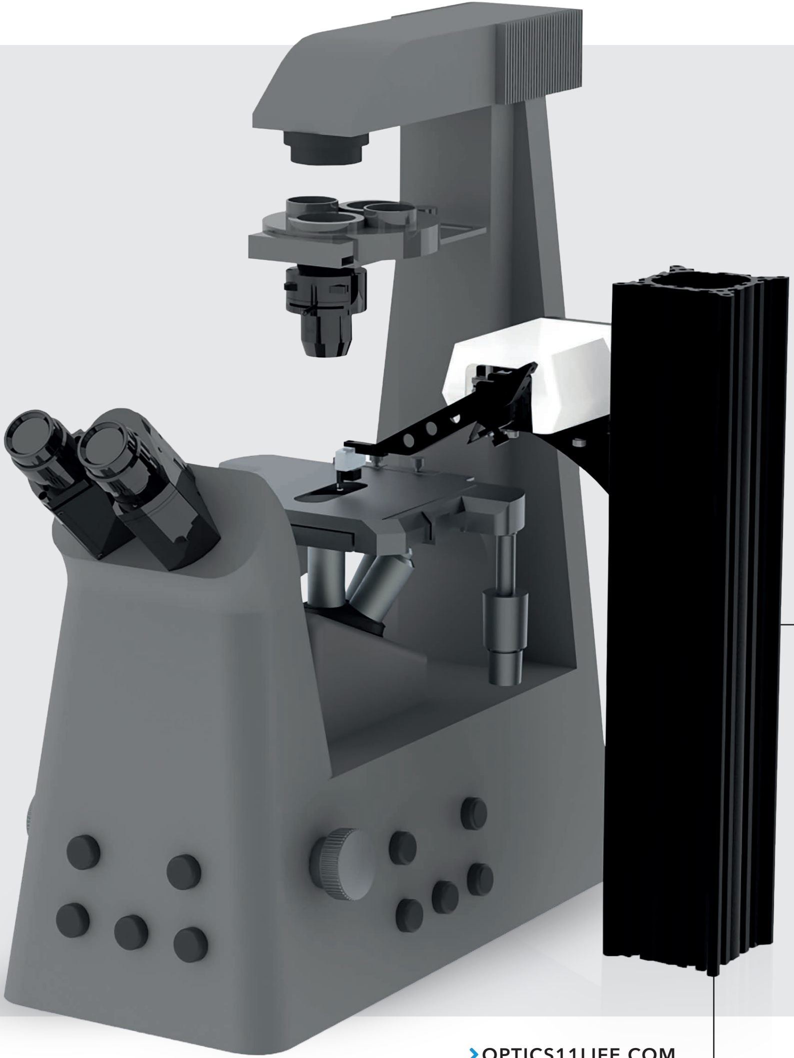


OPTICS11 life

CHIARO

NANOINDENTER

Mechanobiology on your microscope.

OPTICS11 life

ABOUT OPTICS 11 LIFE

Optics11 was founded in 2011 as a university spin-off. The first product was built in 2012: an extremely sensitive and easy to use measurement device for mechanical characterization of soft materials. The company now has two business units: Optics11 develops integrated fiber-optics based sensors for industrial applications while Optics11 Life focuses on Life Science applications.

Currently, Optics11 Life offers a range of Nanoindentation instruments used for various applications, from routine hydrogel testing and single-cell mechanobiology experiments to high-throughput mechanical screening of 3D tissue models.

Go the the website

PATENTED **FIBER OPTICS TECHNOLOGY**

USED IN **22 COUNTRIES** AND **5 CONTINENTS**

Amsterdam, The Netherlands

Boston, US

ABOUT CHIARO
NANOINDENTER

Are you curious about the mechanical behavior of cells, spheroids, tissues, or 3D cell cultures? Do you work with biological materials that are challenging to characterize?

