

HORIBA

Explore the future

HORIBA Scientific

HORIBA FRANCE SAS

Dr. Chiraz Frydman

Which photonic solutions to investigate the Bio-Nano World



June 2019

HORIBA: Five Segments, Five Markets

Automotive Test Systems



- Emission Measurement Systems (EMS)
- Mechatronics Devices (MCT)
- Test Automation Systems (TAS)
- Intelligent Transport Systems (ITS)

Process & Environmental



- Environmental & Process Systems
- Environmental Radiation Monitor
- Environmental Regulation & Process Business

Medical



- In-Vitro Diagnostic (IVD) Systems
- Integration of HORIBA ABX's Technology & Marketing Know-how

Semiconductor



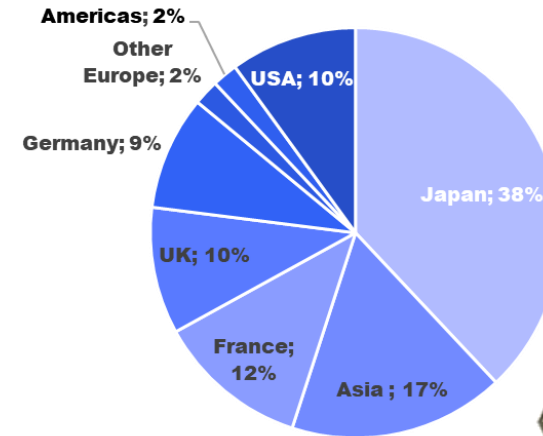
- Mass Flow Controller
- In-situ Analysis
- Synergy among HORIBA HQ, HORIBA STEC and HORIBA Jobin Yvon's Technologies

Scientific

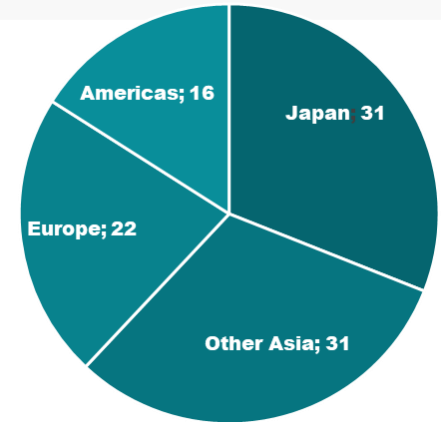


- Raman, Grating, Particle Size & Fluorescence
- Synergy of HORIBA and HORIBA Jobin Yvon's Technologies

