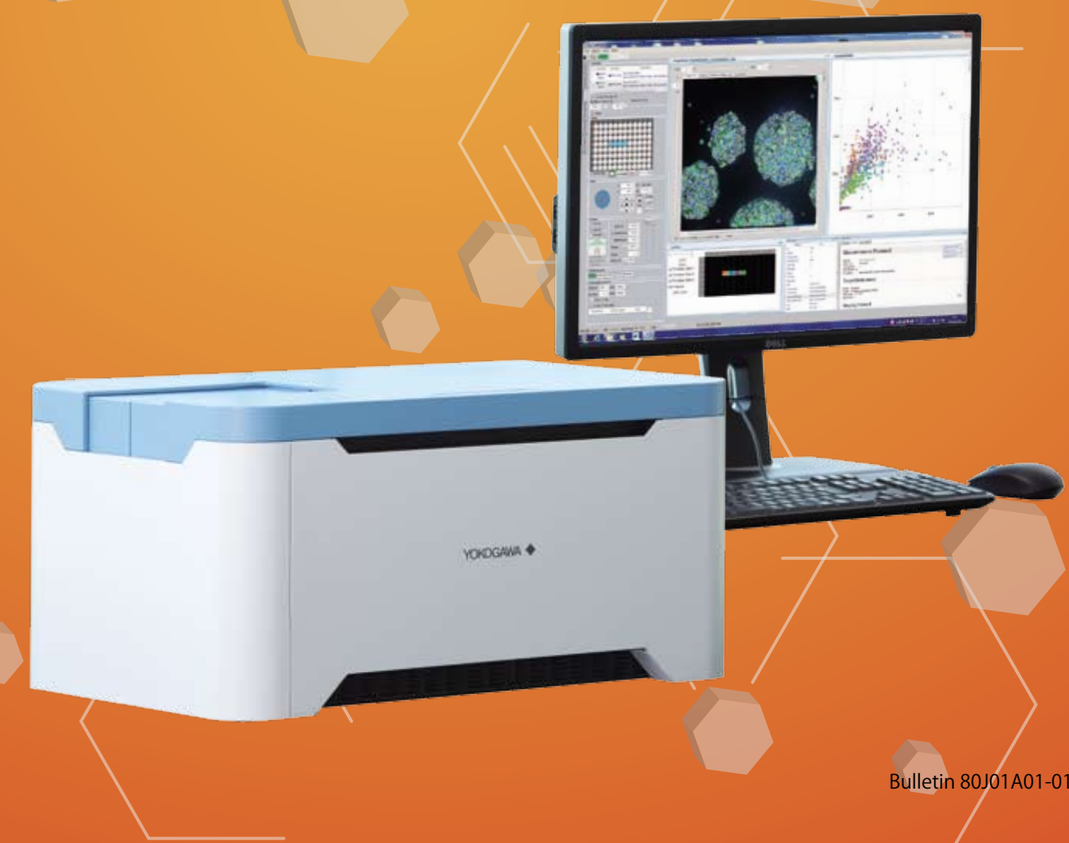
E-mail : CSU_livecell_imaging@cs.jp.yokogawa.com
URL : http://www.yokogawa.com/scanner

Represented by :

[Ed:03/a] Printed in Japan, 610

Confocal Quantitative Image Cytometer CQ1

YOKOGAWA

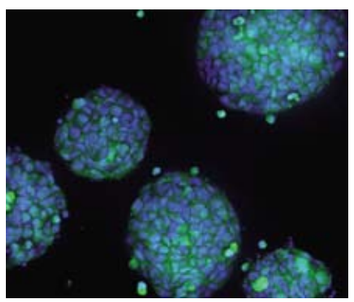


Bulletin 80J01A01-01E

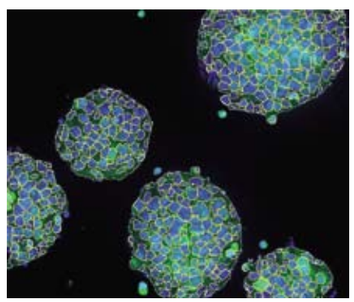
Cell measurement by high-throughput 3D imaging

Confocal Quantitative Image Cytometer CQ1 offers a new approach to cell measurement

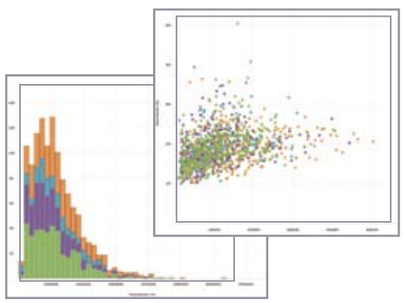
Clear 3D images obtained from confocal microscopes have been enabling advancements in cell biology research for many years. This imaging technology combined with population analysis now provides a significant advancement for cytometry.
The CQ1 enables clear 3D imaging, object recognition, and rapid quantification of live cells and cell clusters. Images linked to data help in the understanding, and enhance the reliability of data. The CQ1's live cell chamber acts as a cellular incubator enabling time lapse imaging while the CQ1's unique imaging technology is gentle on the cells.
The Yokogawa CQ1 is an easy to use all-in-one confocal microscope for a reasonable price. The CQ1 comes with a number of configurable options and can be integrated into a fully automated screening system.