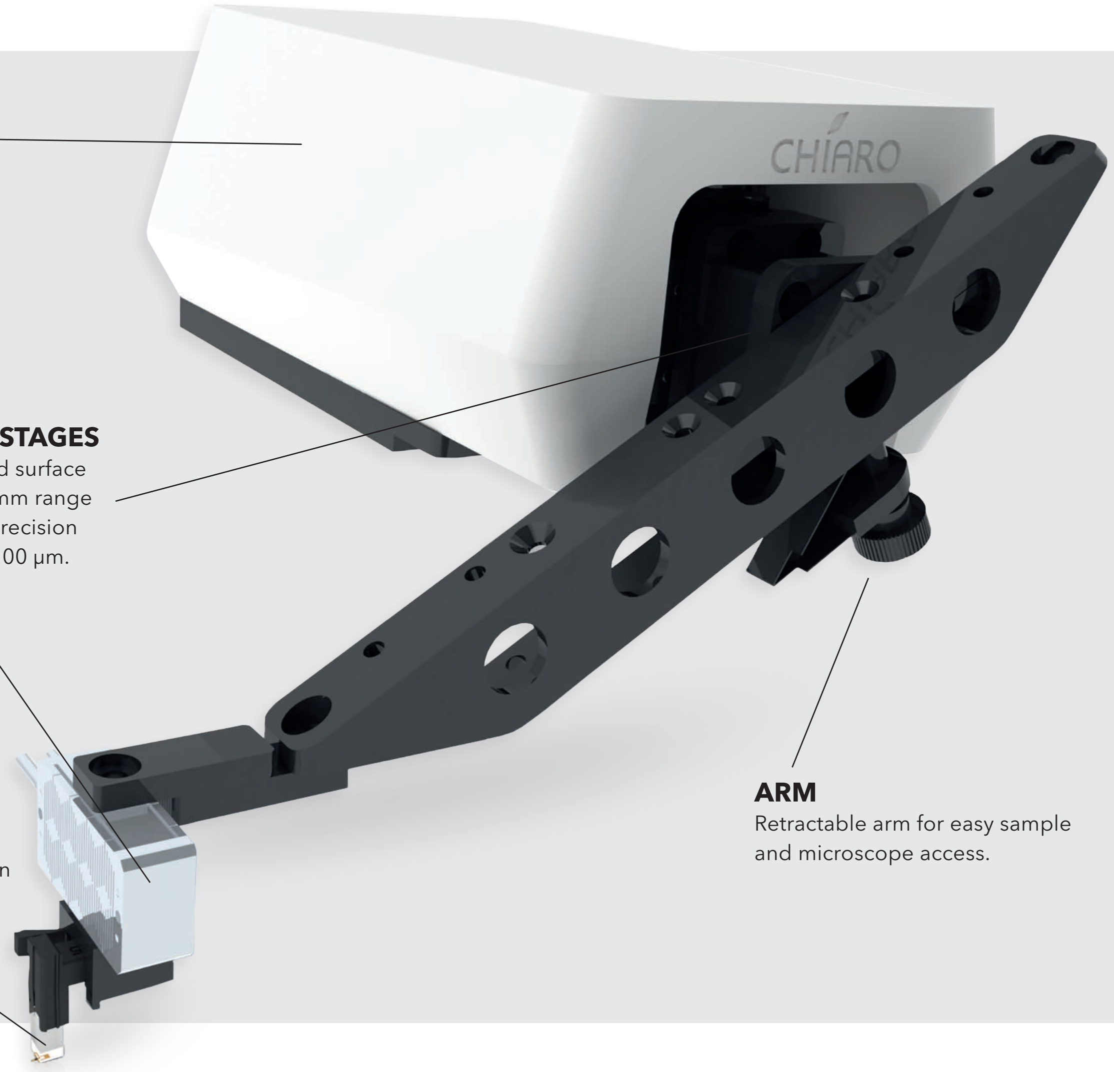
The Chiaro is the ideal nanoindentation instrument to explore the **micro-mechanical properties of various biomaterials**. Therefore, this instrument is purpose-built to measure the forces of cells or other microstructures while imaging with an inverted microscope.

The Chiaro is designed as a compact yet powerful device **compatible with almost any inverted or upright microscope**. You can now start to explore mechanobiology in your lab!

MEASURE MECHANICAL PROPERTIES AND FORCES OF BIOMATERIALS

- Single cells
- Cell monolayers
- Spheroids, organoids, oocytes
- Tissue slices and cryosections
- Embryos, zebrafish
- Cells on micropatterns or pillars
- Microparticles and microgels
- Hydrogels and scaffolds
- 3D printed microstructures

DESIGNED FOR MECHANOBIOLGY



TECHNOLOGY

MULTI-SCALE MECHANICS

The Optics11 Life Chiaro Nanoindenter is purpose-built to explore soft and stiff materials (5Pa-1GPa) from cell-length scales (micro) up to tissue scales (macro), providing true insights into the mechanics of natural and engineered biomaterials.