Sales of FY2018: 1,897 M\$
Total Number of Employees: over 7,934



Employees by key area



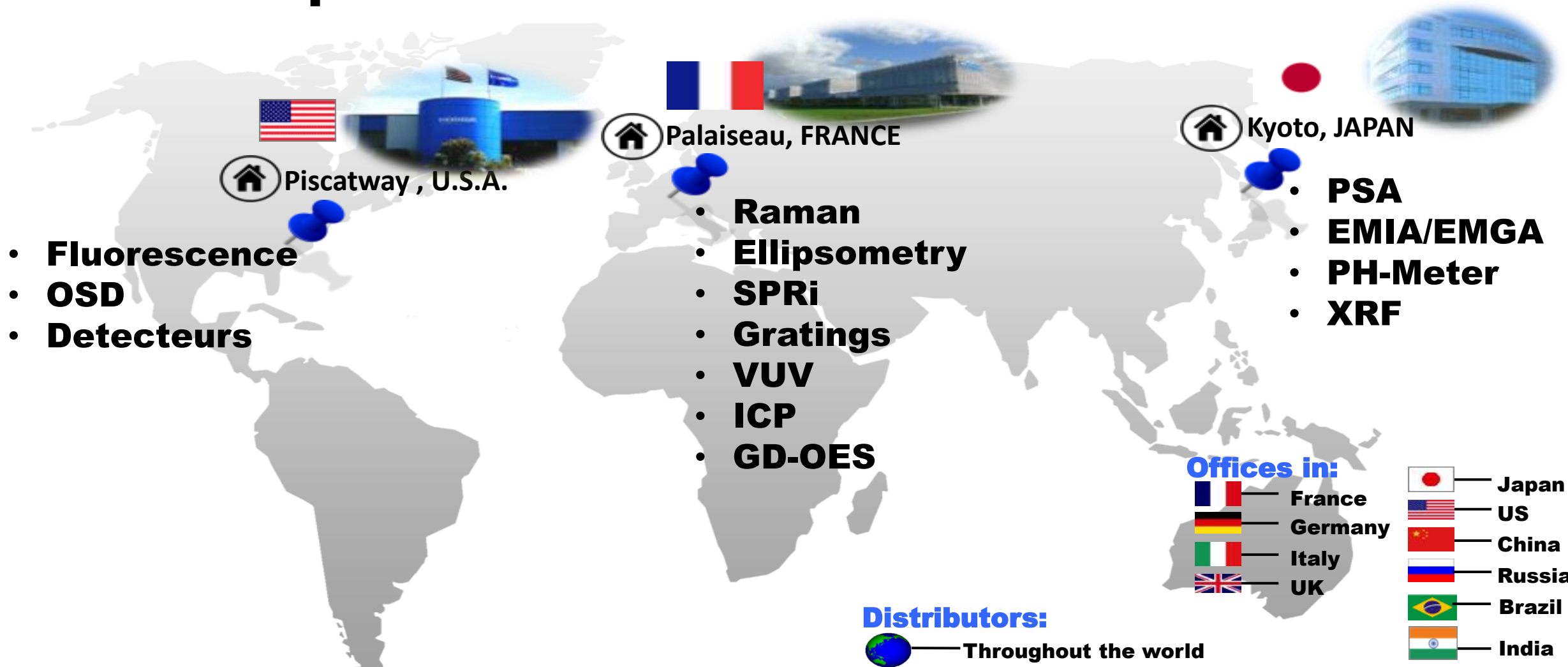
Sales by region



www.horiba.com

HORIBA Group Motto: Joy & Fun

Mission: Explore the future



Facilities in France



Villeneuve d'Ascq



Palaiseau



Longjumeau



A 200 year history



Lense

1819



A. Fresnel



Interferometer

1900



C. Fabry

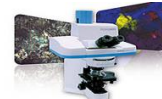


Gratings

1970



A. Labeyrie



Raman microscope



M. Delhaye



Ellipsometer

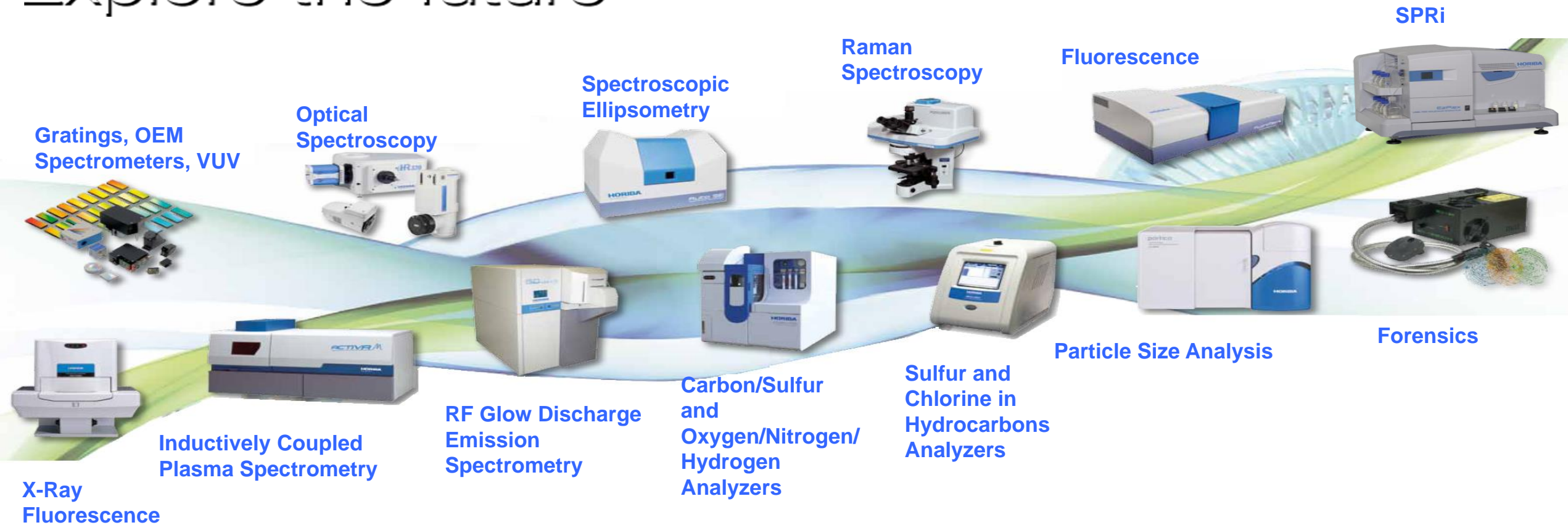
1980



B. Drevillon

Products and Techniques portfolio

Explore the future



What is Life Sciences?