Measurement



Recognition



Quantification

■ Enables measurement of spheroids, colonies and tissue sections.

- Possible to measure cells in culture dish without preprocessing such as cell peeling, unlike a flow cytometer
- Thanks to the confocal disk confocal, 3D images are acquired rapidly and gently
- Max.10 colors emission with 4 colors excitation and transmission illuminataion imaging
- Live cell chamber and time-lapse measurements
- Rich feature extraction to facilitate sophisticated cell analysis
- Wide field of view and tiling capability enables easy imaging of large sample

■ Offers the similar capabilities as flow cytometery

- Analyzed data displayed in real-time with image acquisition (On the fly analysis)
- Application protocols guided by templates
- Ability to trace back to the original image from a data point in a graph and to remeasure
- All-in-one system with easy operation

■ Open platform

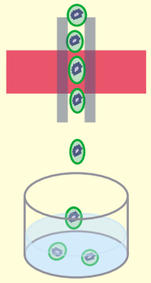
- Expandable to integrated systems as an image acquisition and quantification instrument
- Output FCS/CSV/ICE data format readable by third-party data analysis software
- Connectable with external systems via plate handling robot
- A variety of cell culture and sample vessels are applicable

■ Compact footprint, light weight bench-top device; no need for darkroom

■ Contrast of measurement methods

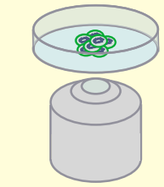
Flow cytometer

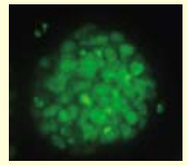
- Cell peeling treatment is necessary.
- Risk of damaging to cell



Unable to re-measure nor confirm by image

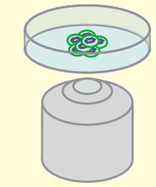
Non-confocal imaging system

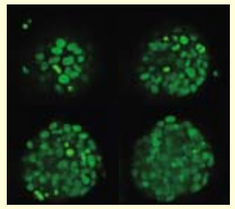




Imaging is difficult sample is thick.

Confocal imaging system





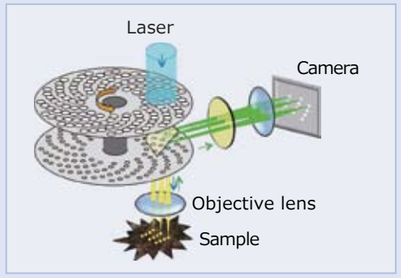
3D imaging of thick sample

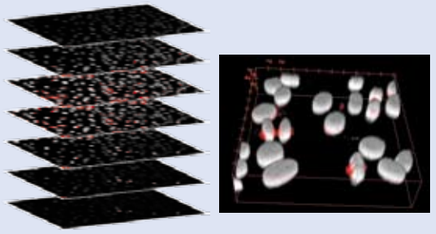
In addition, CQ1 is high-throughput and gentle with cell.

Multiple Functions Fully Integrated in a Compact Box

■ Confocal Scanner Unit

Multi-beam scan by “Microlens enhanced dual Nipkow disk confocal” achieve high-throughput 2D/ 3D imaging with minimum damage to samples.





Example: Cellcycle measurement of cancer cells

■ Microscope Unit

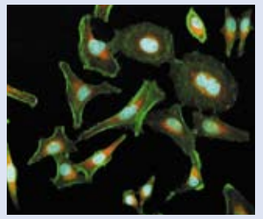
Maximal performance objective lens (super apochromat) and the widest field/ highest-resolution sCMOS camera achieve high-throughput measurement of submicron sample.

■ Emission Filter

Up to 10 Emission filters can be mounted. Measurement of multiple markers can be achieved in just one experiment.

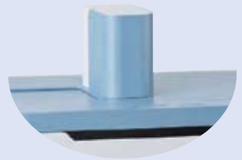
■ Illumination for Fluorescent Imaging (Laser)

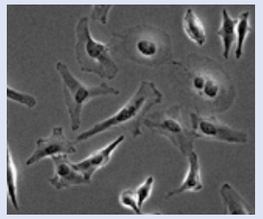
Up to 4 laser illumination for confocal (fluorescent) imaging can be mounted.
Measurement of multiple fluorophore can be achieved in just one experiment.



■ Illumination for Transmission Imaging*1

Transmission illumination for phase contrast or bright field*2 imaging can be mount. It is useful for confirming sample shape.



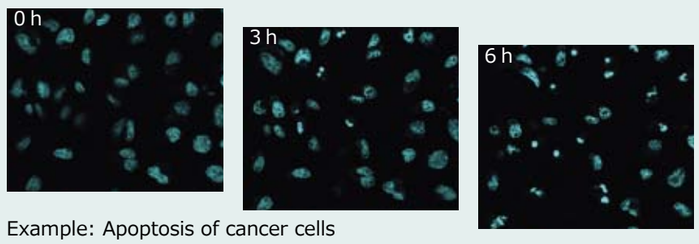


■ Environment Keeping Function

Stage heater controls temperature and humidity and gas mixer controls CO_2 / O_2 concentration of sample environment.
Measurement with keeping cell viability can be achieved by this function.

Stage Heater*1

Gas Mixer*1*3



Example: Apoptosis of cancer cells

■ Supported Sample Vessels

Various sample vessels, as microplate, can be used for measurement.