UNIQUE PATENTED TECHNOLOGY

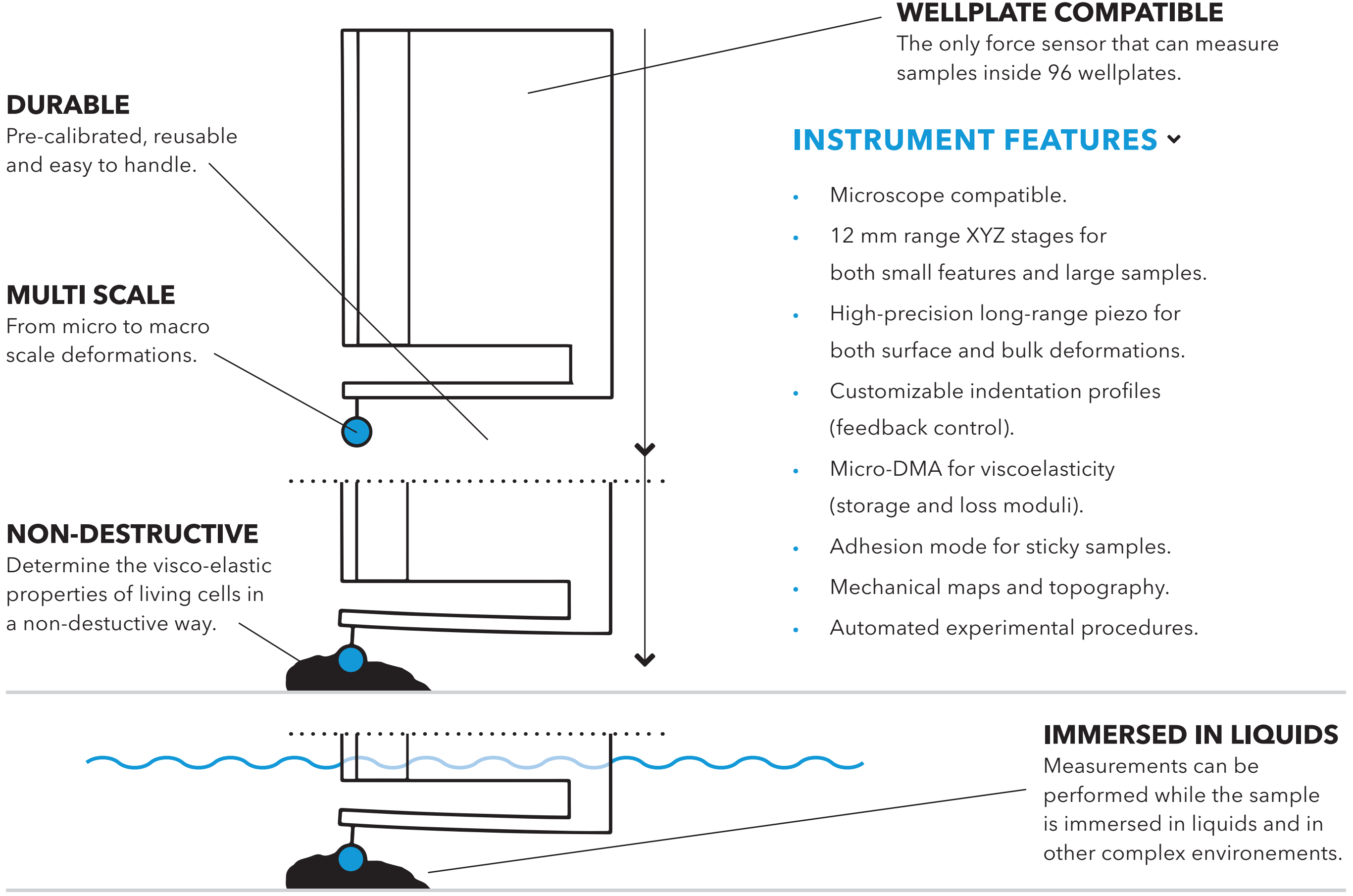
The unique fiber-optical interferometric MEMS technology developed by Optics11 Life makes it possible to measure even the softest materials with high force resolution in a non-destructive way, also while immersed in liquids or air. The design of the probes combined with novel sensing technology also enables measurements of heterogeneous and irregularly-shaped samples inside 96 wellplates or custom chambers, giving flexibility to your experimental protocol.

NANOINDENTATION

Chiaro Nanoindenter uses the **sensor to gently push a spherical glass tip on the surface of the sample similar to AFM**. By closely monitoring the resulting sample deformation, the Chiaro Nanoindenter can rapidly provide mechanical information of the indented spot. Indentation profiles are **fully customizable** to provide high-precision in terms of maximum load, indentation depth, and deformation rate. Beyond classical static indentations, Piuma can perform **dynamic mechanical analysis (DMA)** for viscoelastic characterization of biomaterials similar to rheometry.

