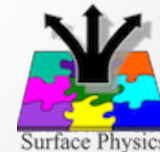
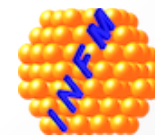




# CERIC Research Grant

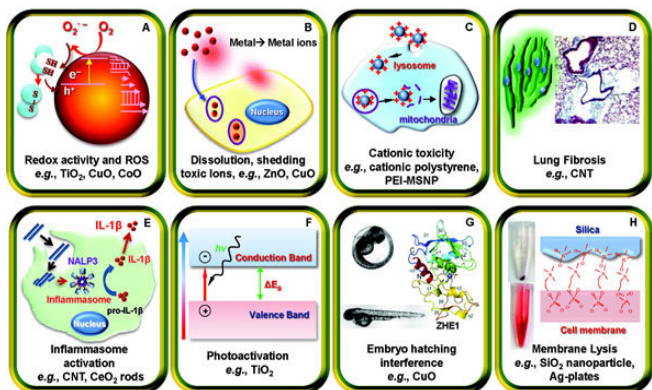
## RENEWALS

### gRaphENE for WATER in Life Sciences

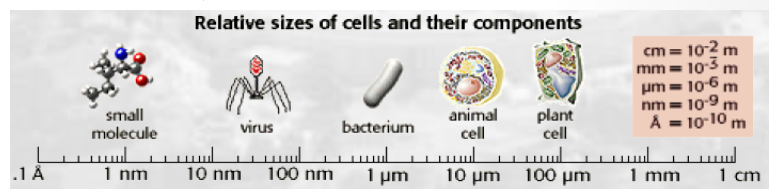
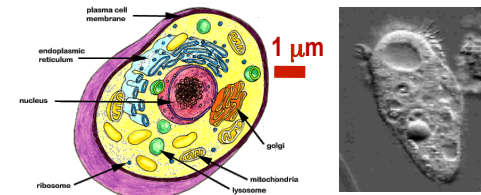
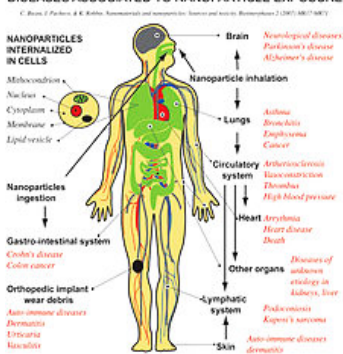


## Nanotechnology - Pollution and Health hazards

Nano-particulate matter (inhaled, consumed orally or injected) can penetrate the cells and affect their functions, depending on their 'biological' reactivity



DISEASES ASSOCIATED TO NANOPARTICLE EXPOSURE



Clearly assessment of NMs' toxicity needs microscopy methods...  
...while keeping cells in their physiological environment.

*“Water is life’s matter and matrix, mother and medium. There is no life without water”*

[Albert Szent-Gyorgyi, Nobel Prize for Medicine in 1937]

There is not reliable characterization of biological samples without water!

But.. still water is a 'nightmare' for many spectroscopy and microscopy techniques.

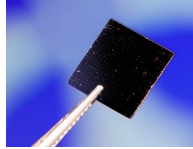
## RENEWALS Key Objective

**Develop and implement environmental liquid cells, using photon and electron transparent graphene membranes (Graphene Liquid Cell, GLC), suitable for cross-talk characterization of bio-cellular samples with atomic force, photon and electron-based microscopes at Elettra, Charles University and National Institute of Materials Physics.**

## RENEWALS Ultimate Scientific Goal

**Assessment of nano-objects' toxicity by cutting-edge experiments using multi-probe synergic methodology and new concepts.**

*Demonstrate the potential of developed complementary micro-analysis by exploring the correlations between cytotoxic effects of uptake, localization and interaction in human cells of Al NPs, potential effective additives in bio-ethanol fuels.*

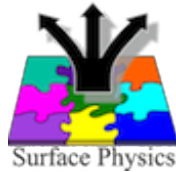


**Deep X-ray Lithography (GLCs' fabrication)**

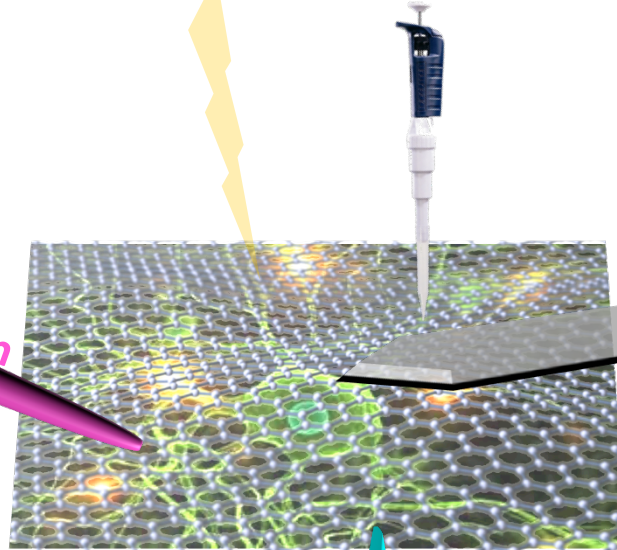
**Biological Assay (Structural Biology Laboratory, 3<sup>rd</sup> Party)**