Microplate

35 mm dish*1

60 mm dish*1

Slide glass*1

Cover glass chamber*1

■ System Integration with CQ1

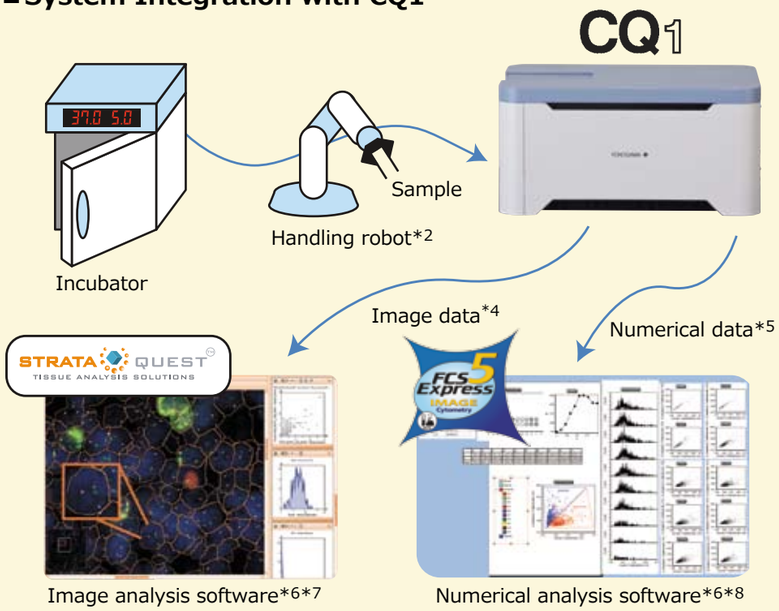


Image analysis software*6*7

Numerical analysis software*6*8

*1 Option *2 Under development *3 GM-8000 (Tokai Hit) is recommended *4 Output by OME-TIFF format *5 Output by FCS, CSV or ICE format *6 Example of system integration. CQ1 also has image / numerical analysis function. *7 StrataQuest is the trademark of TissueGnostics
*8 FCS Express™ 5 Image Cytometryis is the trademark of Denovo Software

Set the Condition and One Click! -Easy & Universal Software-

Start!

Sample Loading

Step 1

Imaging Setting

Set wells, fields, focus, color, time-inteval of imaging.

Step 2

Imaging

Images of samples are acquired full-automatically by set condition.

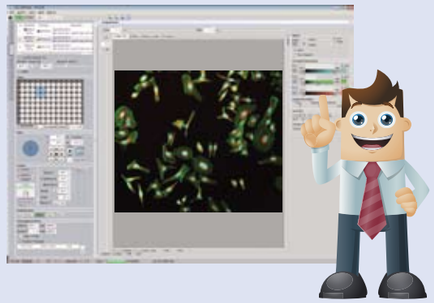
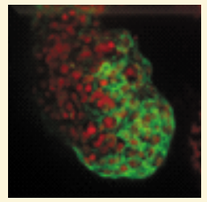


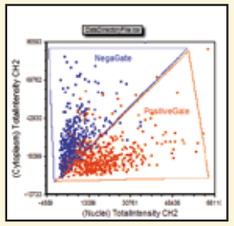
Image Data

Beautiful confocal images can be used for your presentation, documentation and so on*1. Also, images can be loaded to third party*2 analysis software.



Numerical Data

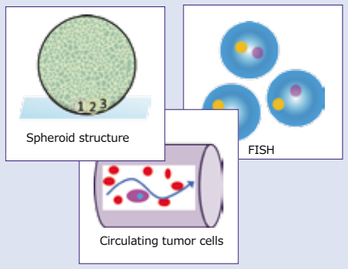
Measurement data*3 output from CQ1 can be loaded to Numerical analysis software, such as FCS Express™ 5 Image Cytometry*4.



Step 3

Recognition, Analysis Setting

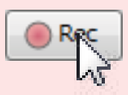
Set image recognition parameters and extract the structures to be recognized.



Various analysis template are prepared. Complicated settings are not needed.

Also, detail recognition/ analysis condition can be set by customer.

1 Click!

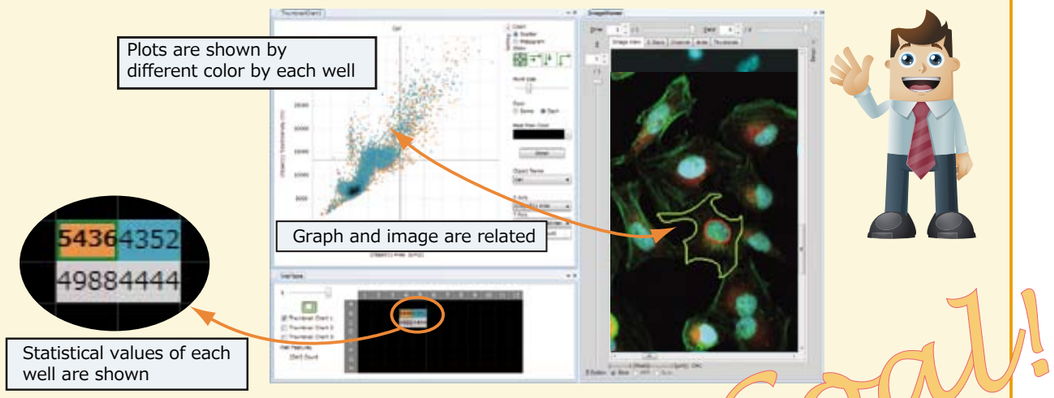


Automatic Measurement

Imaging and analysis, is performed by One Click.