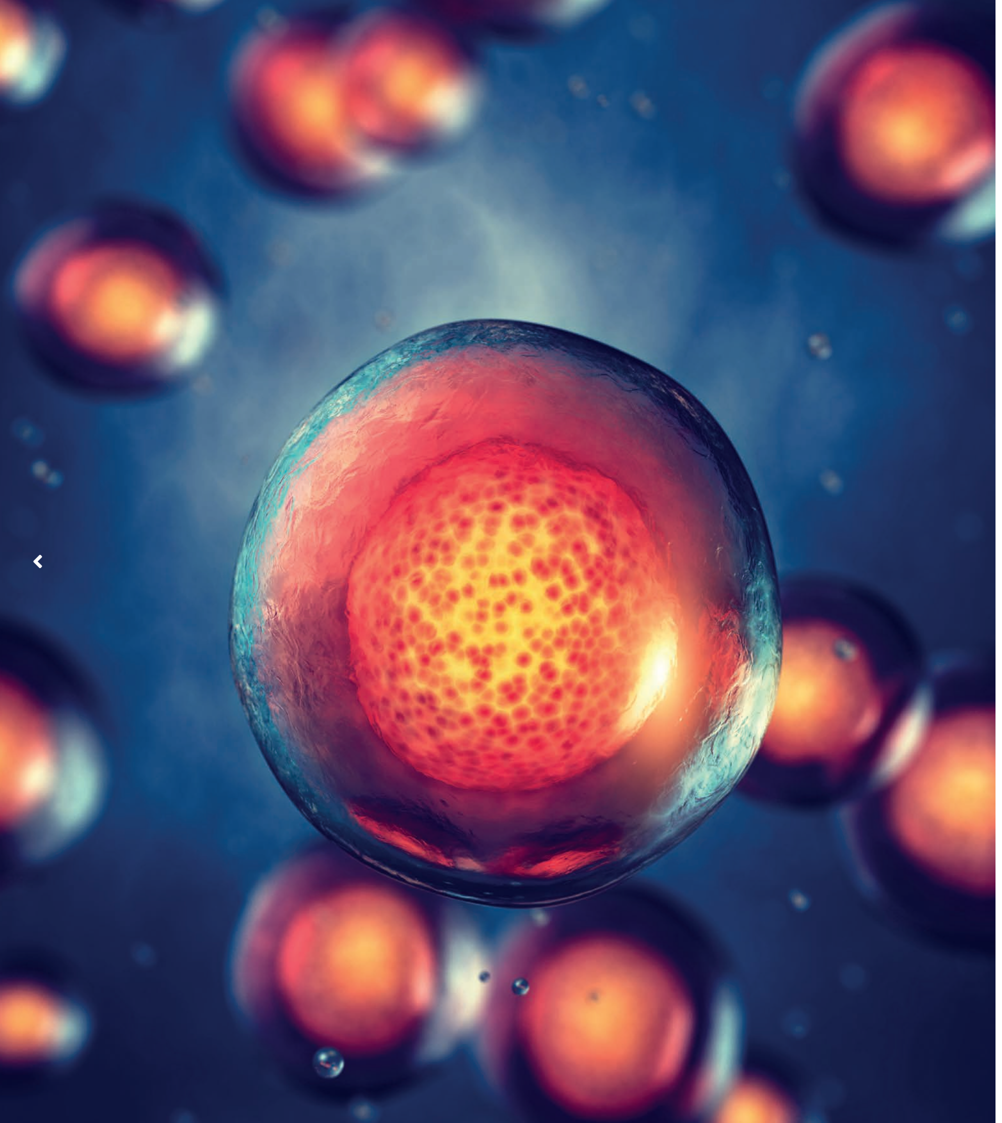
EASY TO USE

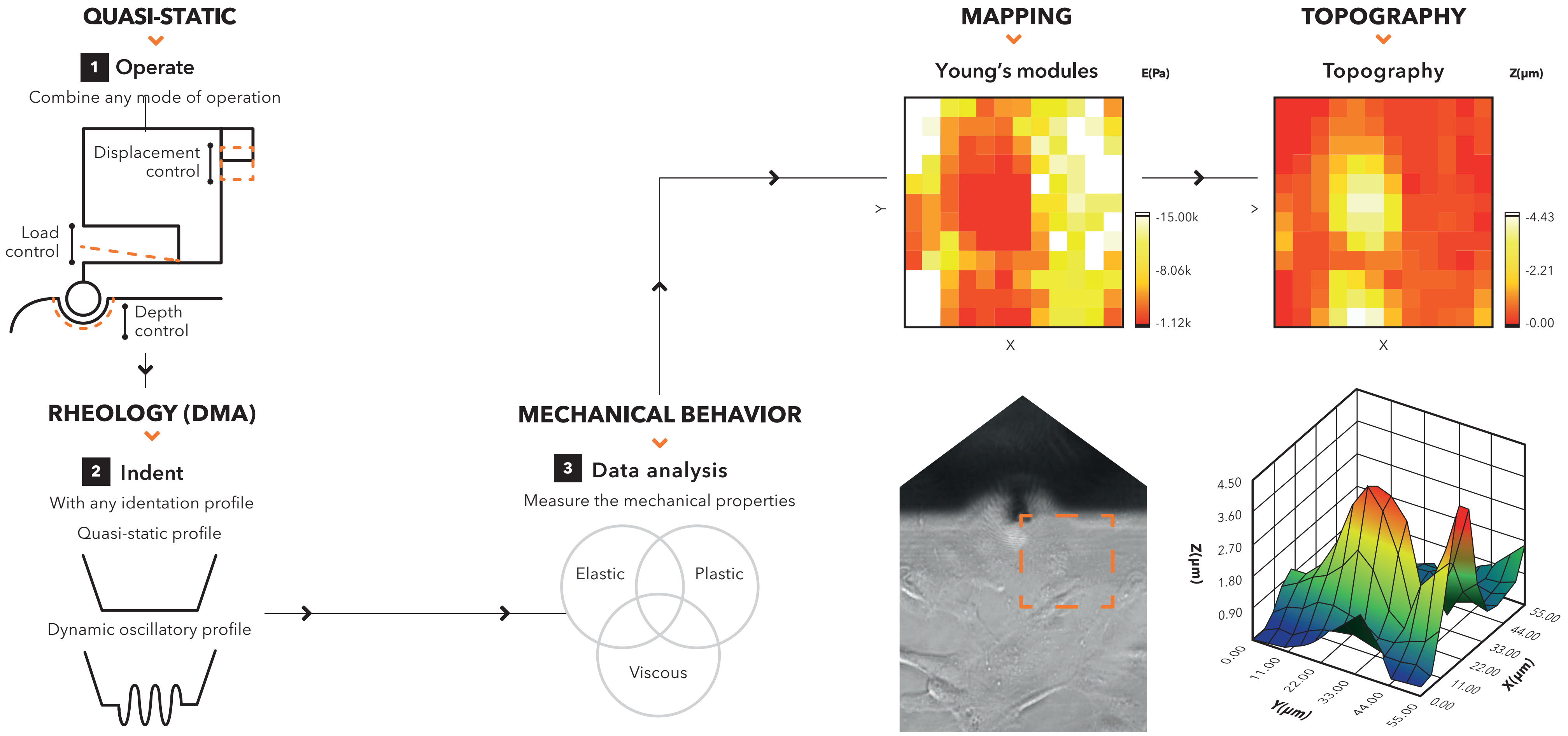
All Optics11 Life probes are **pre-calibrated making them plug-and-play design that** streamlines experiments. This ensures fast measurements which are critical for time-sensitive biology-related experiments.