Life science
generally seeks
to answer
the what, where,
how and why of
all living things

← HEALTH ←

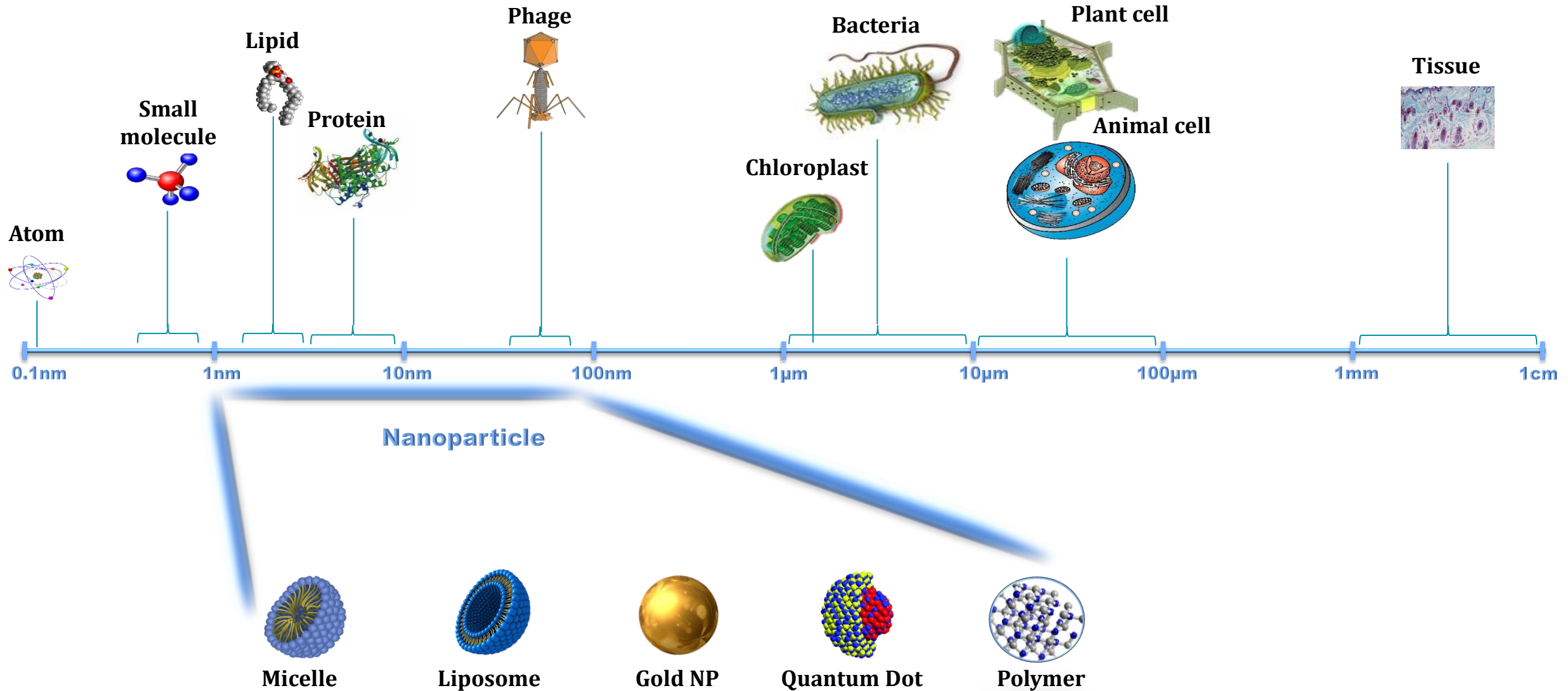
EXPECTATION →

- Diagnostic
- Drug
- Nutraceutical
- Agri-Food
- Environment
- Biosecurity

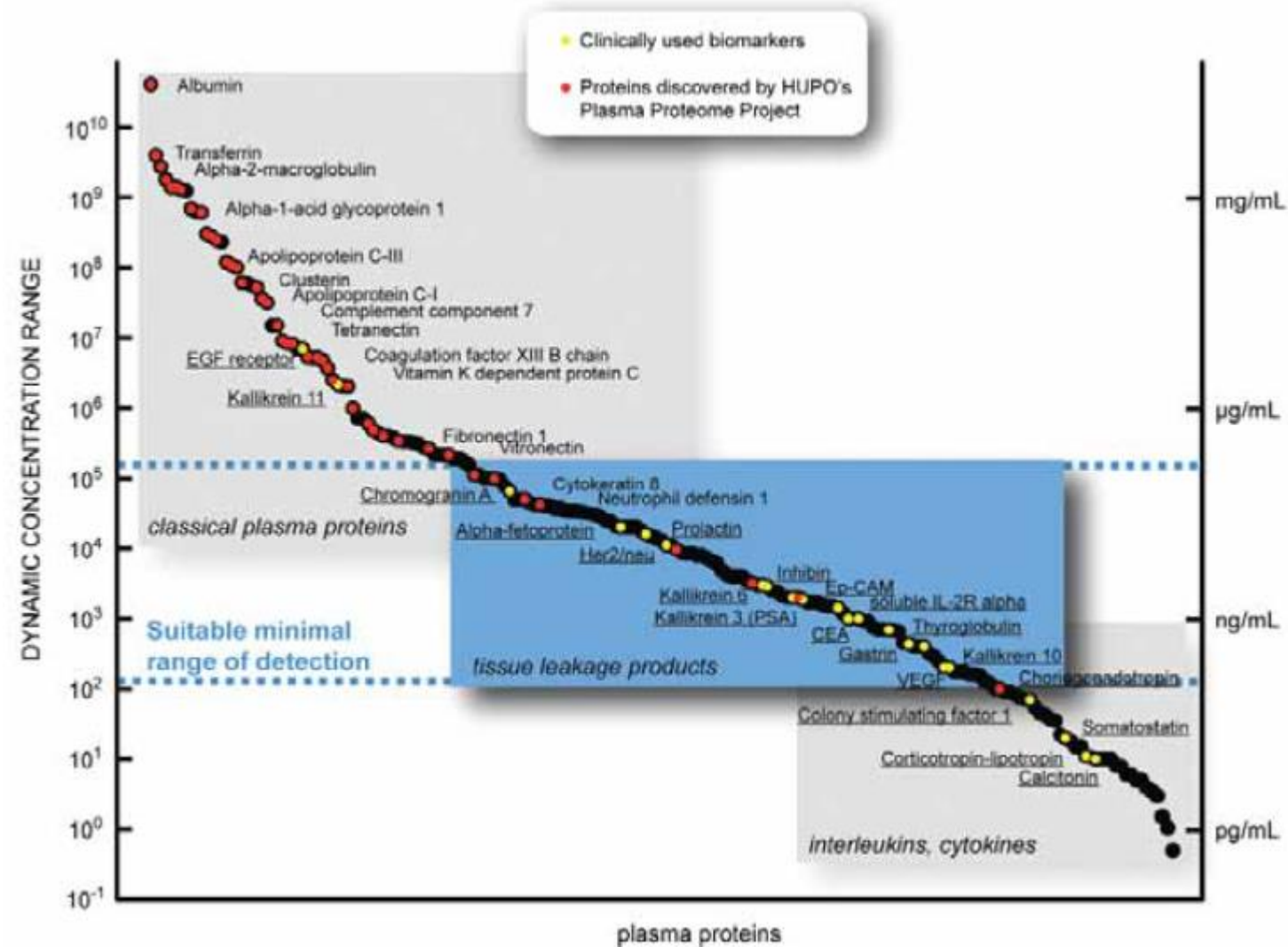
- Reliable
- Sensitive
- Push button
- High Throughput
- Saving time
- Data analysis



The size of the Bio-World



Plasma protein concentration



Sample challenges:

- ✓ Concentration
- ✓ Multiple biomarkers
- ✓ Crude samples
- ✓ ...