Image Analysis, Result Output

Attribute of extracted structures (size, intensity, location and so on) are quantified and they are shown as graph.



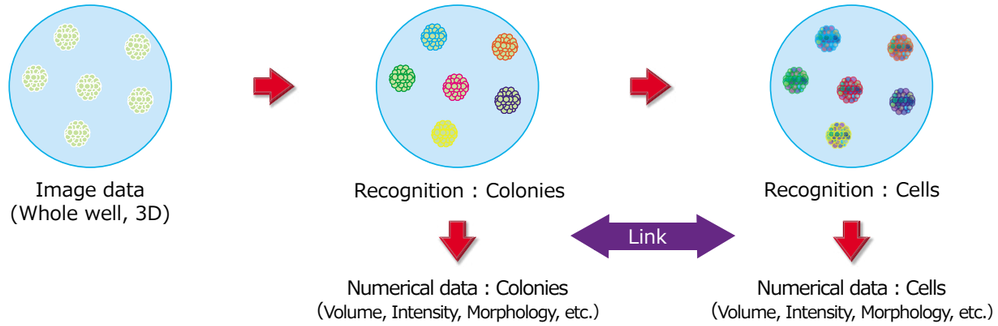
Goal!

*1 Output by PNG, JPG or 8bit-TIFF format *2 Output by OME-TIFF format *3 Output by FCS, CSV or ICE format *4 FCS Express™ 5 Image Cytometry is trademark of Denovo Software

Let's start the easiest 3D Measurement!

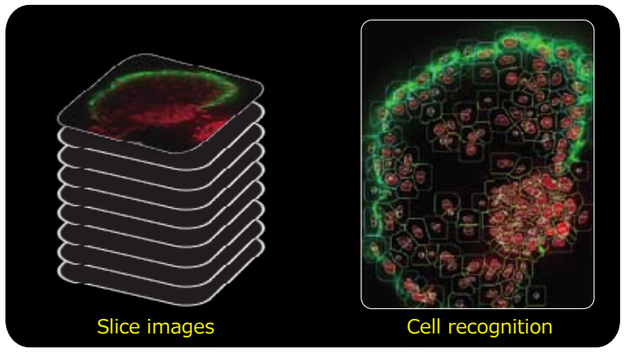
The CQ1 is the easiest way 3D measurement system
Simple cell identification, colony counting, and complex colony property analysis are available.
Of course you can do whole well imaging and analysis.

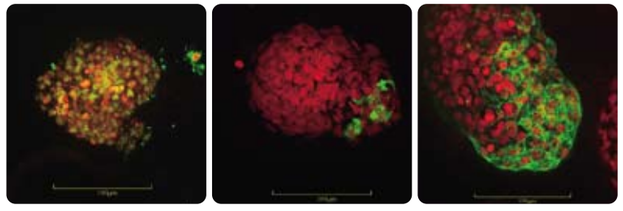
■Example of protocol

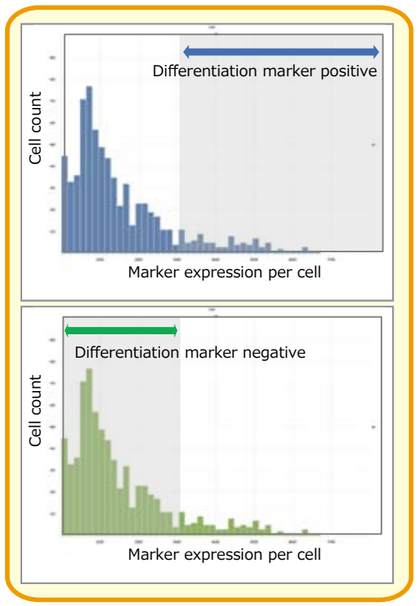


High-speed | High resolution | 3D | Multi-color

■Quality control: Induction of differentiation

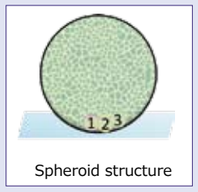






Aggregated cell images were taken in slices and presented as 3D.
Marker expression level as well as spatial information of individual cells were quantified via image analysis.

■Template

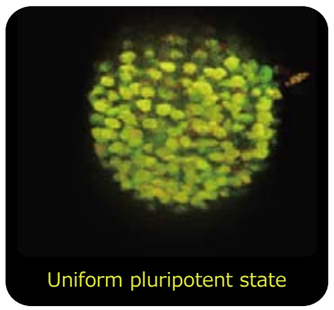


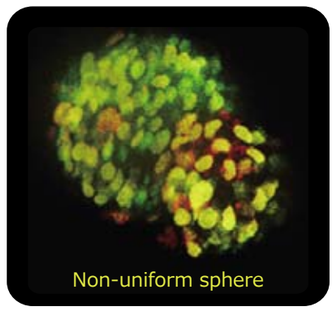
Spheroid structure
Cell-by-cell measurement of aggregated cells like spheroids.

