



“Characterization of graphene immune-impacts through omics approaches and genotoxic analysis”

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Consortium Partners



University of Sassari ([Partner 1](#))
Chemistry and Pharmacy Department
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Chemical and Pharmaceutical Sciences Department
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Prof.
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PRATO



Centre National de la Recherche Scientifique ([Partner 3](#))
Immunopathologie et Chimie Thérapeutique
(CNRS - France)

Prof. ALBERTO
BIANCO



University of Manchester ([Partner 4](#))
Institute of Inflammation and Repair
(UNIMAN – United Kingdom)

Prof. KOSTAS
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Ankara University ([Partner 5](#))
Biomedical Engineering Department
(UNIANK – Turkey)

Dr. ACELYA
YILMAZER



University Hospital Cologne ([Partner 6](#))
Institute for Genome Stability in Ageing and Disease
(UKK – Germany)

Prof. BJORN
SCHUMACHER

Graphene for biomedical applications

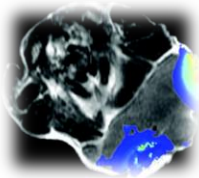
Gene delivery



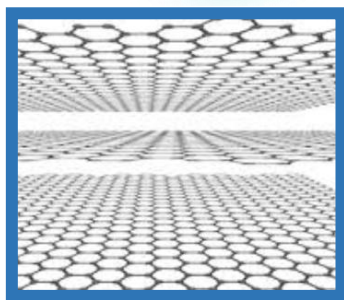
Drug delivery



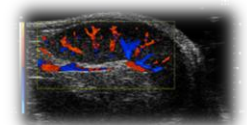
Thermal therapy



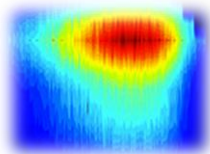
Therapy



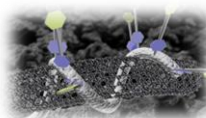
Diagnosis & Imaging



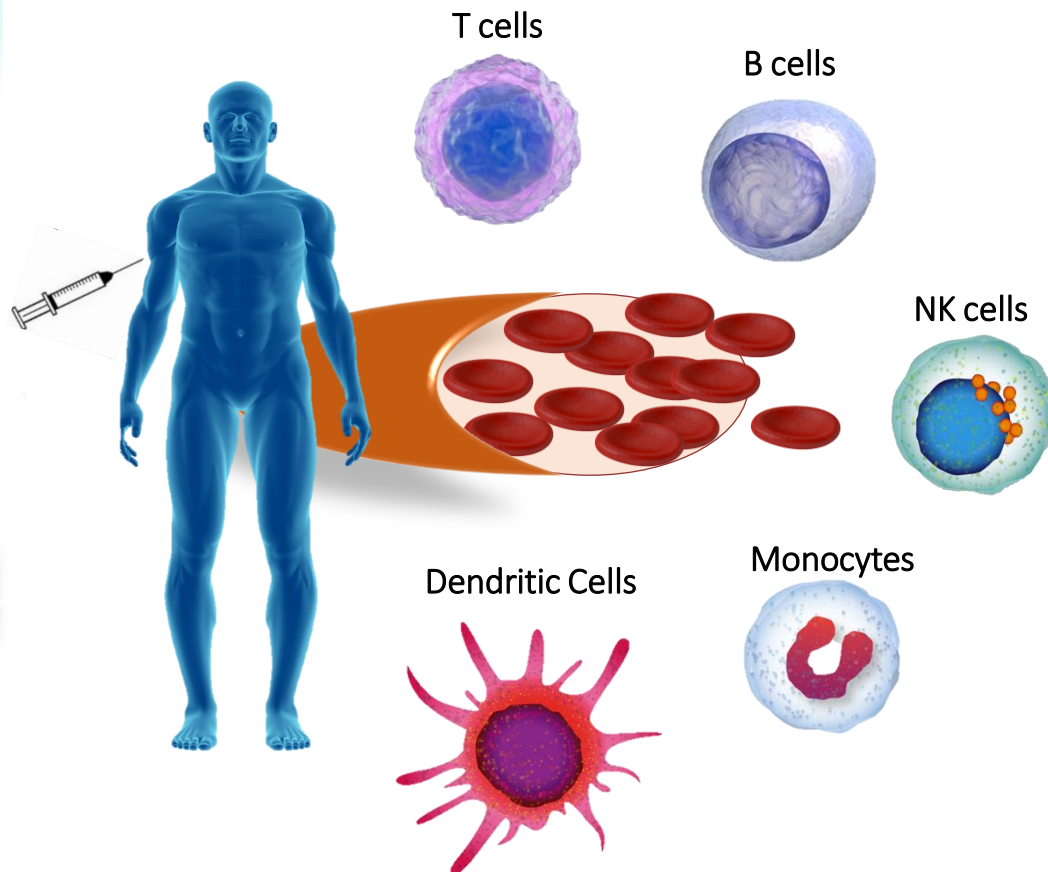
Photoacoustic



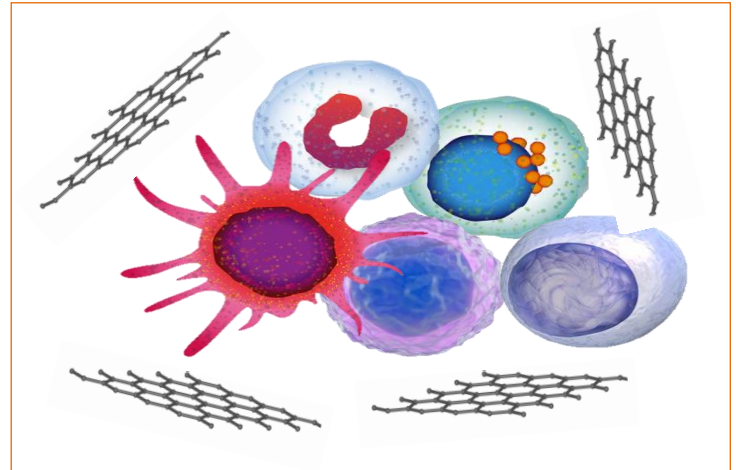
Ultrasonography



Sensors



Overall Objective



To complement Flagship research on graphene safety with immunogenomic and proteomic data.

