



Digital Cameras for Microscopes

Shedding New Light On **MICROSCOPY**

# DIGITAL SIGHT SERIES

Digital Cameras for Microscopes



# Nikon Digital Sight series

## Introducing a new model with excellent cost performance.

The new Digital Sight 1000 is an economical color camera solution that can directly display high-definition microscope images on a full HD display without using a PC.

As with the DS-Fi3 and DS-Ri2, it can also be connected to a tablet PC to save space and easily acquire images.


Four camera options covering two computing platforms

Microscope Camera <b>Digital Sight 1000</b> <span style="color:red">NEW</span>	Microscope Camera <b>DS-Fi3</b>	Microscope Camera <b>DS-Ri2</b>	Monochrome Microscope Camera <b>DS-Qi2</b>
			
➔ P.3	➔ P.4	➔ P.8	➔ P.10
2.0 megapixel   Color   Full HD	5.9 megapixel   Color   High-resolution	16.25 megapixel   Color   High-resolution	16.25 megapixel   Mono-chrome   Cooled
Frame rate 30 fps (1920×1080)	Frame rate 15 fps (2880×2048), 30 fps (1440×1024)	Frame rate 6 fps (4908×3264), 45 fps (1636×1088)	Frame rate 6 fps (4908×3264), 45 fps (1636×1088)
Max recordable pixels 1920×1080	Max recordable pixels 2880×2048	Max recordable pixels 4908×3264	Max recordable pixels 4908×3264
C-Mount	C-Mount	F-Mount	F-Mount

### Using a tablet PC

Imaging software  
**NIS-Elements**  
*Advanced Solutions for your Imaging World*

**L**



➔ P.14

### Using a desktop PC

Imaging software  
**NIS-Elements**  
*Advanced Solutions for your Imaging World*

**F D Br Ar**



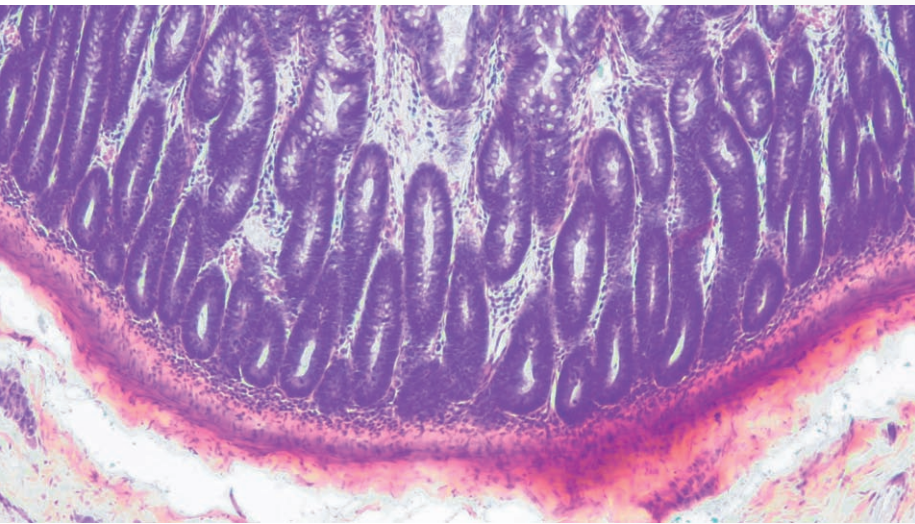
Only NIS-Elements F is compatible with Digital Sight 1000.

➔ P.12



Microscope Camera

# Digital Sight 1000 **NEW**

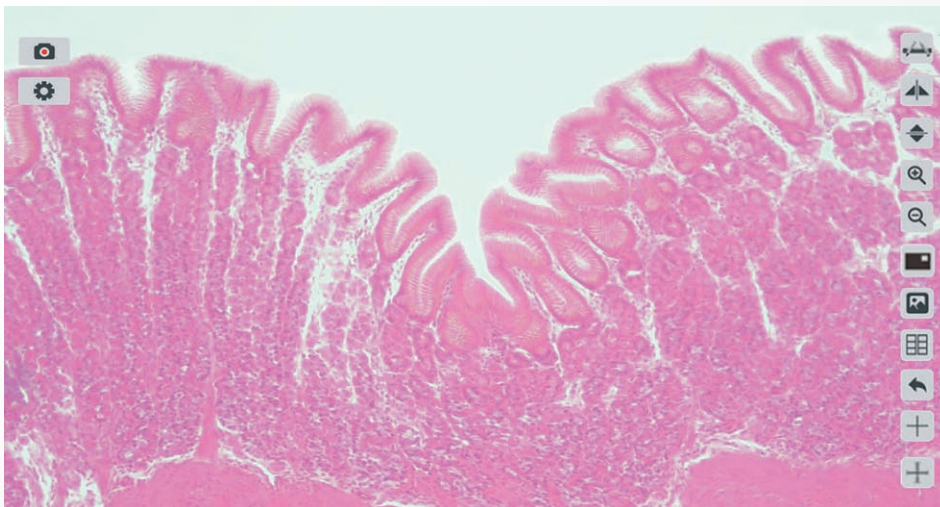


## Full HD images

Equipped with a 2 megapixel CMOS image sensor, the Digital Sight 1000 can display, capture and save full HD, 1920x1080 pixel images at 30 frames / second.

## Stand-alone mode

By connecting a Full HD display and a mouse, the Digital Sight 1000 can be used without a PC, conserving bench space. Captured images and videos can be saved directly to an SD card which is inserted into the camera. Users can easily display scale bars, measure areas and calculate distances between two points.





Microscope Camera

# DS-Fi3



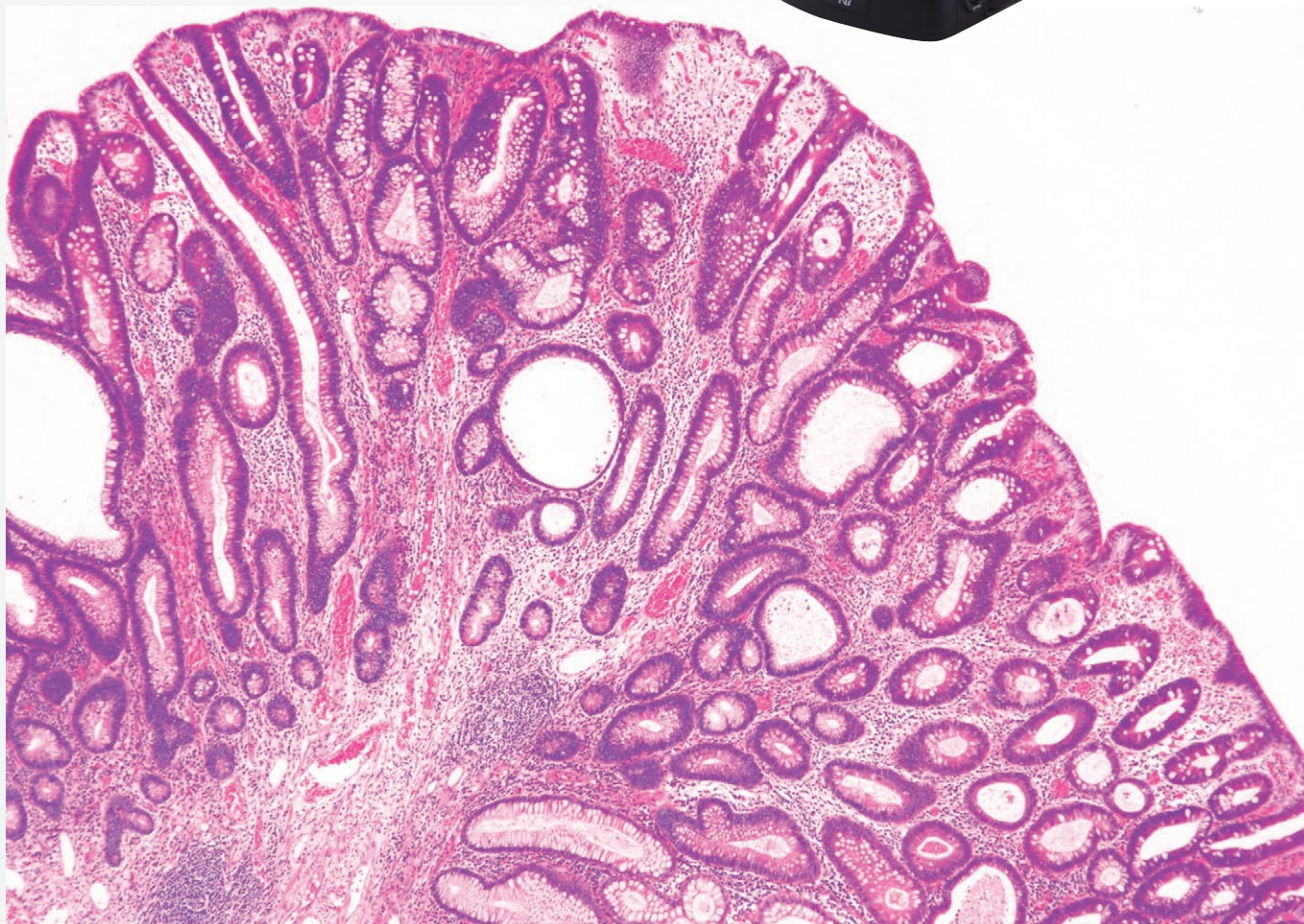
5.9  
megapixel

Color

High-  
resolution

## High-resolution images

A CMOS high density 5.9 megapixel sensor produces high resolution images. USB3.0 data transfer allows fast focusing at high resolution, and easy capture images in all types of observation methods such as brightfield, differential interference contrast, and phase contrast.