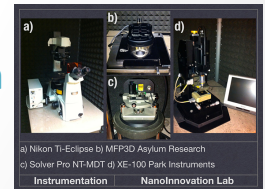
**FESEM**



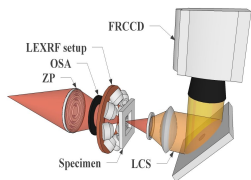
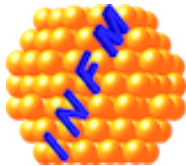
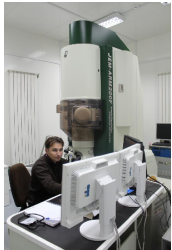
Surface Physics



**AFM (NanoInnovation Laboratory, 3<sup>rd</sup> Party)**

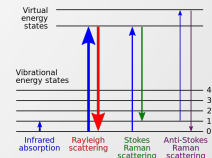
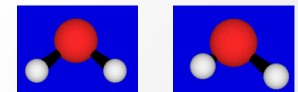


**HRTEM**



**X ray Microscopy: Imaging combined with micro XRF and XAS**

**FTIR Microscopy  
UV Raman Microscopy**



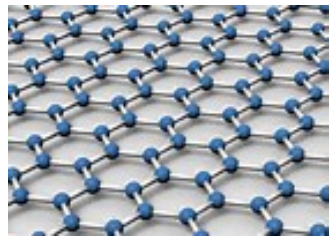
**Photon beam**



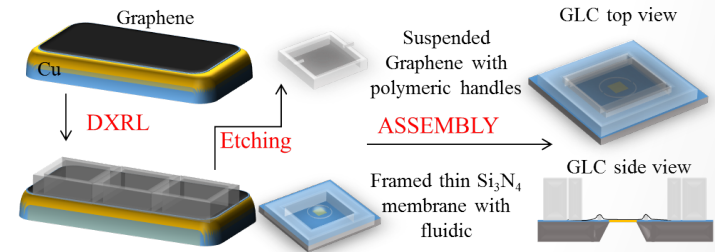


## WP1: Design and fabrication of Graphene Liquid Cells (GLCs)

Delivery: engineered GLC for correlative microscopy of hydrated samples - key for *in situ* characterization of living systems since water plays a very crucial role in biomolecular interactions.

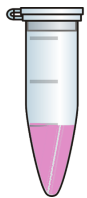


**Graphene: the thinnest possible impermeable and conductive membrane, transparent for electrons and photons.**

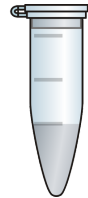


## WP2: Characterization of 10-50 nm Al NPs upon interaction with Lung Lining Fluid compared to pristine Al NPs

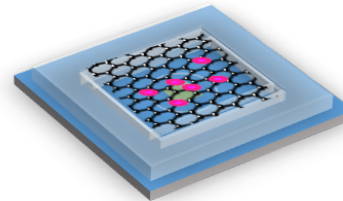
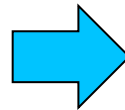
Evaluation of the interactions of Al NPs with Lung Lining Fluid



Al NPs incubated with simulated LLF



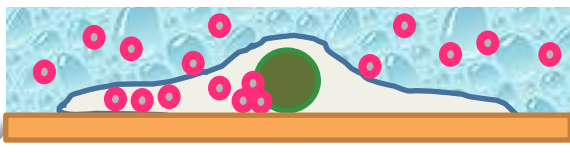
Shell Al NPs re-suspended in NaCl 0.9%



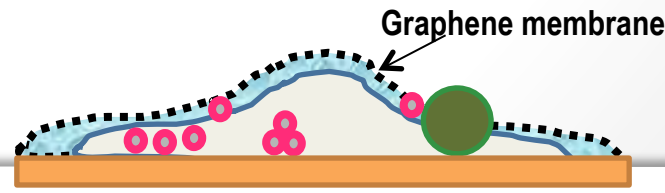
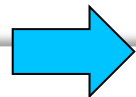
NPs kept hydrated in GLCs with physiological solution during measurements

## WP3: Cellular Internalization of Shell Al NPs: localization and cell adverse effects

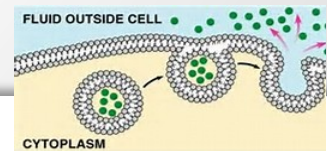
To assess the effective internalization of NPs and their localization, in order to correlate this information with the cytotoxicity results



A549 cells incubated with shell Al NPs in simulated LLF



A549 cells after incubation in GLCs for multi-method characterization



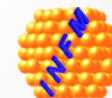
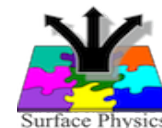


# RENEWALS: Long-term benefit for CERIC-ERIC

- International recognition in complementary micro-analyses of cellular samples in natural environment attracting broad life science user communities;
- Proliferation of developed in-vitro/in-operando methodology into other fields of material science, involving technology transfer as well;
- *Demonstration of the strength of CERIC in fostering collaborations for exploiting new R&D challenges with high social impact!*



**Dr. Lisa Vaccari**  
Leading Actor!



**Alessandra Gianoncelli**



**Barbara Rossi**



**Loredana Casalis**



**Paola Storici**



**Dr. Benedetta Marmioli**



**Prof. Iva Matolinova**



**Dr. Corneliu Ghica**