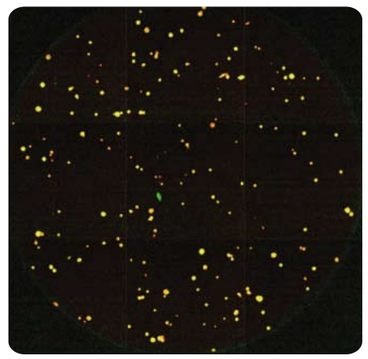
Applications
Sheroids, Differentiation

High-speed | High resolution | 3D | Multi-color

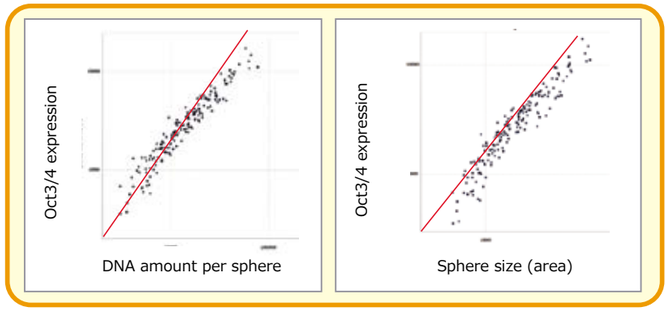
■Quality control: human iPSC sphere







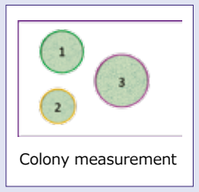
Whole well tile image



Sphere shape and pluripotencymarker expression level are suitable index for evaluation of quality of pluripotent state of human iPSC sphere.

Data provided by ReproCell

■Template



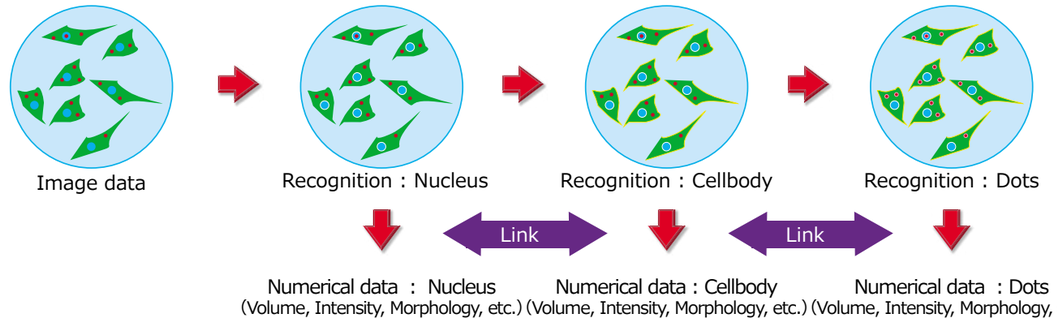
Colony measurement
Cell-by-cell measurement of aggregated cells like spheroids

Applications
Colony growth evaluation, Differentiation

Want to go more deeper analysis!

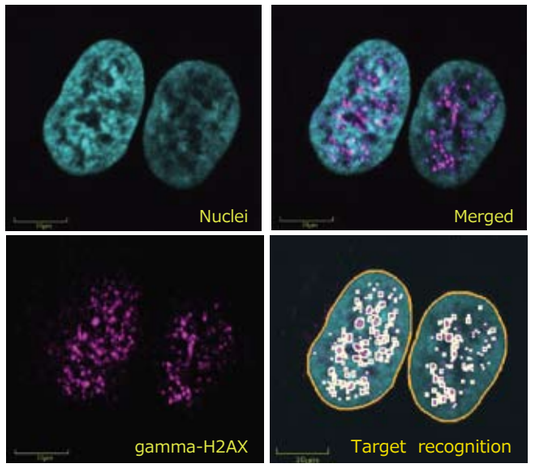
High-quality Confocal images from the CQ1 enable many types of image analysis. Morphology change, particle analysis and other HCA that require high resolution images.
Of course CQ1 can work like simple Confocal Microscopy to get analyzed data and images.

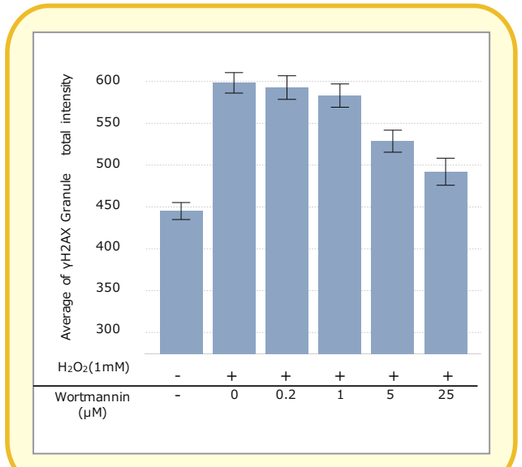
■ Example of protocol



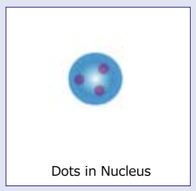
Quantitative High resolution

■ Analysis: gamma-H2AX focus formation





The phosphorylation of histone H2AX Ser139 (gamma-H2AX) is one of the significant events upon the breakage of double strand DNA. Quantitative measurement of gamma-H2AX focus formation can be easily performed by using the high-speed confocal image acquisition in combination with the Granule Analysis Template.