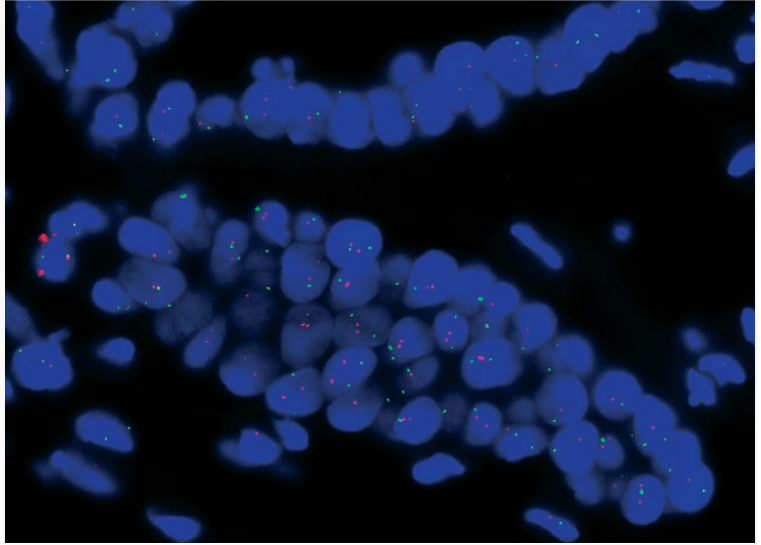
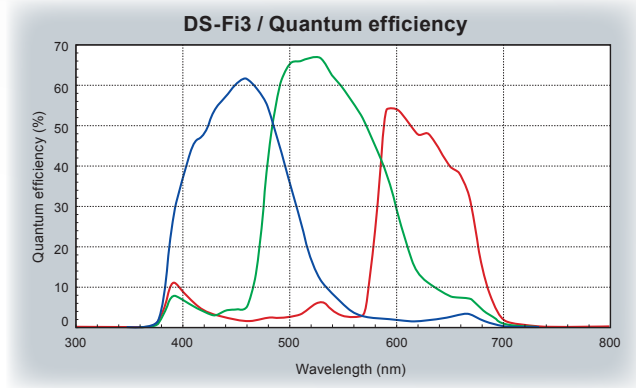
Tubular adenoma, HE staining (Objective: CFI Plan Apochromat Lambda 4X)

Photos courtesy of: Dr. Yasunori Ohta, Department of Pathology, IMSUT Hospital, Institute of Medical Science, The University of Tokyo



## High sensitivity, low noise

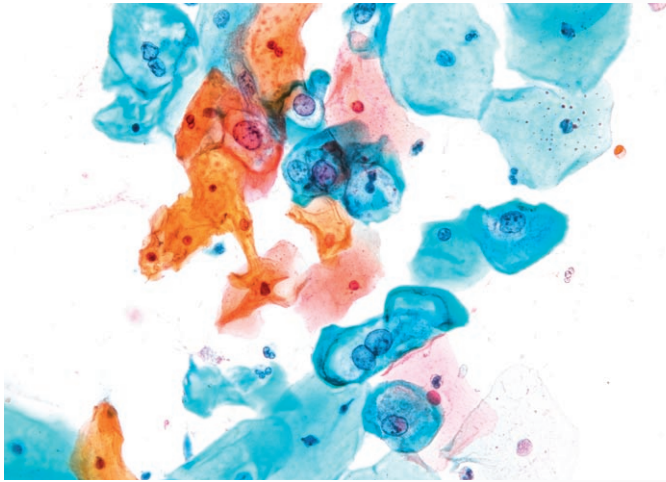
Quantum efficiency and read noise have been greatly improved, providing better capability for acquisition of fluorescent images with better signal-to-noise ratios than before.



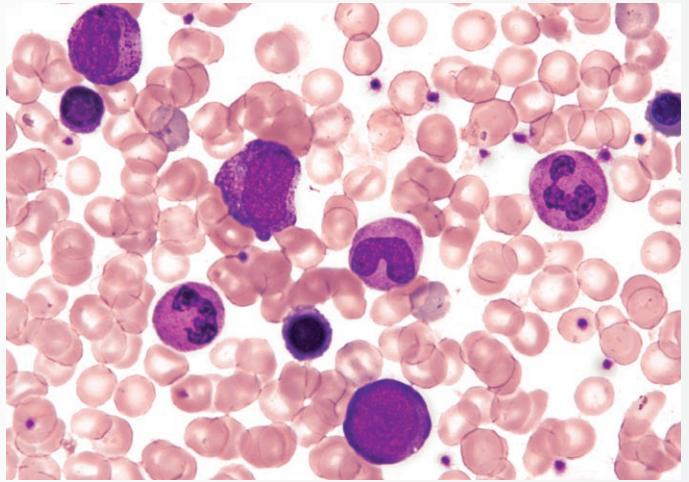
Breast cancer, FISH method (Objective: CFI Plan Apochromat Lambda 100X Oil)  
Photos courtesy of: Hironao Kusakari, Diagnostic Pathology, St. Marianna University Hospital

## Superior color reproduction

Nikon is well-known for outstanding and lifelike color reproduction, and developing superior algorithms for creating results that look like the actual samples. These algorithms are used in all of the color cameras in the digital sight lineup.



Uterine cervix Pap. Staining  
(Objective: CFI Plan Apochromat Lambda 40XC)  
Photos courtesy of: Kazuhiro Mita, Department of Pathology, Yokohama City University Hospital



Bone marrow  
(Objective: CFI Plan Achromat NCG 40X)  
Photos courtesy of: Clinical Laboratory Department, Yokohama City University Hospital

## High-speed live display

Fast USB3.0 data transfer means fast, smooth live updating of images for finding samples or focusing, even at full resolution.

## Camera Control

The DS-Fi3 interfaces with PC via a USB3.0 interface directly to the camera head, and uses NIS-Elements series software for image acquisition.

# Two Large Sensor high resolution 16.25-megapixel CMOS image sensors for microscopy

Two Nikon FX-format CMOS image sensor cameras join the Digital Sight series of microscope digital cameras: the DS-Ri2 color digital camera and the DS-Qi2 monochrome digital camera.