INSTRUMENT FEATURES

- Microscope compatible.
- 12 mm range XYZ stages for both small features and large samples.
- High-precision long-range piezo for both surface and bulk deformations.
- Customizable indentation profiles (feedback control).
- Micro-DMA for viscoelasticity (storage and loss moduli).
- Adhesion mode for sticky samples.
- Mechanical maps and topography.
- Automated experimental procedures.



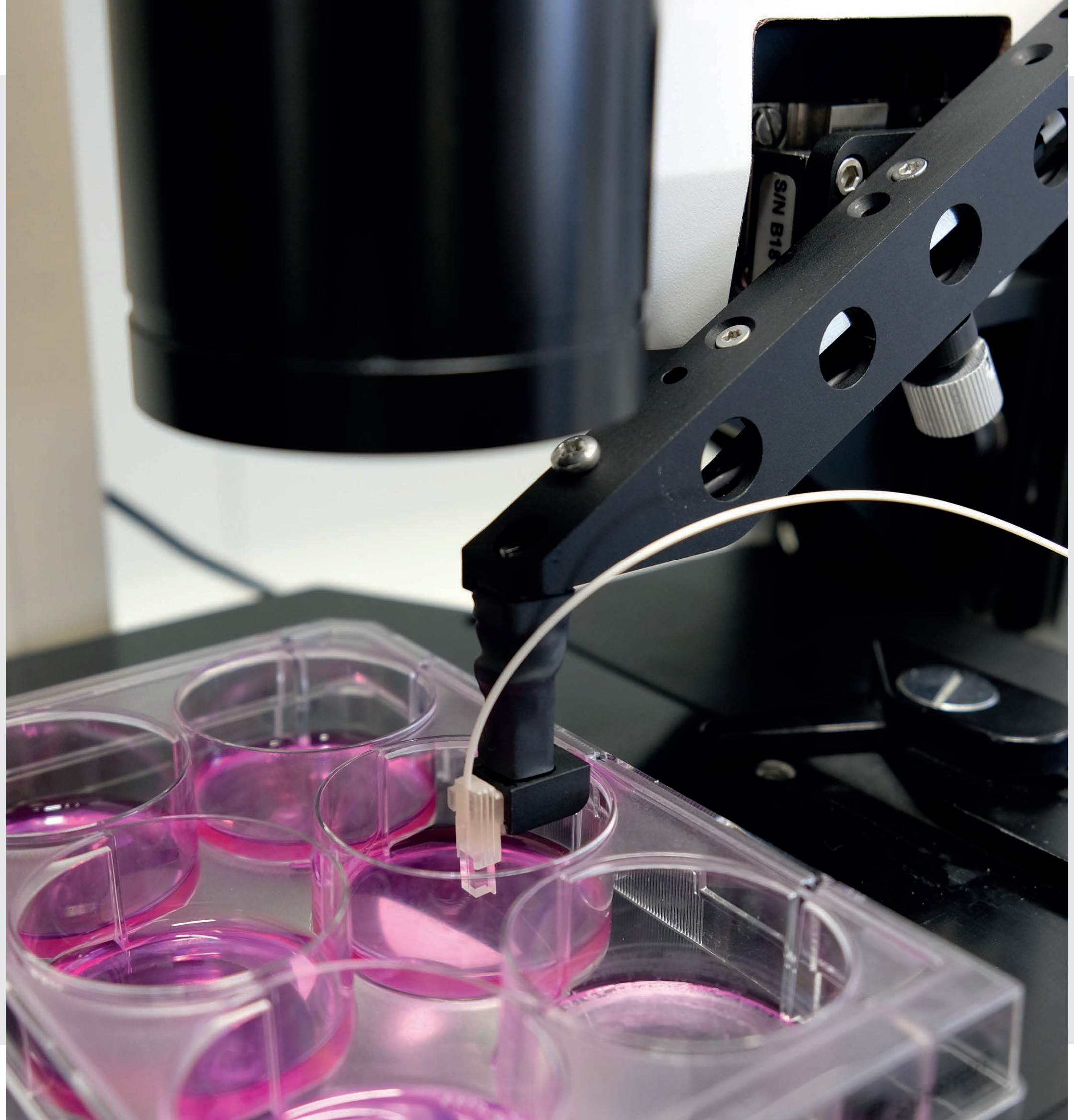

QUASI-STATIC
1 Operate
Combine any mode of operation
Displacement control
Load control
Depth control
RHEOLOGY (DMA)
2 Indent
With any identation profile
Quasi-static profile
Dynamic oscillatory profile
MECHANICAL BEHAVIOR
3 Data analysis
Measure the mechanical properties
Elastic
Plastic
Viscous
MAPPING
Young's modules
E(Pa)
-15.00k
-8.06k
-1.12k
Y
X
TOPOGRAPHY
Topography
Z(μm)
-4.43
-2.21
-0.00
X
Z(μm)
4.50
3.60
2.70
1.80
0.90
0.00
11.00
22.00
33.00
44.00
55.00
Y(μm)
X(μm)

COMBINE WITH MICROSCOPY

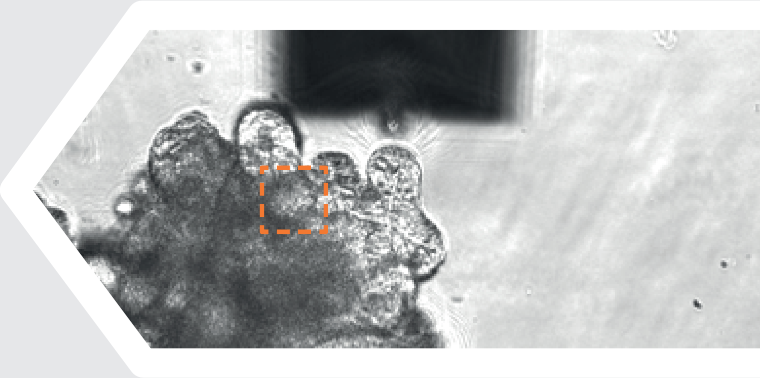
The Chiaro Nanoindenter combines with almost any inverted microscope, various upright microscopes and other research instruments. Therefore, you can combine the Chiaro with the imaging equipment of your choice. For example, **bright-field, phase contract, fluorescence and confocal microscopes** can be used with Chiaro for any mechanobiology challenge. Combination of imaging and indentation enables novel experiments easier than before.

Due to the low-footprint, immersible force sensor and independent mounting options the Chiaro Nanoindenter is the ultimate companion for research on forces and mechanical behavior in biology.