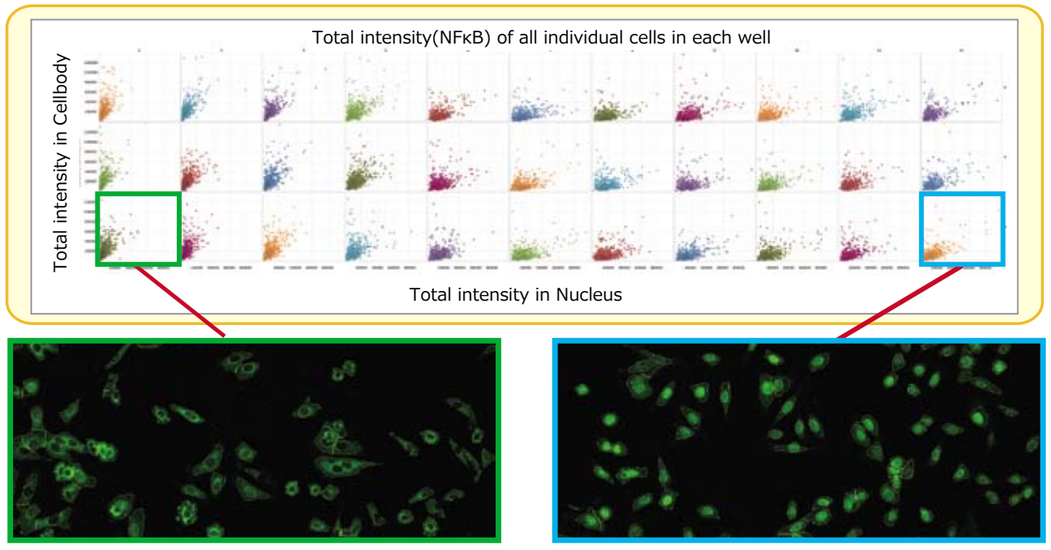
■ Template

Dot in Nucleus
Measurements of dots in cytoplasm and nuclei
Precise separation of individual dots by the confocal unit

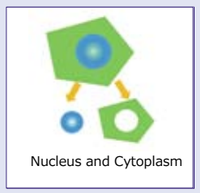
Applications
・FISH ・GPCR

Quantitative High resolution

■ Nuclear translocation



NFκB is one of the famous transcription factor of DNA. NFκB plays a key role in regulating the immune response and inflammation and is attracting attention as a tumor therapy and anti-inflammatory drug target.
NFκB is located in the cytoplasm with IκB which is inhibitory protein. Once the signaling pathway has been activated by the cytokine stimulation via cell membrane receptor, dissociate IκB from NFκB and activate NFκB. Then NFκB translocate into the nucleus to bind specific sequence of DNA, which induce inflammation.
Nucleus and intracellular NFκB level indicates protein level between cytoplasm and nucleus.



■ Template

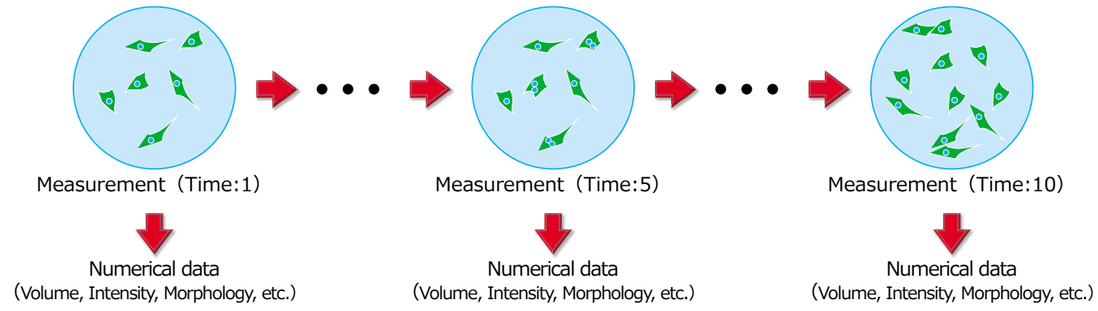
Nucleus and Cytoplasm
Measurements of nuclei and cytoplasm
Precise separation of localization by the confocal unit

Application
・Nuclear translocation ・Membrane translocation

Try time lapse imaging! New

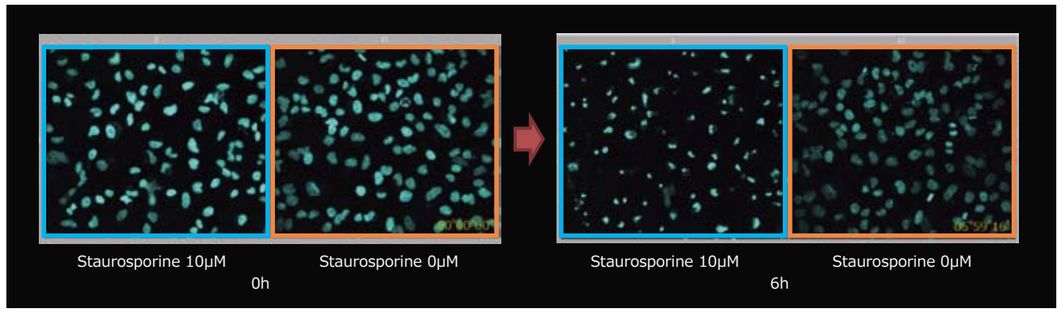
Keep cells happier in incubator to see how they react on live.
Low photo toxicity and photo bleaching offers time lapse imaging of live cell to see what they are.