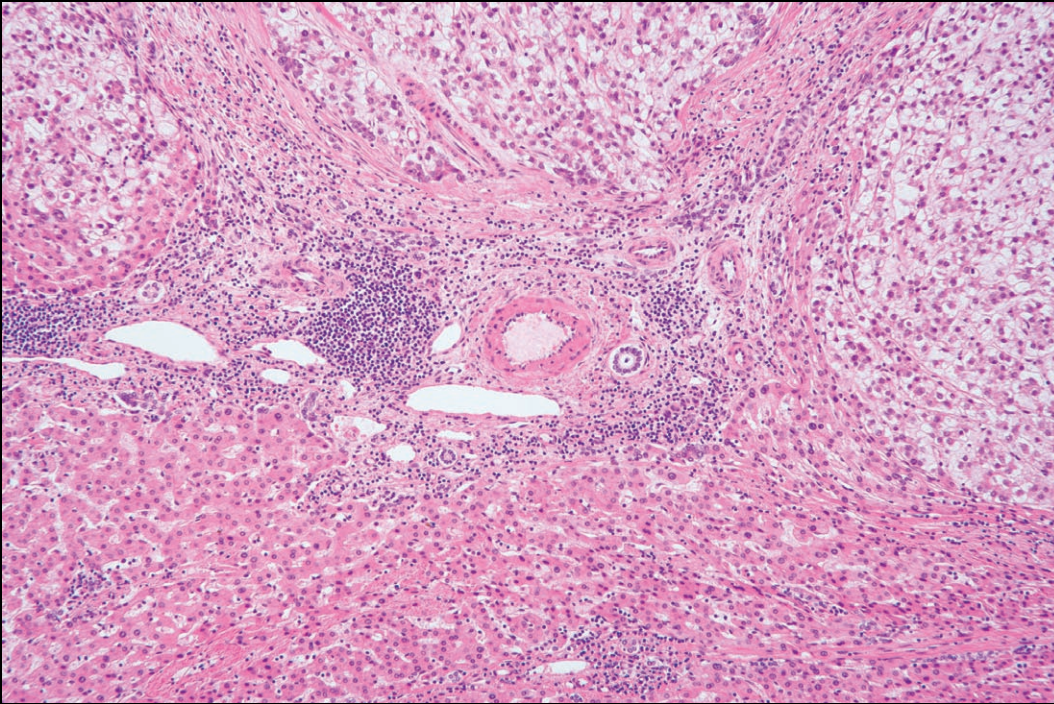
High pixel density and large field of view coupled with USB3.0 high speed data transfer offer fast frame rates and high resolution images with these CMOS image sensors.



## Large Format CMOS image sensors

Nikon manufactures CMOS image sensors and imaging technologies for professional DSLR cameras, and has optimized our sensors for microscopy





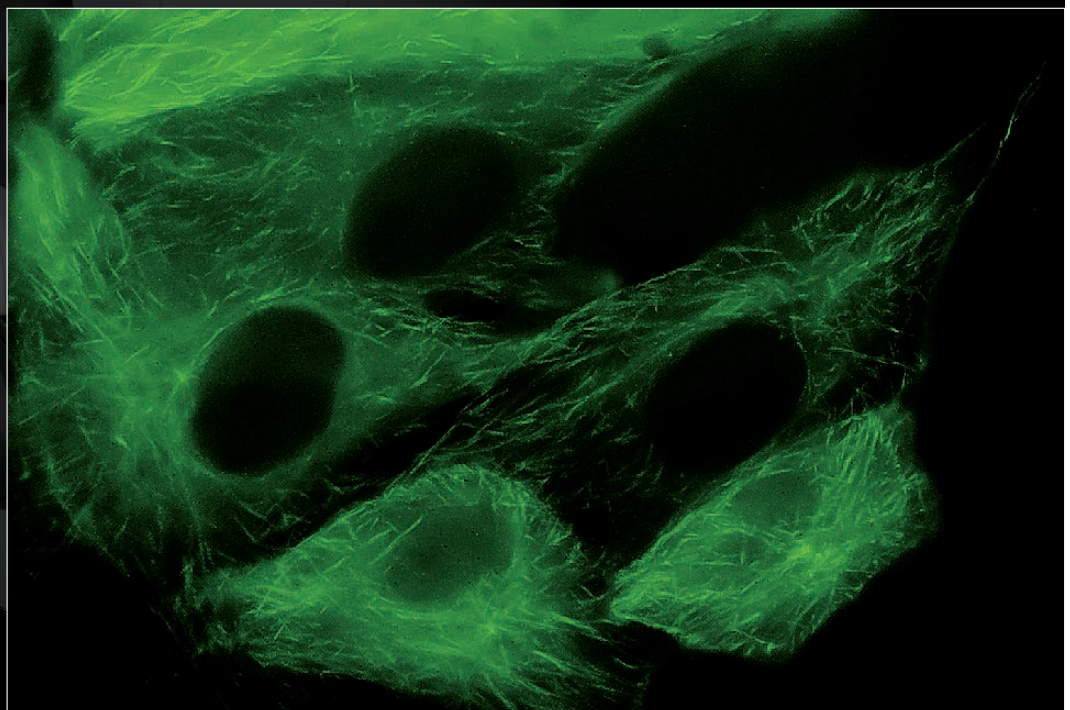
The tissues of the liver, HE staining  
(Objective: CFI Plan Achromat Lambda 10X)  
Photos courtesy of: Kazuhiro Muraoka, Photography Division,  
Tokyo Women's Medical University

## DS-Ri2

16.25 megapixel (not interpolated) and accurate color rendition are features that make the DS-Ri2 an excellent choice for recreating color images as they eyes see them.

## DS-Qi2

High pixel density, high sensitivity and low noise are key features of the DS-Qi2 monochrome camera.



Pig kidney epithelial cells expressing GFP-EB3 tubulin  
Sample courtesy of: Michael Davidson, National High Magnetic Field Laboratory, Florida State University





# Fast, one-shot capture of ultra-high resolution color images.

Microscope Camera

## DS-Ri2



16.25  
megapixel

Color

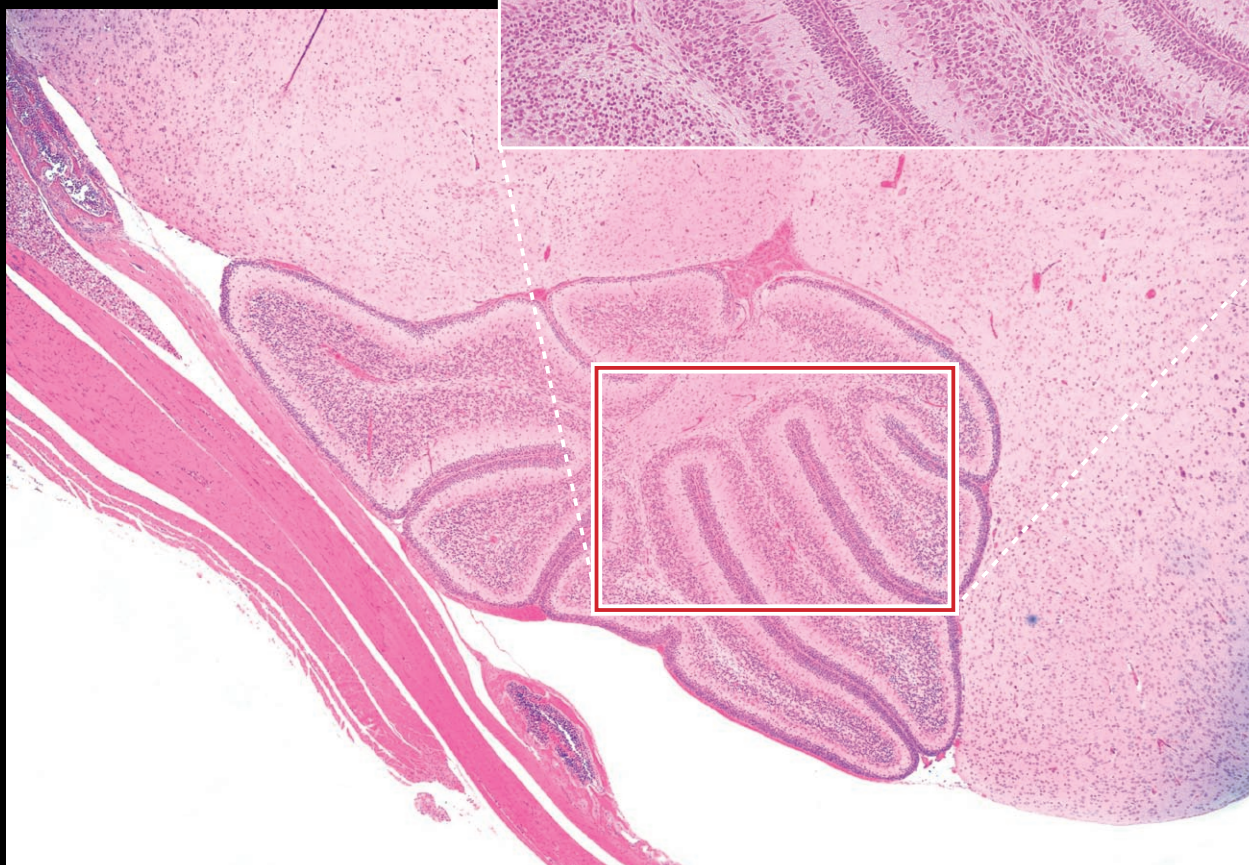
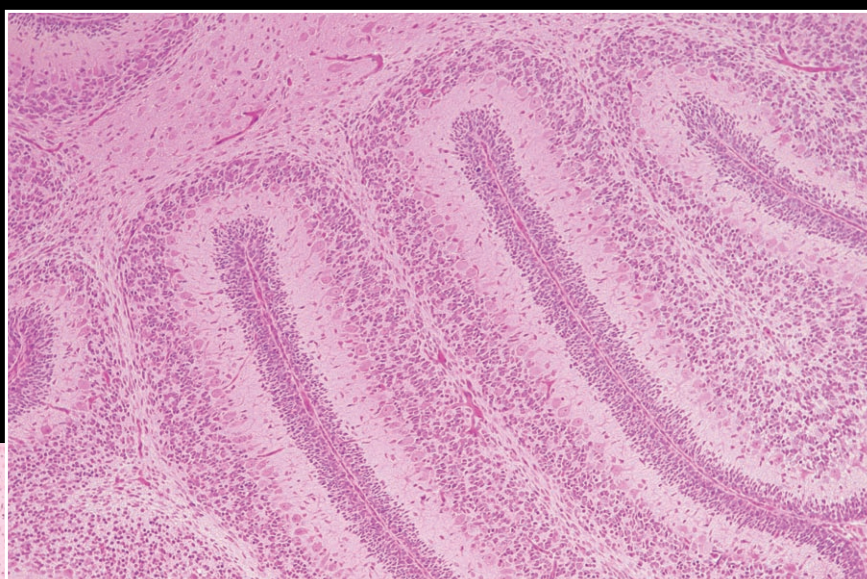
High-  
resolution