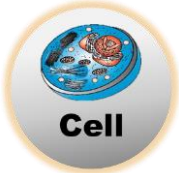
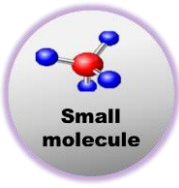
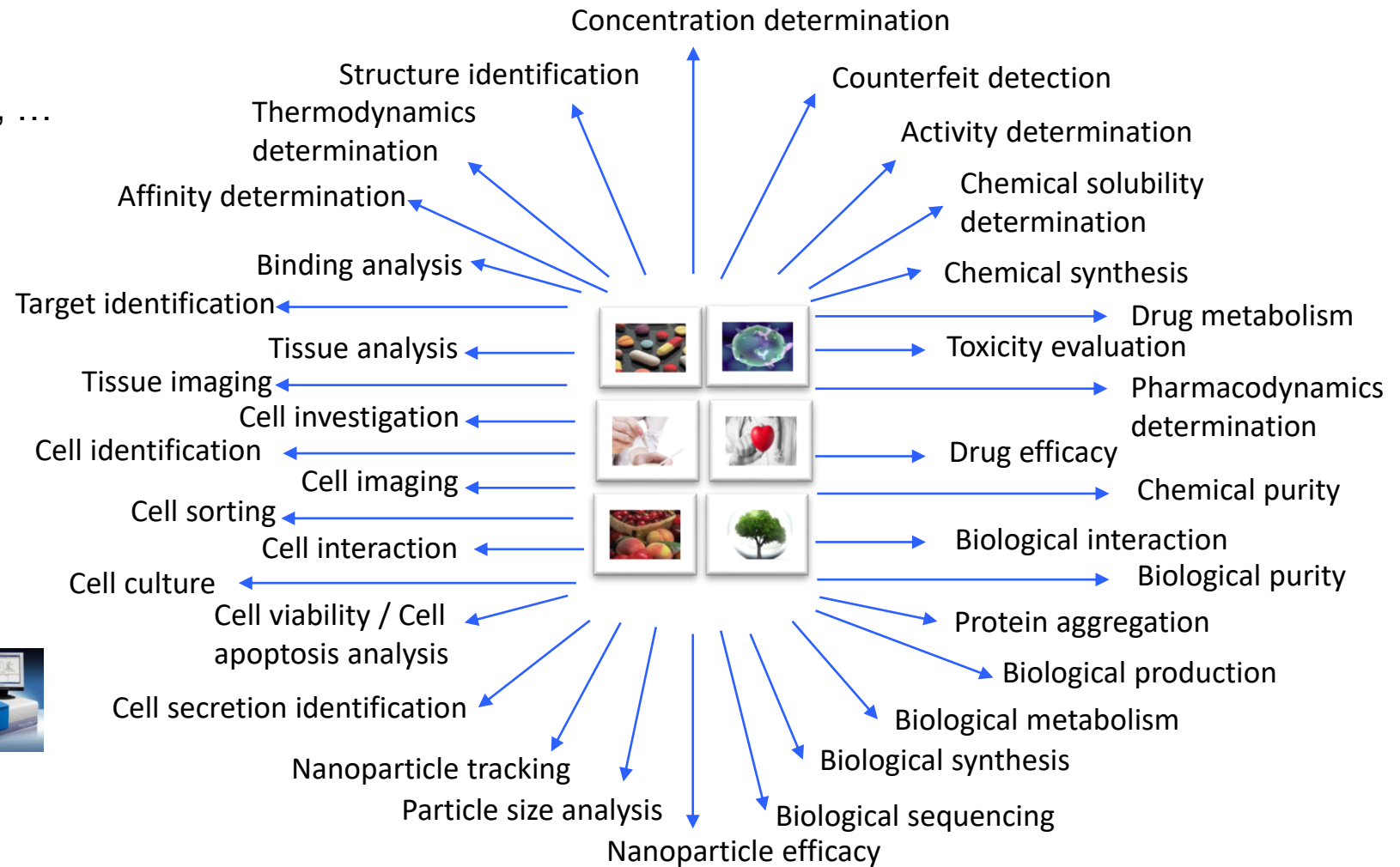
Technical challenges:

- ✓ Sensitivity
- ✓ Multiple sampling
- ✓ Complex sample
- ✓ ...

Techniques Vs Applications

Existing solutions

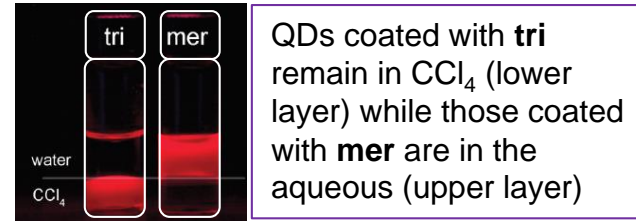
- Fluorescence
- Capillary electrophoresis
- Chromatography: GC, MS, Gel, ...
- MS
- ELISA
- Infrared spectro
- Bioreactors
- NMR
- Raman
- DLS
- SPRi
- ...