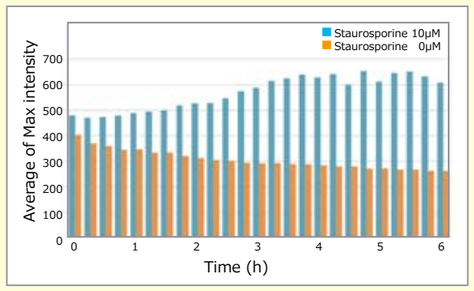
■Example of protocol

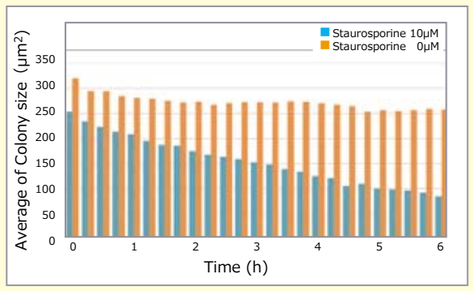


Time-lapse Quantitative

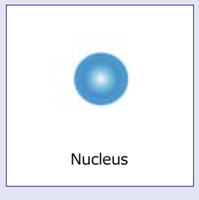
■Time lapse analysis : Apoptosis







Spread HeLa cells to 96well microplate with 10,000 cells/well.
Stain with Hoechst33342 (1 μg/ml, 30 min, 37 ℃) and treat with Staurosporine (0 - 10μM) and capture image every 15 min. Recognize DNA fragmentation area of nuclei at Staurosporine 10μM treatment.



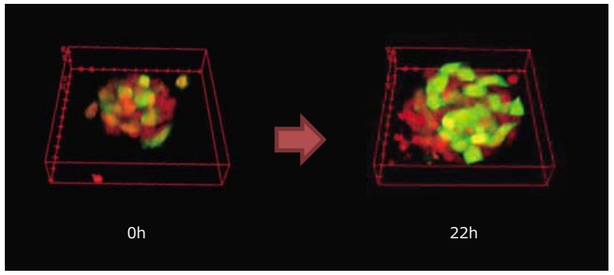
■Template

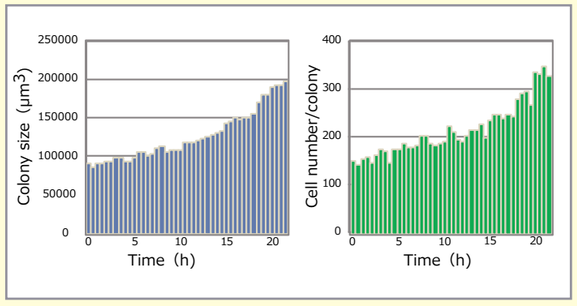
Nucleus
Measurements of Volume, Intensity and Morphology

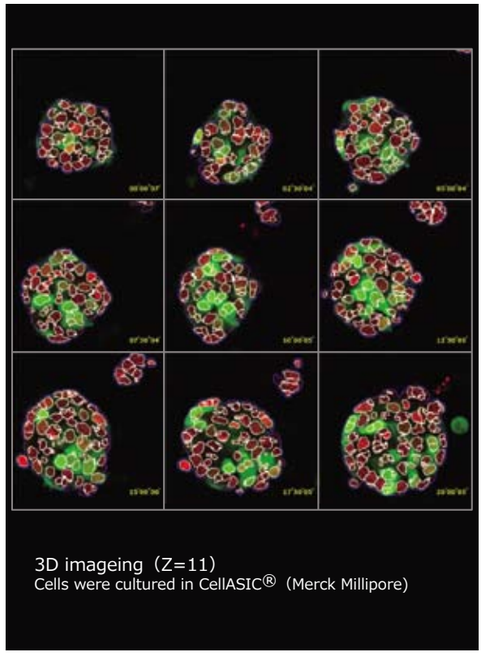
Application
Cellcycle, Apoptosis

Time-lapse Quantitative 3D Multi-color

■Time lapse analysis : ESC colony



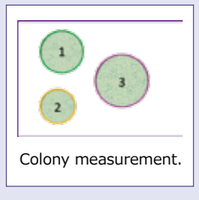




3D imageing (Z=11)
Cells were cultured in CellASIC® (Merck Millipore)

Time lapse analysis of colony size and individual cells allow to monitor colony formation state.
CQ1's image can perform image acquisition with low photo-toxicity.

Data provided by Kyoji Horie,ph.D, Physiology II, Nara Medical University



■Template

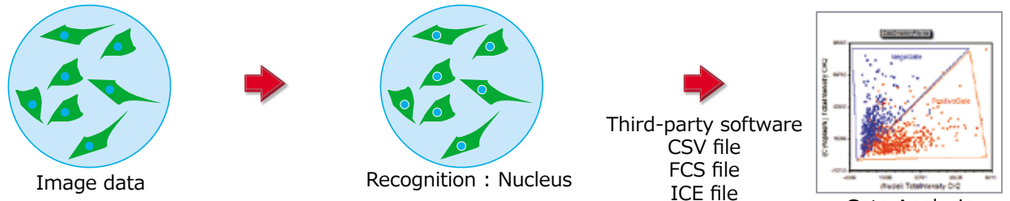
Colony measurement
Time course measurement allows to monitor cell colony growth

Applications
Cell colony growth , Differentiation

Want to try the measurement again...