### High-resolution images

#### 16.25-megapixel CMOS image sensors for astonishing image quality

The DS series enables one-shot instantaneous capture and fast storage of images with resolution as high as 4908x3264 pixels, without pixel shifting or pixel stepping.

This pixel density is ideally suited for photomicrography of ultra-fine structures or patterns in biological or industrial samples, at low or high magnifications.



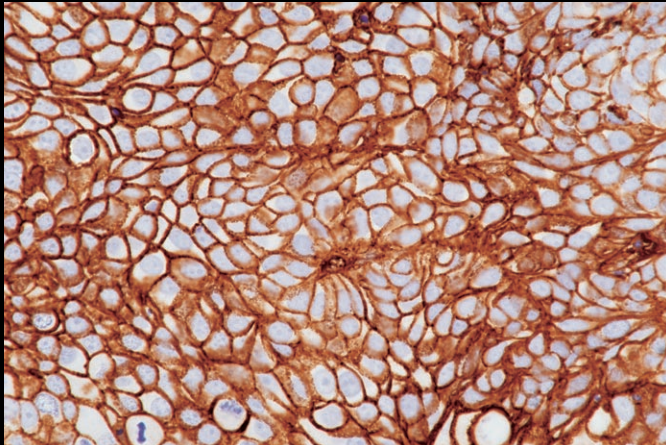
Mouse cerebellum sagittal section, HE staining (Objective: CFI Plan Apochromat Lambda 4X)



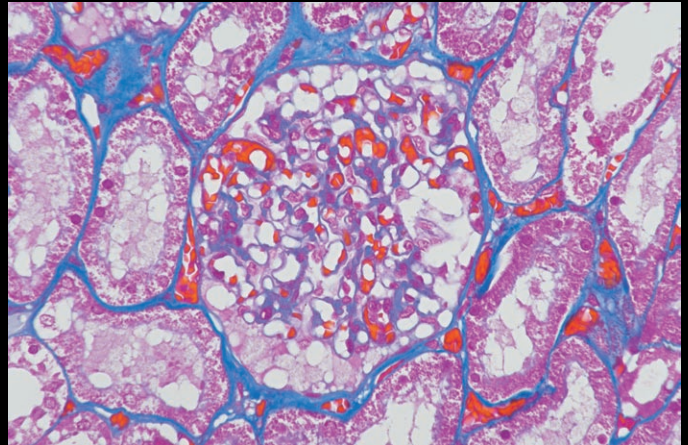
# Photography with the natural colors seen through the microscope

Nikon is a leader in development of algorithms for reproducing color just as the eyes see it

The DS models' image processing engine is based on extensive data accumulated over many years of developing microscope color digital cameras, resulting in perfect reproduction of the colors your eyes see in the microscope.



Pancreatic cancer cell, NGFR immunostaining\*1  
(Objective: CFI Plan Apochromat Lambda 40XC)



Human glomerulus of kidney, Azan stain\*2  
(Objective: CFI Plan Apochromat Lambda 40XC)

\*1, \*2 Photos courtesy of: Dr. Atsushi Furuhashi and Noriyoshi Sueyoshi, Assistant General Manager, Laboratory of morphology and image analysis, BioMedical Research Center, Juntendo University Graduate School of Medicine

## High-speed live display

High-speed display, even of supra-HDTV-class live images

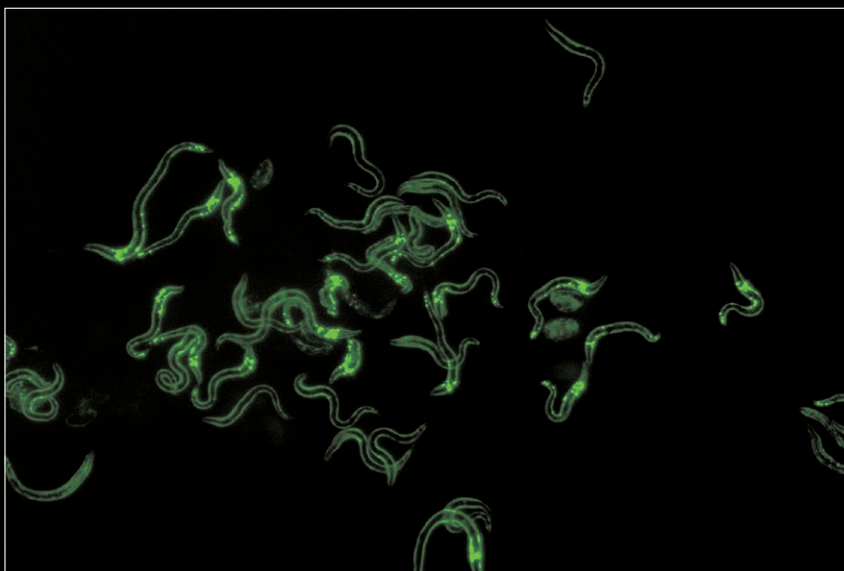
The DS-Ri2 can display 4908x3264 pixel (full-pixel) images at 6 fps, or 1636x1088 pixel (3x3 pixel averaging) images at 45 fps.

This fast-live frame rate makes fine focusing easy to perform.

## High sensitivity, low noise

Fluorescent color image capture with high signal to-noise ratio

Sensitivity settings that span the range from ISO200 to ISO12800 allow the capture of vivid fluorescent color images.



Transgenic *C. elegans* expressing venus in the head neurons and EGFP in the body wall muscles.  
Photos courtesy of: Drs. Keiko Gengyo-Ando and Junichi Nakai, Saitama University Brain Science Institute



# Capture Low light fluorescence and Large Fields of View

Monochrome Microscope Camera

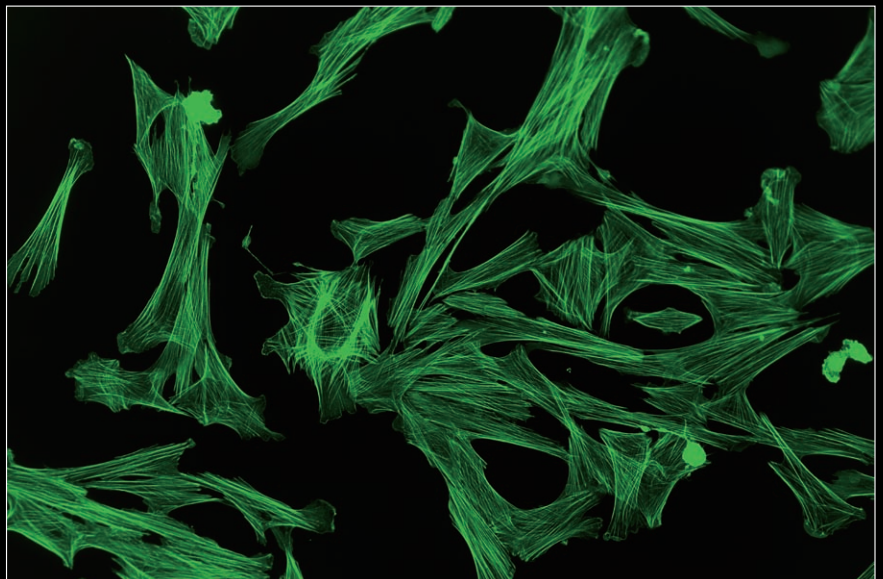
## DS-Qi2



16.25 megapixel

Mono-chrome

Cooled

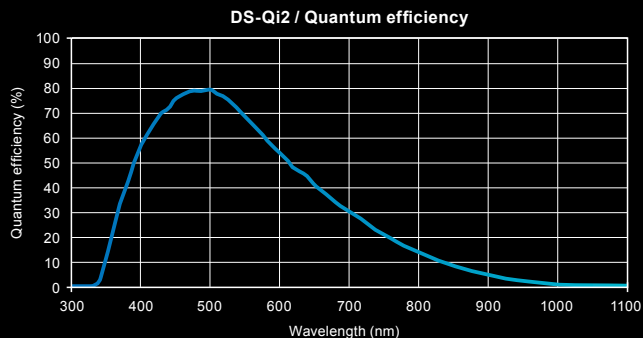


Indian Muntjac Deer Skin Fibroblast Cells, Cytoskeletal F-actin labeled with Alexa Fluor 488  
Sample courtesy of: Michael Davidson and Florida State University