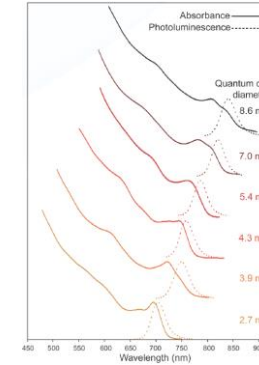
Fluorescence & Particle Size Analysis

Photoluminescence Spectro of Quantum Dots (QDs)

QDs coated with tri-*n*-octyl phosphine oxide (tri) and mercaptoacetic acid (mer)



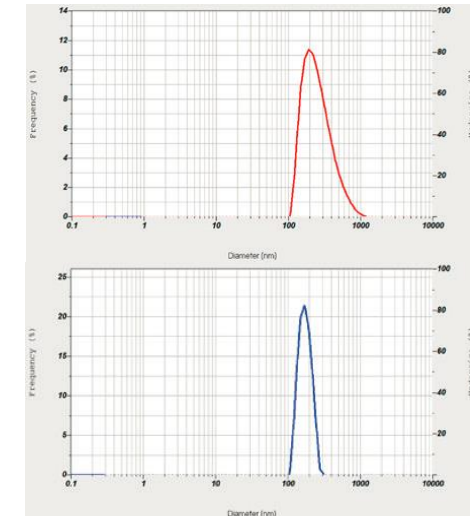
QDs coated with **tri** remain in CCl₄ (lower layer) while those coated with **mer** are in the aqueous (upper layer)



Diameter vs absorbance and photoluminescence of various sizes of CdSe_{0.34}Te_{0.66} QDs

Virus Purity controls / filtration process

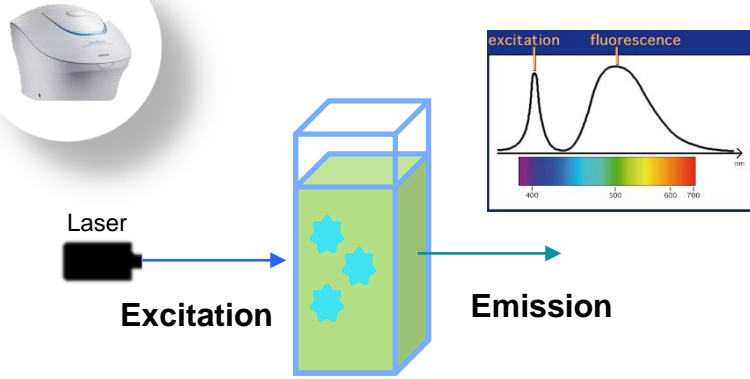
DLS results	Mean size (nm)	Median (D50) (nm)	Cumulative % < 300nm
Virus concentrated	255,8	217,6	74
Virus after filtration	164,5	160	100