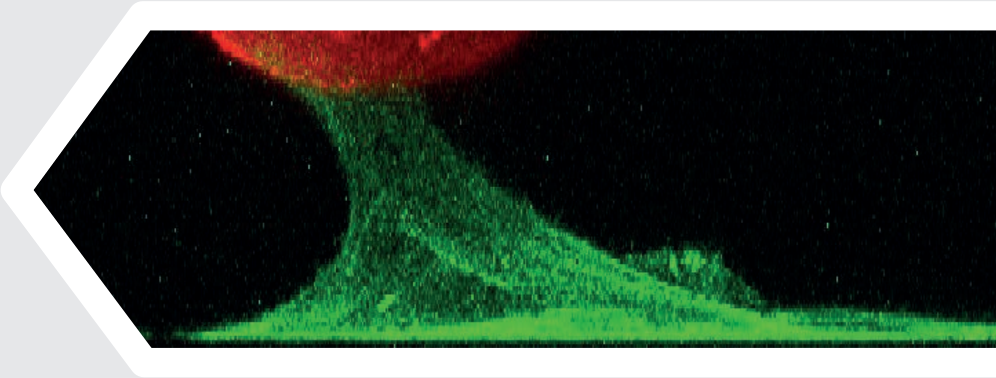
Measure inside wellplates ›



Target regions of interest



Advanced mechanobiology experiments using fluorescence



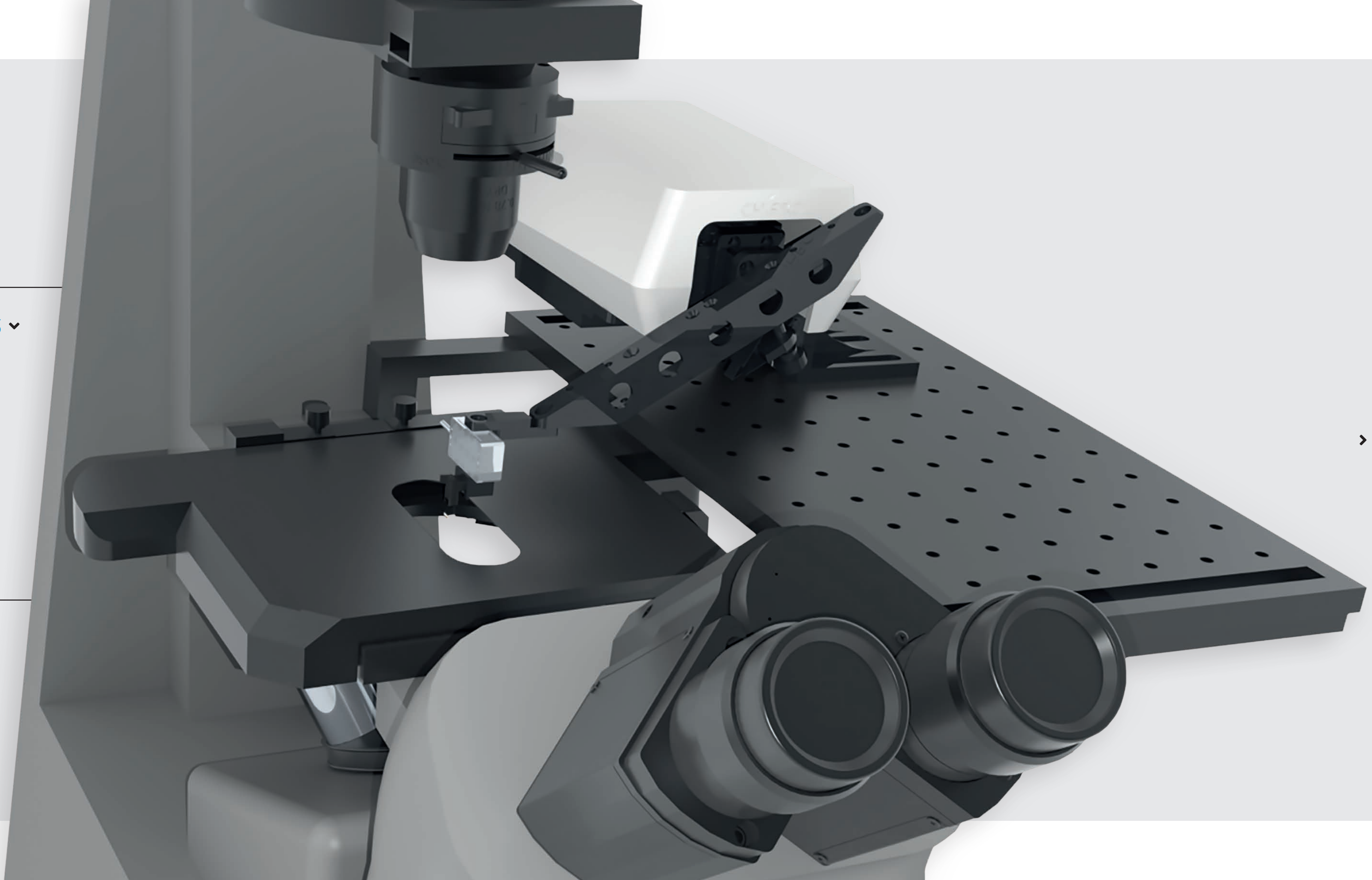
APPLICATIONS

3D tissue models are revolutionizing diagnostics, drug development, and regenerative medicine fields. Mechanics have the potential to serve as a label-free biomarker for the assessment of the structure and function of cell cultures and tissues. Some key applications are:

- Assess the **mechanical phenotype** of cell cultures.
- Mechanically characterize **pathological tissues**.
- **Engineer disease models** with abnormal mechanical microenvironment e.g., fibrosis, cancer, inflammation.
- **Mimic in vivo** mechanical microenvironment.
- Study **effects of drugs** to mechanical integrity of 2D and 3D cell cultures.
- Assess mechanical alterations during **growth and maturation** of tissues.
- Discover mechanical effects of new **biofabrication methods**.
- **Build** mechanically relevant modular tissues.