### High sensitivity

#### Detects even faint fluorescent signals

7.3  $\mu\text{m}$  pixels, high quantum efficiency, and very low read noise allow the DS-Qi2 to read in even faint fluorescent signals.



### Excellent linearity

#### Reliable quantitative analysis made possible

With a linearity error of  $\pm 1\%$ , the DS-Qi2 is a superb tool for measuring intensities in fluorescence samples, including time-based intensity measurement and ratiometric measurement.

### High frame rate

#### Fast focusing, even with fluorescent images

With a high-sensitivity CMOS image sensor and USB 3.0-based data transfer, the DS-Qi2 enables high-speed live imaging and image capture at up to 45 fps (1636 $\times$ 1088 pixels).

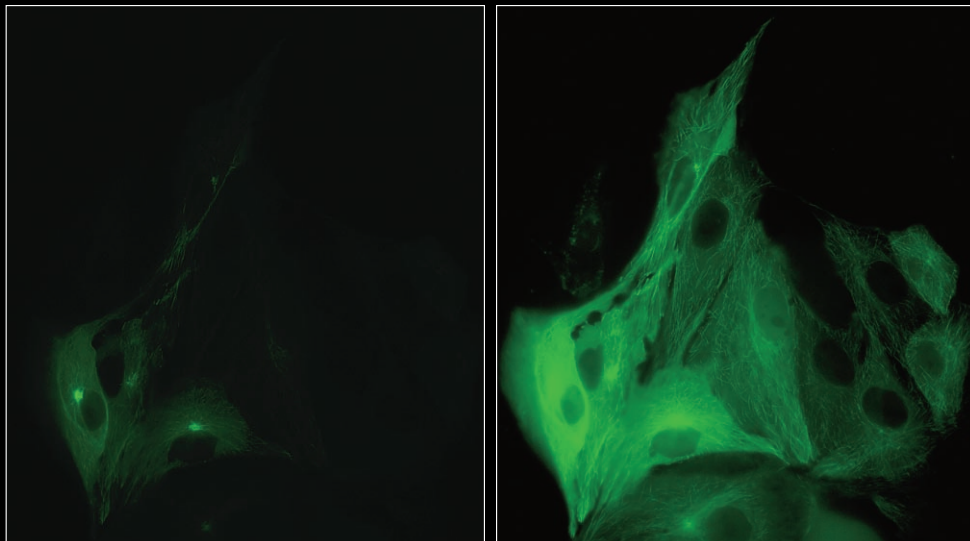
### Low noise

#### Acquires dim fluorescent signals with ultra-low noise

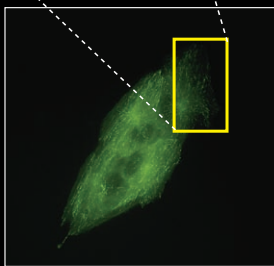
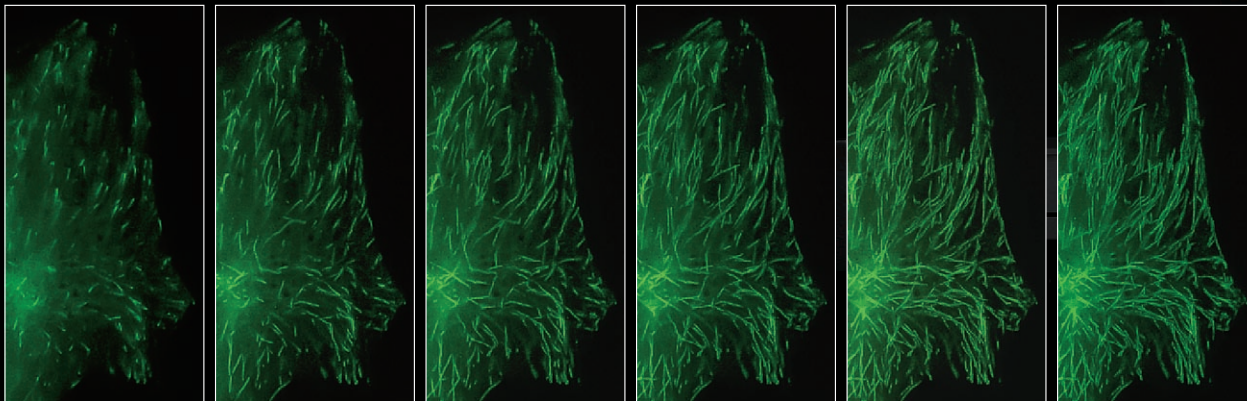
Both 2.2 electrons read noise coupled with a large full-well capacity and 0.6 electrons dark current allow the acquisition of 14bit fluorescence images with very little noise.

LLC-PK1 cells expressing GFP-EB3 tubulin with low noise. Large linear full well capacity allows acquiring both the brightest and dimmest areas in a single capture.

Sample courtesy of: Michael Davidson, National High Magnetic Field Laboratory, Florida State University







Time-lapse images (every 1 second) of LLC-PK1 cells with GFP-EB3 tubulin. Each image represents the maximum intensity projection of the timelapse, allowing visualization of the end-binding protein located on the microtubule plus-ends, and allowing tracing of the microtubule path.

DS-Qi2 captures an extremely large field of view, but still represents very fine details as demonstrated in this cropped timelapse sequence from a large FOV image. Objective: CFI Plan Apochromat Lambda 60X Oil / NA: 1.4)

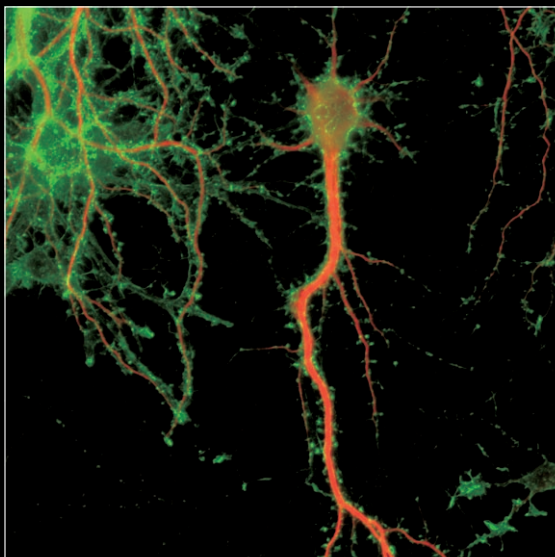
Sample courtesy of: Michael Davidson, National High Magnetic Field Laboratory, Florida State University



## Time-lapse photography

### Fluorescent time-lapse imaging through integration with NIS-Elements software

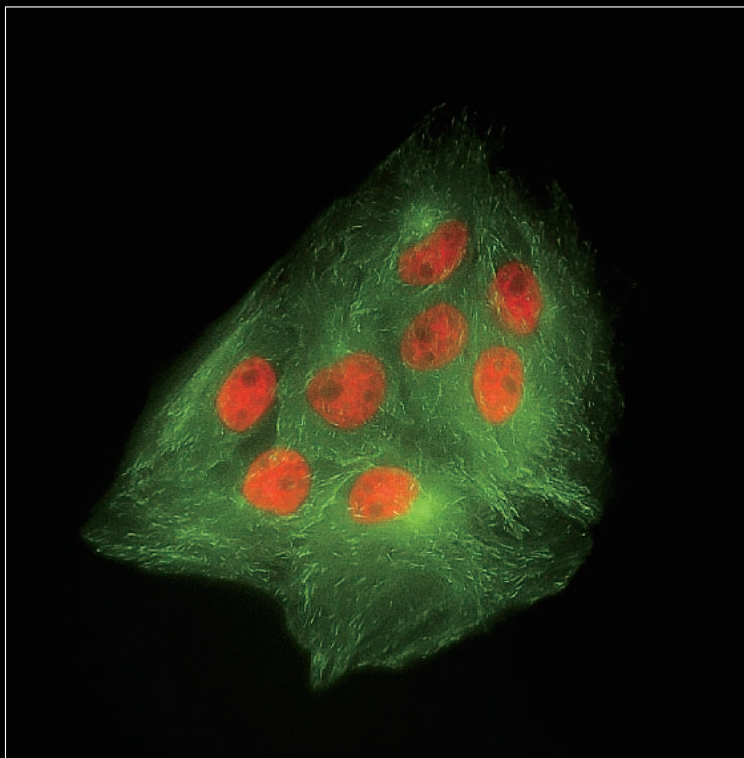
With a large field of view and pixel density, and low noise, the DS-Qi2 is ideal for time-resolved imaging applications.