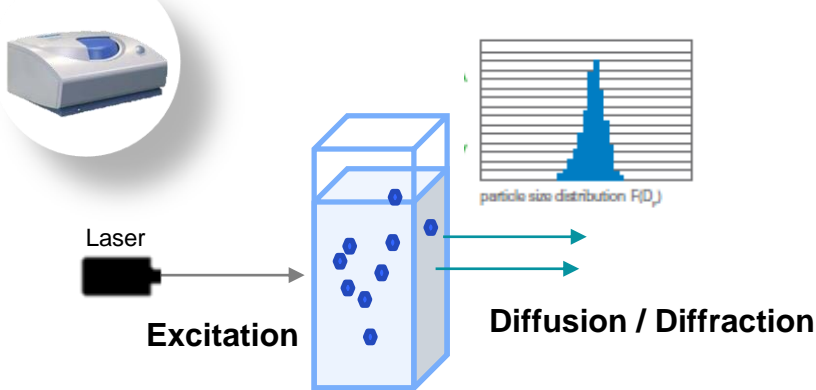
Before

After

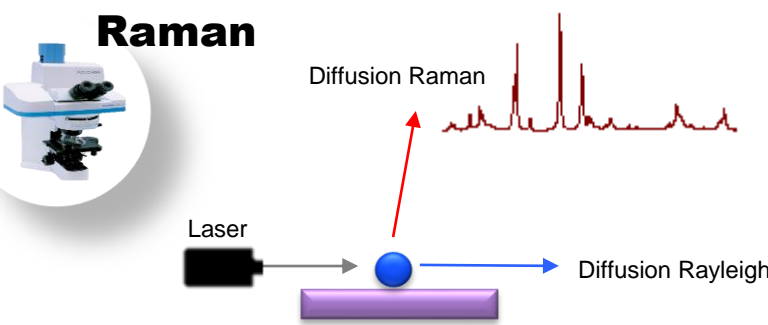
Fluo



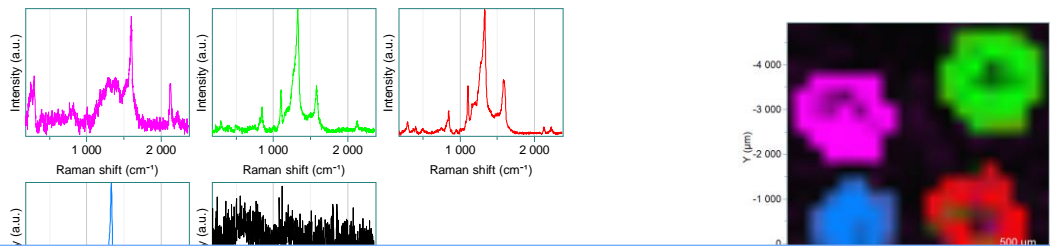
PSA



Raman & Nano-Raman



Nanoparticles with different surface chemistries

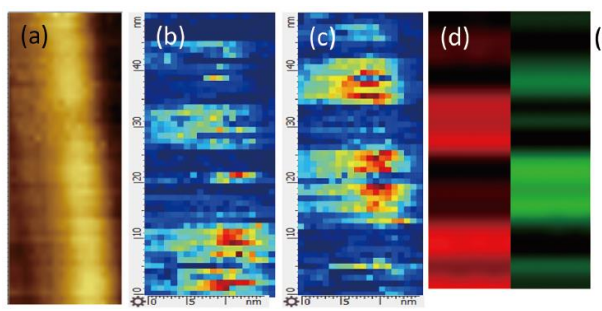
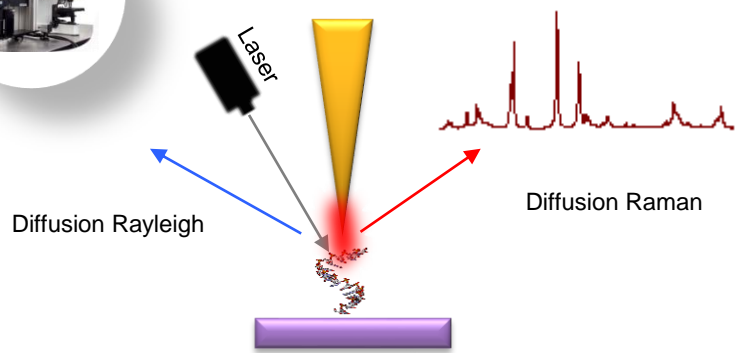


Development of a high sensitive and specific nanobiosensor based on surface enhanced vibrational spectroscopy dedicated to the in vitro proteins detection and disease diagnosis



Nanoantenna

ered DNA
opening up



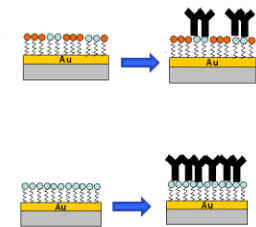
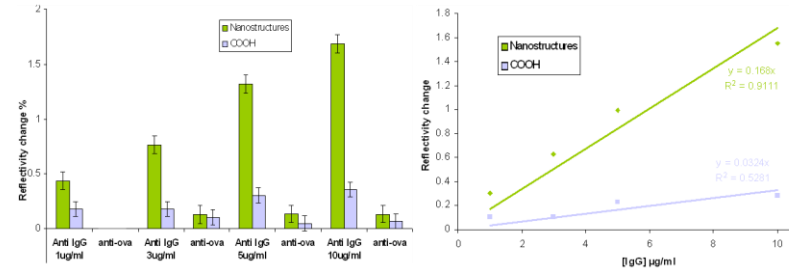
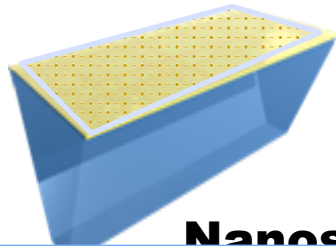
- ✓ (b)-(c) corresponding TERS spectral mapping of over 50 × 20 nm² showing clear differentiation of spectral regions of pattern and size consistent with the expected
 - (b) A/T & (c) G/C homopolymeric blocks,
 - (d) horizontally averaged spectral map from the previous TERS maps, showing a good agreement with the
- ✓ (e) original sequence.

