WP2. Health and Environment Impact

Min aim of this WP:
Determination of the conditions and material properties aimed to a safe use of graphene, 2D crystals and hybrids

WP Leader Maurizio Prato
Deputy: Alberto Bianco

Presenter: Cécilia Ménard-Moyon – CNRS Strasbourg
WP2. Partners and Expertise

Maurizio Prato and Laura Ballerini, University of Trieste (Italy) – Material and cell interfacing

Alberto Bianco, CNRS ICT (France) – Immune system impact and biodegradation

Kostas Kostarelos, University College London SoP (UK) – Toxicity and pharmacokinetics

Ester Vazquez, University Castilla-La Mancha MSOC (Spain) – Material and dispersion

Bengt Fadeel, Karolinska Institutet (Sweden) – Nano/immunotoxicology

Peter Wick and Harald Krug, EMPA (Switzerland) – Nanosafety

Emmanuel Flahaut, Laury Gauthier, CNRS CIRIMAT/ECOLAB (France) – Ecotoxicology

Kenneth Dawson, University College Dublin CBNI (Ireland) – Bionanointeractions

Fabio Benfenati, Italian Institute of Technology NBT (Italy) – Cellular neurophysiology
WP2. Disciplines

The partnership covers multidisciplinary expertise that combines:

- Synthetic chemistry
- Physical chemistry
- Cell biology
- Pharmacology
- Nanomedicine
- Toxicology
- Ecotoxicology
- Nanosafety
WP2. Objectives (1)

- Elucidate the mechanisms of how graphene forms and 2D crystals interact with cells at cellular and molecular level

- Address the effects of graphene forms and 2D crystals on specific tissues such as the immune system, nervous system or placenta

- Identify any possible hazard of graphene forms and 2D crystals in relation to their physico-chemical properties with a special focus on the most important exposure routes (i.e. lung, skin)
WP2. Objectives (2)

• Understand the processes that control biostability and biodegradation of graphene family nanomaterials

• Investigate the potential impact of the various 2D nanoforms on aquatic species (i.e. amphibians), terrestrial organisms and microorganisms

• Develop a standardized and validated testing strategy for graphene forms and 2D crystals, to enable the regulation of these materials
Graphene and 2D hybrid structures

Cell interaction

Membrane contact

Cell uptake

Nucleus entry

Environmental impact

Health impact

Biodegradation?
WP2. WP Exchanges

Exchange and collaboration with the partners of:

WP1 – Materials

WP10 – Nanocomposites

The development of graphene and 2D crystals, their complete characterization in terms of physico-chemical properties and their integration into new devices, envisaged in these two WPs, will be beneficial and fundamental to assess the impact on health and environment.

In WP2 we will indeed test and explore the effects of these engineered nanomaterials in a systematic and comprehensive manner.
French expertise in WP2

- Alberto Bianco, CNRS ICT (France) – **Immune system impact and biodegradation**

  **Expertise**
  - Development of novel platforms based on carbon nanomaterials for therapeutic and preventive biomedical applications.
  - Study of the impact of carbon nanotubes and graphene on health and environment.

  **Role in WP2**
  Functionalisation of graphene, degradation of graphene and 2D crystals by oxidative enzymes, assessment of the toxicological impact of metabolites generated by degradation, interactions with immune cells.

- Emmanuel Flahaut, Laury Gauthier, CNRS CIRIMAT/ECOLAB (France) – **Ecotoxicology**

  **Expertise**
  - Synthesis, nanocomposites, toxicity and environmental impact of carbon nanostructures (CIRIMAT)
  - Evaluation of the potential ecotoxicological impact of contaminants in the environment (ECOLAB)

  **Role in WP2**
  Ecotoxicity tests of graphene materials, acute toxicity assay as well as a genotoxicity assay.