▲ Rat primary culture neuron  
Dendron labeled with MAP-2(Red) and Actin(cytoskeleton) labeled with Phalloidin (Green)

▶ LLC-PK1 cells expressing GFP-EB3 tubulin (green) and H2B-labeled histones (red) illustrating the large field of view of the DS-Qi2 camera.

Sample courtesy of: Michael Davidson, National High Magnetic Field Laboratory, Florida State University





## Integration with the comprehensive imaging software series

Nikon uses the NIS-Elements series as control software. NIS-Elements allows functions from basic imaging to control of the microscope and peripheral devices to be performed, as well as the measurement, analysis, and management of acquired images. Four basic packages and a variety of optional modules are available to suit every application and objective.

### F Free package

The bundled free package offers functions for the display of scale on live images, full-screen display, and more. The simple operation screen makes shooting easy.

### D Documentation package

The documentation package is equipped with measurement and report creation functions. It enables general microscopic image acquisition in fields from biomedical to industrial, and is expandable through optional added features such as EDF and databases.

### Br Ar Research package

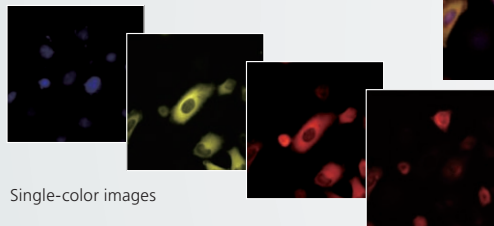
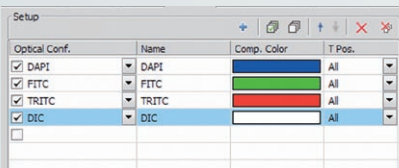
The research package enables the construction of advanced image acquisition systems, including multidimensional imaging (up to 4 dimensions for Br, 6 dimensions for Ar), through integration with systemized microscopes. Sets equipped with a rich range of image processing and analysis functions are available for every application.

Compatible OS: Windows® 10 Pro (32/64-bit version), NIS-Elements Ar is only compatible with the 64-bit version.

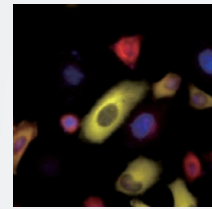
\* For information about compatible desktop PCs, contact Nikon.

## Multichannel (Multi Color) **Ar Br**

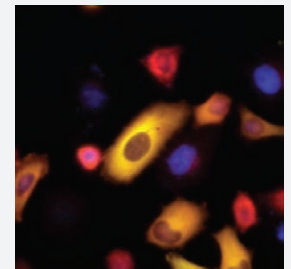
NIS-Elements can acquire full bit depth multi-color images, combining multiple fluorescence wavelengths and different illumination methods (DIC, phase contrast etc.), while offering independently scalable channels.



Single-color images



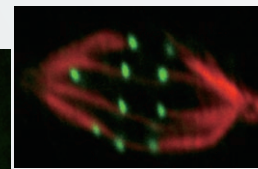
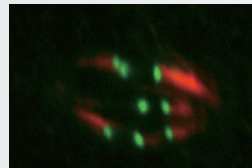
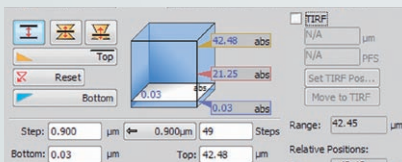
Specified-color merged image



All-color merged image

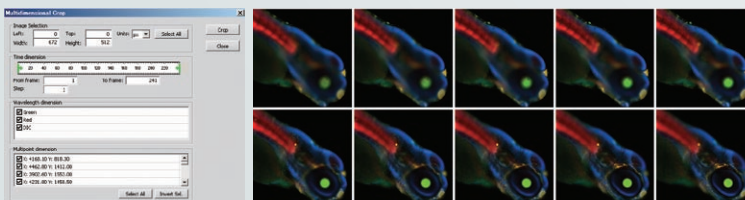
## Z-series **Ar Br D**

Through motorized focus control, NIS-Elements reconstructs and renders 3D images from multiple Z-axis planes.

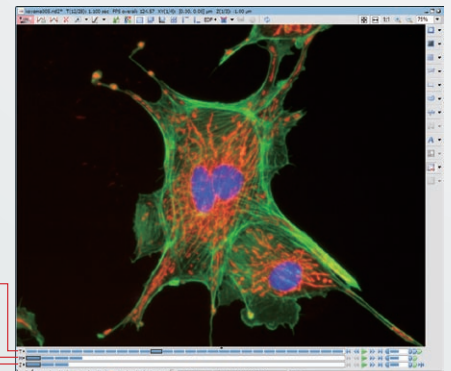


## Multi-dimensional Image Display **Ar Br**

NIS-Elements displays time lapse, multi-channel, multiple X, Y, Z positions in an intuitive layout, which allows for automatic playback and the ability to select subsections of the data to be saved as a new file.



Time  
 Multipoint  
 Z-series  
 Channel

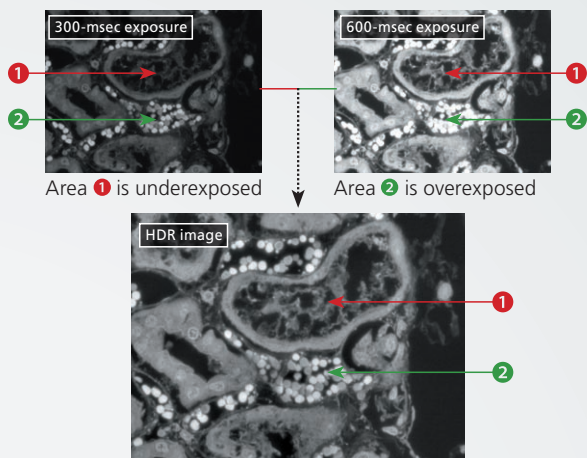




## HDR (High Dynamic Range) image acquisition

Ar Option Br D

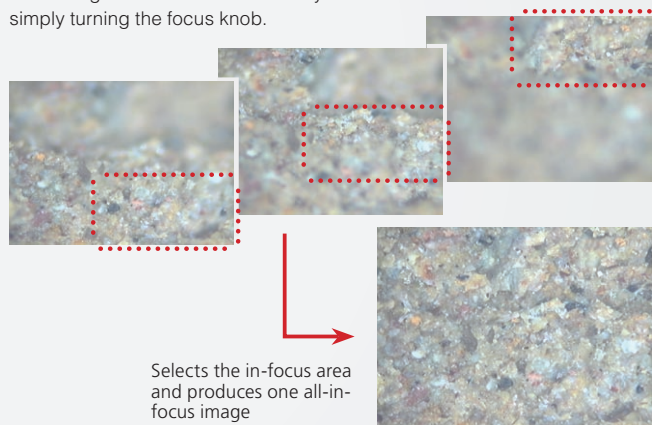
HDR creates an image with appropriate brightness in both the dark and bright regions in a sample by combining multiple images acquired with different exposure settings. It is also possible to create HDR image using multiple captured images.