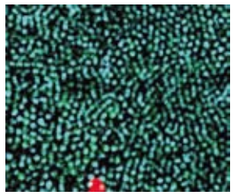
Cells can be imaged at culture plate, no need to prepare single-cell suspension, and you can use same sample to different measurement.
Image and analysis data are associated together and its help to pick up tiny difference.

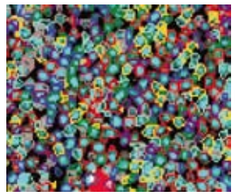
■Example of protocol

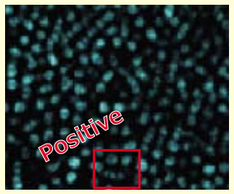


High-speed Quantitative Multi-color

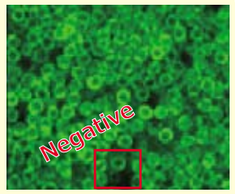
■CTC（Circulating tumor cells）


Captured image

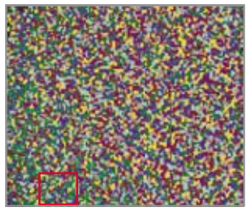

Recognized image



Nuclear:H33342



CD45: FITC



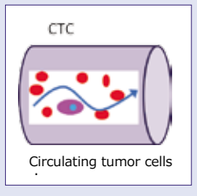
EpCAM: PE

PSMA: APC

Totall cells (count)	113443
CTCs (count)	2 (0.001%)

Example of CTC quantitate (spiking experiment). CTC : CD45 is only Negative.
Data provided by Yusuke Tomita, Min-Jung Lee, Jane B Trepel , Developmental Therapeutics Branch, National Cancer Institute, National Institutes of Health, , Bethesda, MD 20892 USA

CTCs are tumor cells which circulate in peripheral blood. Developed tumors metastasize through the bloodstream and lymph fluid. Therefore, tumor cells exist in the bloodstream when metastasis occurs. The detection of CTCs makes it possible to diagnose recurrence and metastasis at an early tumor stage. CTCs' numbers are very small as only less than 100 CTCs are contained in more than $1x10^6$ of blood cells in 10 ml of cancer patient's blood. Therefore it is difficult to detect CTCs with a flow cytometer because they detect CTCs as noise. However, it is very easy to detect rare CTCs with an Image cytometer.



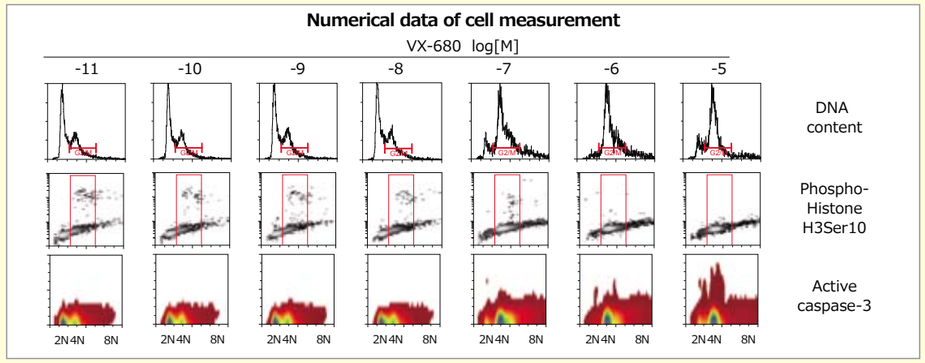
Circulating tumor cells

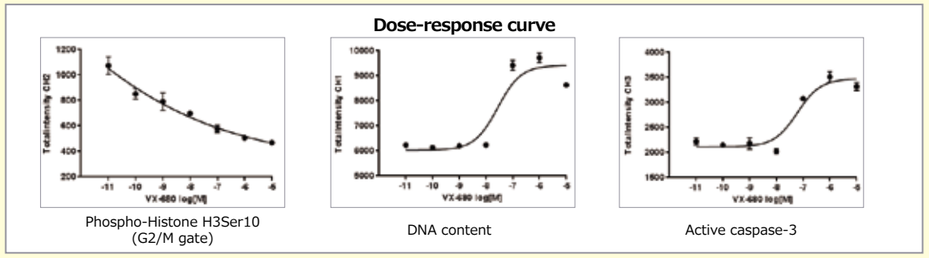
■Template

CTC
You can detect multiple marker expression of the cell.
Not only for circulating tumor cells, but also for the other specific marker can be detected.

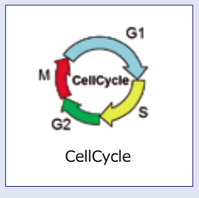
High-speed Quantitative

■Cell cycle analysis: M-phase inhibitor





Cell cycle analysis in relation to H3Ser10P immunofluorescence by utilizing the CQ1' s multi-color channel capabilities. Histone molecules are phosphorylated during cell cycle progression with phosphorylation of the 10th serine of histone H3 being one of the well characterized events of late-G2 to M progression.



CellCycle

■Template

CellCycle
You can detect cell cycle to verify drug treatment efficiency.
This is available by the flow cytometer, but CQ1 can analyze more items which typical at the image cytometer.