SPRi is challenged by the sensitivity

SPRi



Nanostructure the surface chemistry



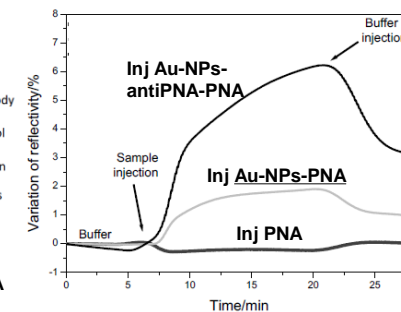
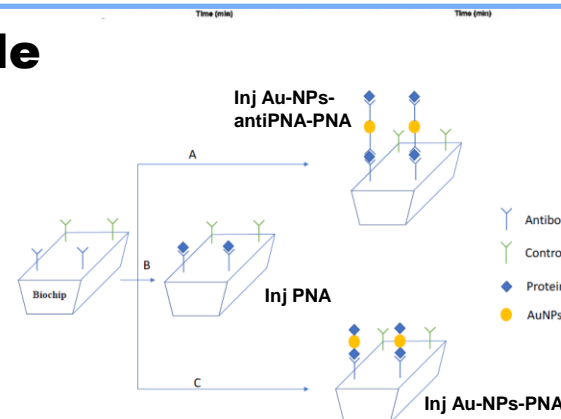
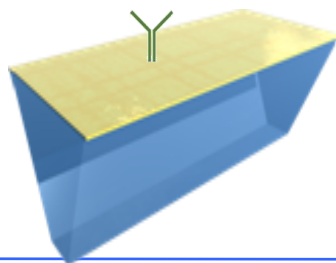
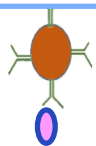
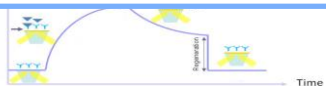
Nanostructure the sensor chip surface

HORIZON 2020

ULTRASensitive PLAsmonic devices for early CANcer Diagnosis

ULTRAPLACAD

Using nano-particle



Industrial context

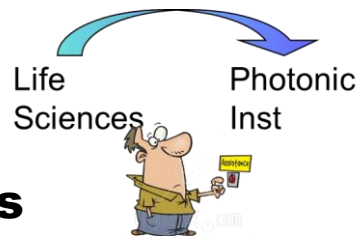
We are in the configuration of supply and demand at the photonics instrumentation level



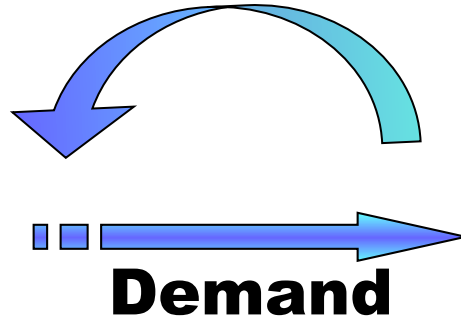
Life Sciences market

- Medicine
- Biology
- Biochemistry
- Pharmacology
- Food science
- ...

Market application analysis



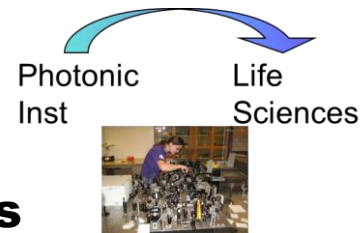
Supply



Instrumental industry

- Physics
- Electronic
- Mechanic
- Fluidic & thermic
- Bioinformatic
- ...

Instrument specification analysis



//

Biologist vs Physicist

■ Language

Substrate + Ez = Prod

→ Substrate = basic material

■ Standard variation

< 10% is enough

→ 0.001 is still not excellent

■ Approaches

Application oriented

→ Instrument oriented

■ Software & Hardware development

Push button

→ Very open platform



Thank you

Thank you

Omoshiro-okashiku
Joy and Fun

おもしろい
おもしろい



감사합니다

Cảm ơn

ありがとうございました

Dziękuję धन्यवाद

Grazie

Merci

谢谢

நன்ற

ขอบคุณครับ

Obrigado

Σας ευχαριστούμε

Tack ska ni ha

شُكْرًا

Большое спасибо

Danke

Gracias