## EDF (Extended Depth of Focus)

Option Ar Br D

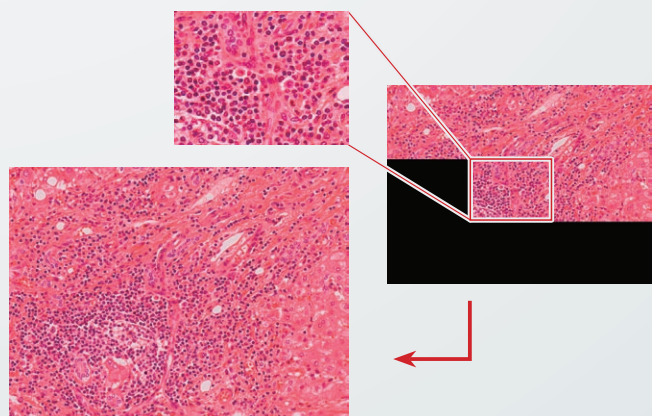
Creates a single, all-in-focus image from images of differing focus. Such images can now be created by simply turning the focus knob.



## Image stitching (Large Image)

Option Ar Br D

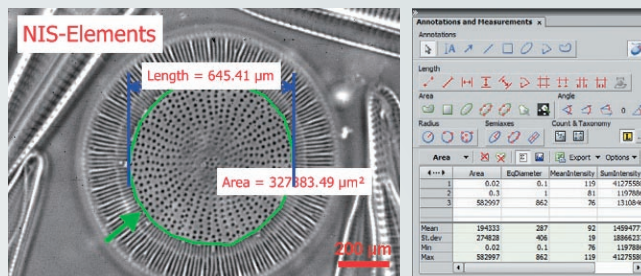
Stitches together images from multiple fields of view during shooting to create an image with wide field of view. Images already acquired can also be stitched together.



## Manual measurement and image annotation

Ar Br D

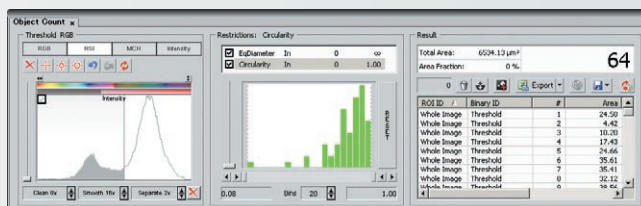
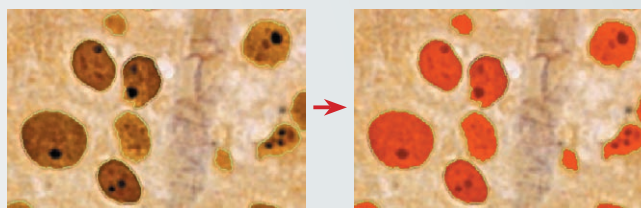
Manual Measurement allows easy measurement of length and area by drawing lines or an object directly on the image. The results can be attached to the image, and also exported as text or to an Excel spreadsheet.



## Auto measurement (Object Counting)

Ar Br Option D

Performs binarization on images using previously set thresholds to measure the number, area, brightness, etc. of identified objects.

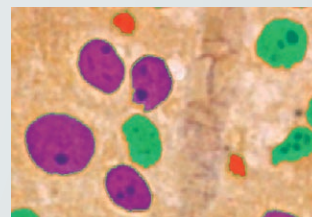


## Classifier

### Object Classifier

Option Ar

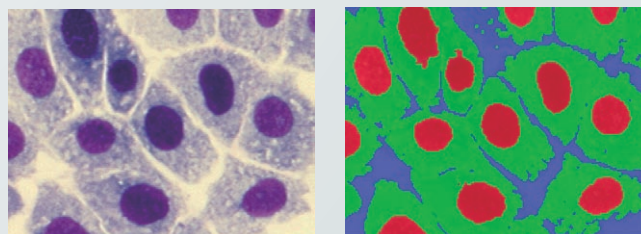
Object classifier uses objects identified by thresholding along with additional features such as shape factors, and other statistical methods including nearest neighbor and neural networks for classifying objects into multiple categories. It is also possible to teach the module based on interactive 'picking' of image pixels.



### Pixel Classifier

Ar Br Option D

This function classifies each pixel in the image with RGB/HIS and intensity across the whole image. Results are reported in percentage and it is possible to save and reuse parameters across a large sample of images. Multiple binary layers are also displayed with multiple colors on the image and are available with other analysis tools within the software package.





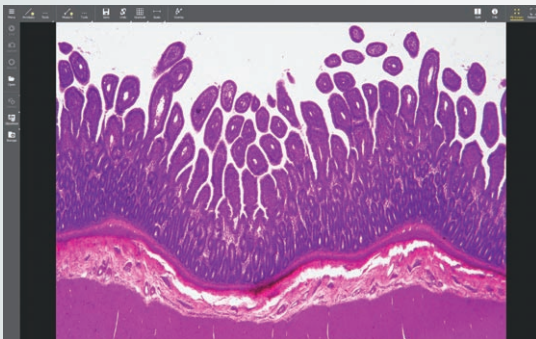
## Allows intuitive control of microscope cameras from tablet PCs

Simply installing NIS-Elements L on a tablet PC enables setting and control of DS-Fi3/DS-Ri2 microscope cameras, live image display, and image acquisition.

(Compatible OS: Windows® 10 Pro) \* For information about compatible tablet PCs, contact Nikon.

### User Interface for naturally simple operation

NIS-Elements L displays various menus for image capture, saving, display, measurement and annotations using intuitive icons. It also supports touch screen operation.



### Scene mode

Ten camera setting patterns for optimal color reproduction and contrast for each microscope light source, observation method and type of sample, as well as custom settings, can be selected. (Available with DS-Fi3/DS-Ri2 microscope cameras)

#### Biological Scene Mode

- Brightfield
- HE
- ELISA
- LED-Brightfield
- Asbestos

### A wide variety of tools

NIS-Elements L enables the conducting of simple measurements on images, with input of lines and comments. These can also be written onto and saved with the image, and measurement data can be output.

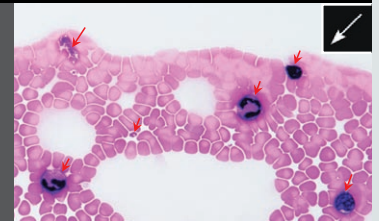
#### Measurement function

- Line distance
- Area
- Circle
- Circle distance
- Pitch distance
- Angle



#### Annotate function

- Line
- Arrow
- Text
- Marker
- Polyline

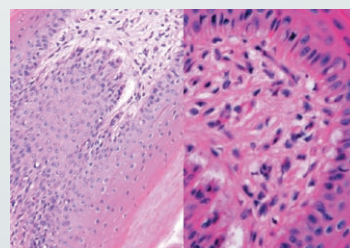


#### Graticule/scale function

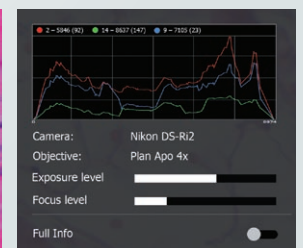
- Crosshairs
- Simple crosshairs
- Circle
- Grid
- Horizontal scale
- Vertical scale

### Other functions

- **Split screen display function:** A live image is displayed on the left side of the screen and the saved image is displayed on the right side. When synchronization is activated, synchronized magnification is applied to the both images.
- **Camera information:** A histogram and metadata of the image are displayed.
- **Full screen:** The image is displayed across the entire screen.
- **Saving:** The displayed image is saved with a new file name.