ADVANCED EXPERIMENTS

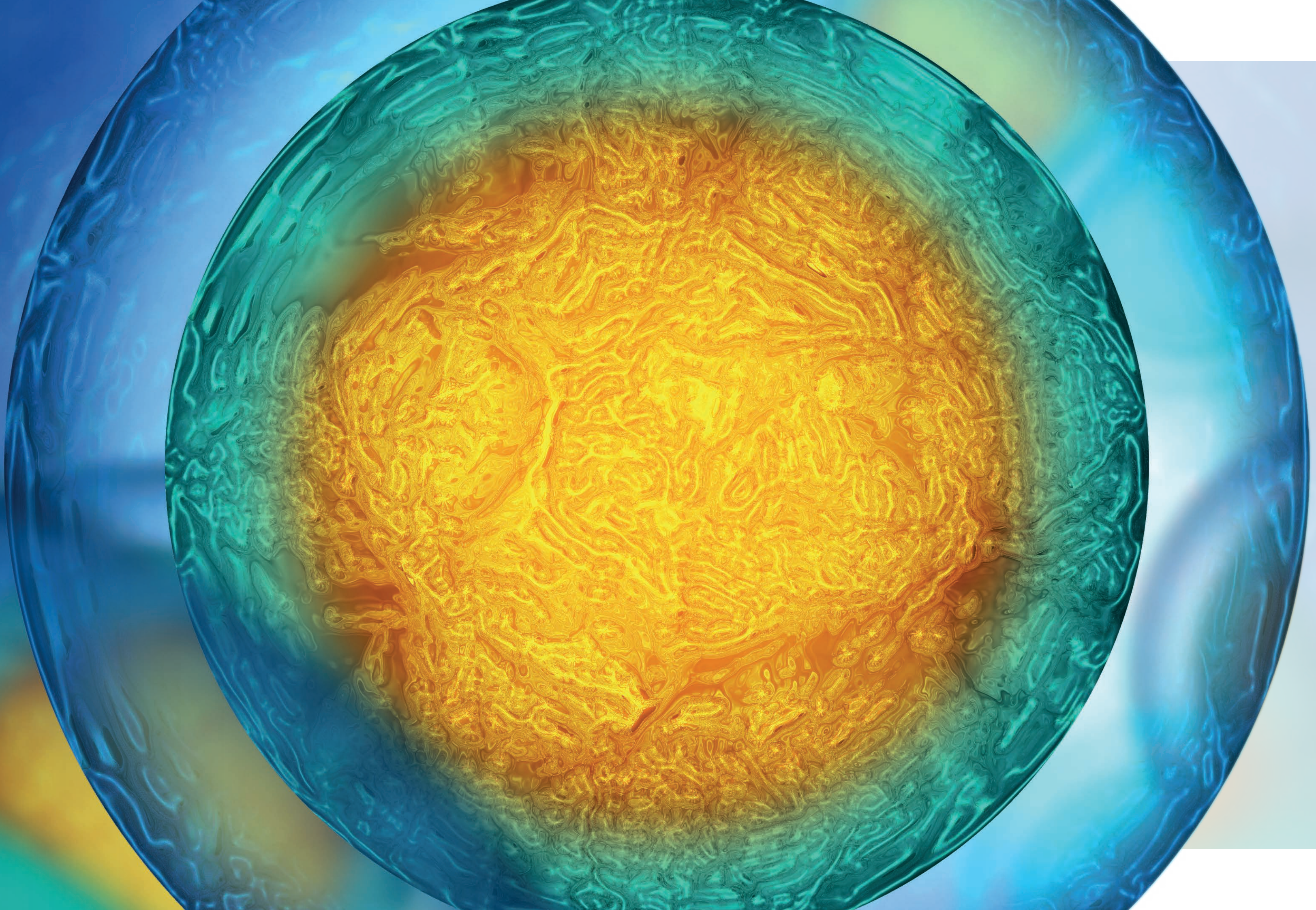
- Force-sensing in contractile cells.
- Force-sensing during swelling, migration and growth.
- Adhesion force spectroscopy.
- Cell-material interactions.
- Force-induced mechanotransduction processes.



APPLICATION NOTE

PRACTICAL CASES

The use of the Chiaro nanoindenter in myocardial infarction research.



Download application note

TECHNICAL SPECIFICATIONS

Probes

Young's modulus*	5 Pa – 1 GPa
Stiffness range	0.02 – 200 N/m
Tip radius (spherical)	3 – 250 μm
Force range*	200 pN – 4 mN
Cantilever bending range	up to 30 μm
Noise level	5nm RMS
Probe material	Glass and silicon nitride
Cleaning	Isopropanol, Helizyme, Trypsin
Calibration	Pre-calibrated

System capabilities

Indenter dimensions (WxLxH)	120x150x280 mm
Indentation stroke	90 +/- 5 μm @0.5 nm resolution
X-Y stage range	12x12 mm @ 80 nm resolution
Z stage range	12 mm @ 80 nm resolution
Minimum lateral pitch	0.2 μm
Output signal bandwidth	20 kHz

Software

Operation	Programmable for automation
Data analysis	DataViewer software Young's modulus E (Hertz, Oliver-Pharr, JKR) Storage and Loss moduli (E', E''), tan(δ)
Raw data format	.txt
Data acquisition rate	1 Hz – 16 kHz

Indentation capabilities

Modes of operation	Displacement, load, indentation
Types of indentation	Quasi-static, step-response (creep/stress-relaxation), dynamic/oscillatory (DMA)
Indentation profiles	Customizable
DMA frequency range*	0.01 – 20 Hz
Maximum displacement speed	100 μm/s
Indentation depth*	0.01 – 100 μm
Contact size diameter*	1 – 500 μm

Options

Dynamic module	Add load/indentation control and DMA modes
Mounting	Direct on a microscope or on a post

Maintenance

Software	Regular updates
Training	New user onsite/remote training, online course, advanced training
System	Maintenance visits and upgrade options

* These specifications depends on combination of parameters: probe and sample stiffness, set indentation depth or load, tip radius and environmental noise.

OPTICS11 life

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