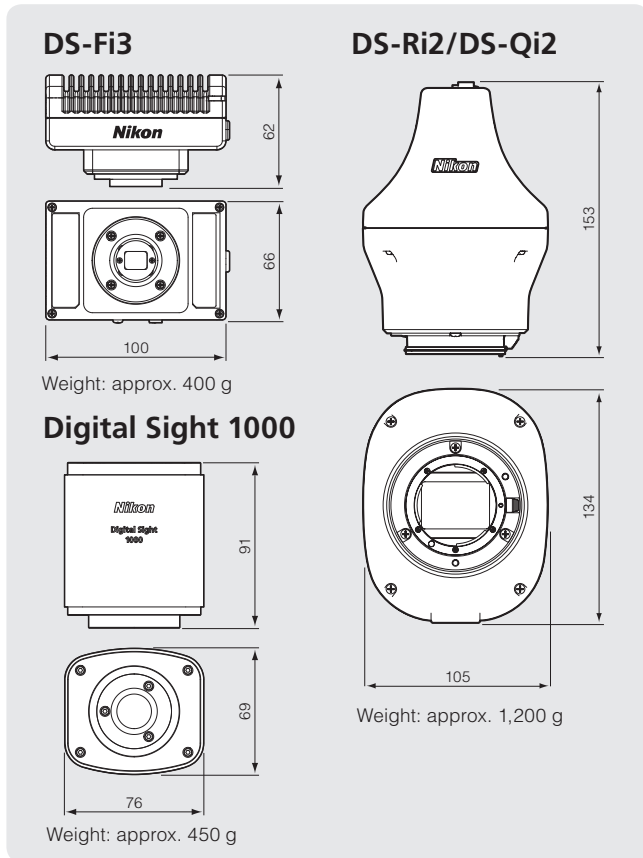
Split screen display function



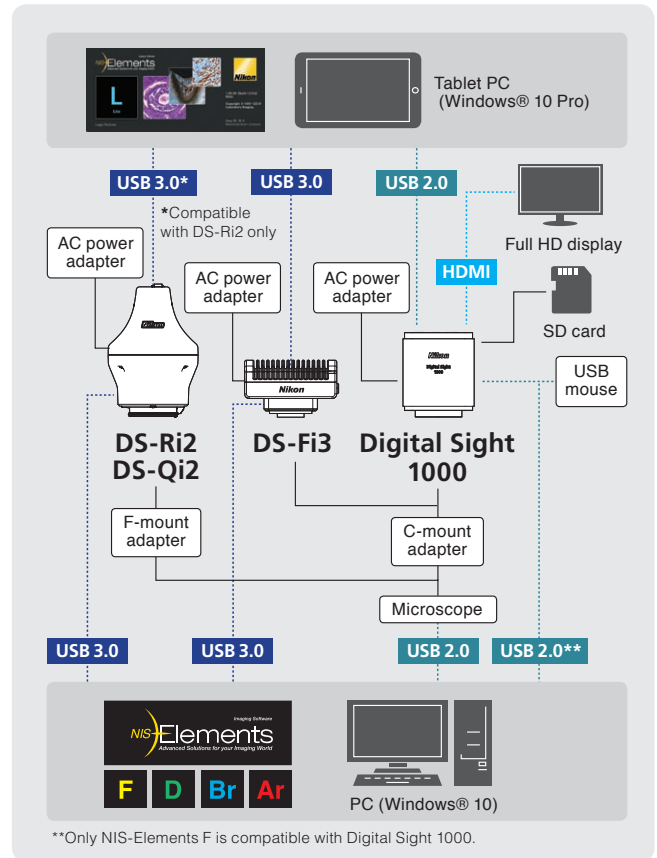
Camera information



## Dimensions



## System Diagram



## Specifications

Model name	Digital Sight1000	DS-Fi3	DS-Ri2	DS-Qi2
Image sensor	1/2.8 inch Color CMOS image sensor Size: 5.57 × 3.13 mm	1/1.8 inch Color CMOS image sensor Size: 6.91 × 4.92 mm	Nikon FX-format Color CMOS image sensor Size: 36.0 × 23.9 mm	Nikon FX-format Monochrome CMOS image sensor Size: 36.0 × 23.9 mm
Recordable pixels	1920 × 1080 pixels	All pixels: 2880 × 2048 2 Vertical and 2 horizontal pixels average: 1440 × 1024	All pixels: 4908 × 3264 3 × 3 pixels average: 1636 × 1088	
Lens mount	C-mount		F-mount	
Cooling method		—		Electronic cooling
ISO sensitivity (recommended exposure index)	Standard: equivalent to ISO 150	Standard: equivalent to ISO 50 (Selectable from ISO 50 to ISO 3200 equivalent)	Standard: equivalent to ISO 200 (Selectable from ISO 200 to ISO 12800 equivalent)	Standard: equivalent to ISO 800 (Selectable from ISO 800 to ISO 51200 equivalent)
Quantum efficiency		—		77%
Full well Capacity		—		60000e (- typ.)
Readout noise		—		2.2e (- typ.)
Dark current		—		0.6e-/p/s (Ta=25°C)(typ.)
Live display mode* (maximum fps)	1920 × 1080 pixels: 30 fps	All pixels (2880 × 2048): 15 fps 2 Vertical and 2 horizontal pixels average (1440 × 1024): 30 fps	All pixels (4908 × 3264): 6 fps 3 × 3 pixels average (1636 × 1088): 45 fps	
Exposure time	1 m sec ~ 10 sec	100 μsec ~ 30 sec	100 μsec ~ 120 sec	
Photometry mode	Average photometry 1920 × 1080 pixels (all area)	Average photometry: Average intensity within the photometry area Peak photometry: Maximum intensity within the photometry area		
Exposure control	Automatic exposure, Manual exposure	One-time automatic exposure: Exposure time is adjusted automatically for one-time within the optimum range for the camera Continuous automatic exposure: Automatic exposure adjustment is performed continuously to keep the exposure within the camera Manual exposure: Exposure time and gain settings are made manually		
Exposure correction	Available	±1EV Step:1/6EV		Average metering: -1 EV ~ +1/2 EV Peak hold metering: -1 EV ~ ±0 EV
Interface	USB2.0 (connect with PC or USB mouse) × 1, HDMI × 1, SD card slot x1**	USB3.0 (connect with PC) × 1, External trigger × 1		USB 3.0 (connect with PC) × 1, External trigger × 1
Power supply	AC100-240V 50Hz/60Hz			
Power consumption	3 W	4.8 W	13 W	24 W
Operating environment	0-40°C, 60% RH max. (without condensation)			0-30 °C, 80% RH max. 30-40°C, 60% RH max. (without condensation)

\*Maximum frame rate depends on exposure time.

\*\*Both SD and SDHC memory cards are available.

**Specifications and equipment are subject to change without any notice or obligation on the part of the manufacturer. June 2020 ©2004-2020 NIKON CORPORATION**

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\*Products: Hardware and its technical information (including software)



**WARNING**

TO ENSURE CORRECT USAGE, READ THE CORRESPONDING MANUALS CAREFULLY BEFORE USING THE EQUIPMENT.



**NIKON CORPORATION**

Shinagawa Intercity Tower C, 2-15-3,  
Konan, Minato-ku, Tokyo 108-6290, Japan  
phone: +81-3-6433-3705 fax: +81-3-6433-3785  
<https://www.healthcare.nikon.com/en/>

ISO 14001 Certified  
for NIKON CORPORATION

**NIKON INSTRUMENTS INC.**

1300 Walt Whitman Road, Melville, N.Y. 11747-3064, U.S.A.  
phone: +1-631-547-8500; +1-800-52-NIKON (within the U.S.A. only)  
fax: +1-631-547-0306

<https://www.microscope.healthcare.nikon.com/>

**NIKON INSTRUMENTS EUROPE B.V.**

Tripolis 100, Burgenweeshuispad 101, 1076 ER Amsterdam, The Netherlands  
phone: +31-20-7099-0000 fax: +31-20-7099-298

[https://www.microscope.healthcare.nikon.com/en\\_EU/](https://www.microscope.healthcare.nikon.com/en_EU/)

**NIKON INSTRUMENTS (SHANGHAI) CO., LTD.**

CHINA phone: +86-21-6841-2050 fax: +86-21-6841-2060  
(Beijing branch) phone: +86-10-5831-2028 fax: +86-10-5831-2026  
(Guangzhou branch) phone: +86-20-3882-0550 fax: +86-20-3882-0580  
[https://www.microscope.healthcare.nikon.com/zh\\_CN/](https://www.microscope.healthcare.nikon.com/zh_CN/)

**NIKON CANADA INC.**

CANADA phone: +1-905-602-9676 fax: +1-905-602-9953

**NIKON FRANCE S.A.S.**

FRANCE phone: +33-1-4516-45-16 fax: +33-1-4516-45-55

**NIKON GMBH**

GERMANY phone: +49-211-941-42-20 fax: +49-211-941-43-22

**NIKON INSTRUMENTS S.p.A.**

ITALY phone: +39-55-300-96-01 fax: +39-55-30-09-93

**NIKON GMBH SWITZERLAND**

SWITZERLAND phone: +41-43-277-28-67 fax: +41-43-277-28-61

**NIKON UK LTD.**

UNITED KINGDOM phone: +44-208-247-1717 fax: +44-208-541-4584

**NIKON CEE GMBH**

AUSTRIA phone: +43-1-972-6111 fax: +43-1-972-611-140

**NIKON SINGAPORE PTE LTD.**

SINGAPORE phone: +65-6559-3651 fax: +65-6559-3668

**NIKON INSTRUMENTS KOREA CO., LTD.**

KOREA phone: +82-2-2186-8400 fax: +82-2-555-4415