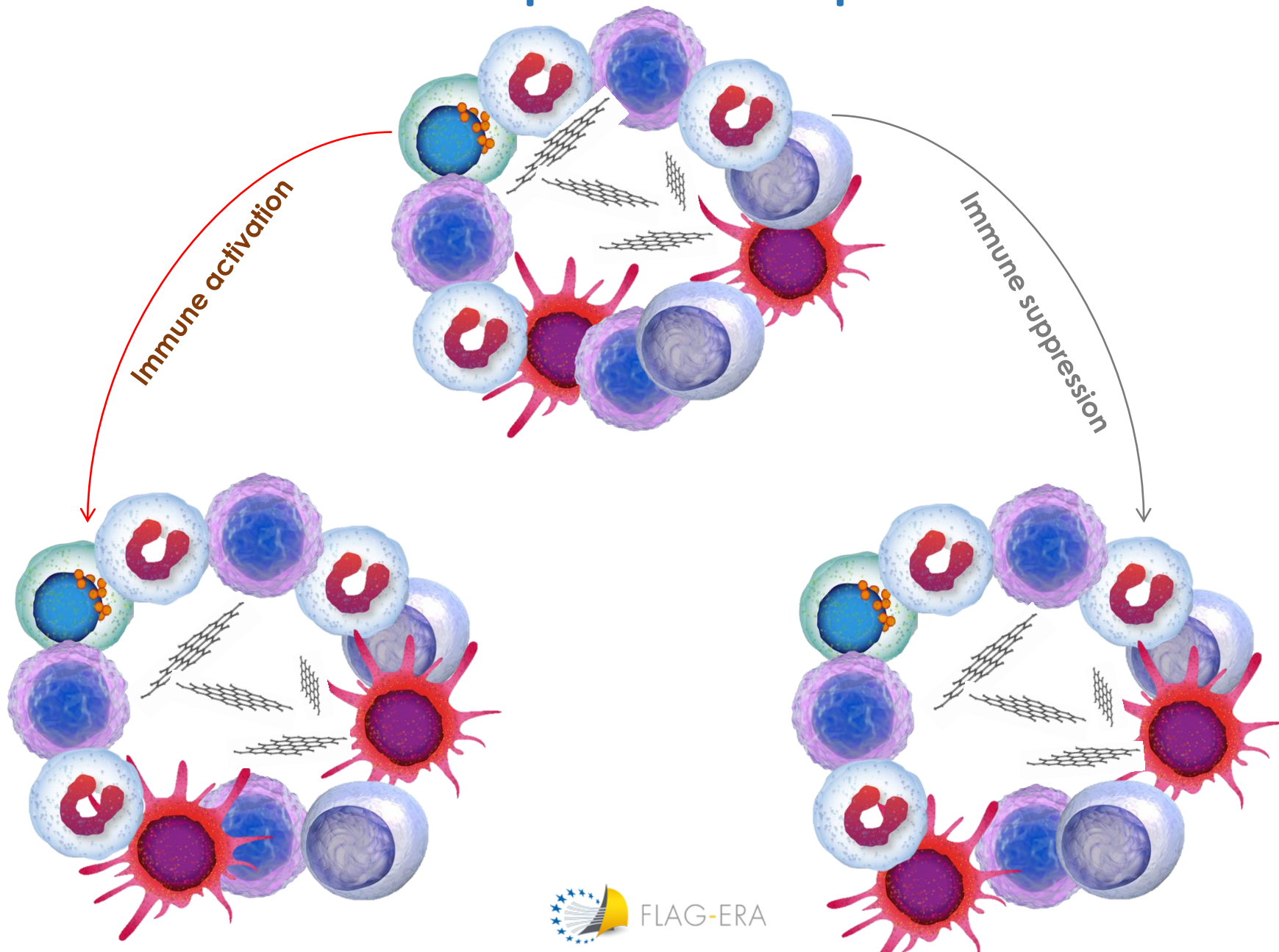
G-IMMUNOMICS will provide new insights on the immune potential impact of several types of graphene.

Expected Impact

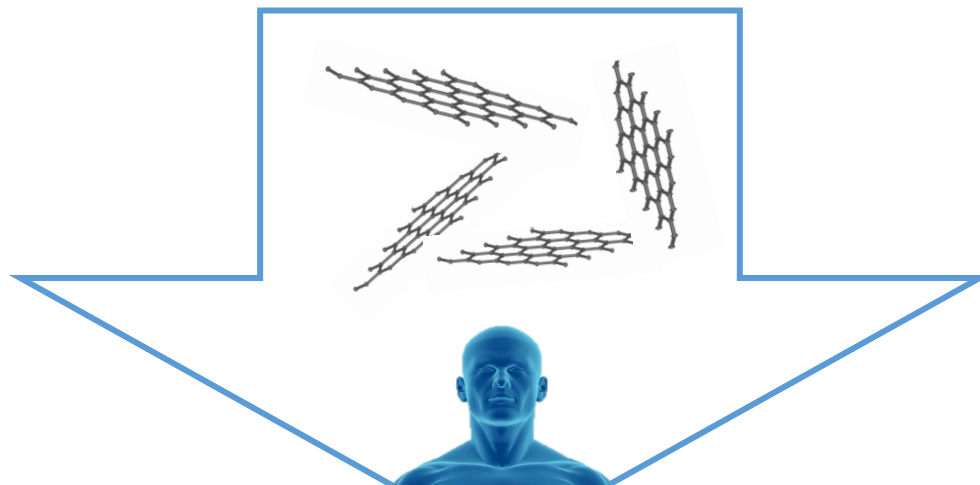
To Minimize the risk for human health raising from graphene usage.

To Identify the best candidate materials for translational applications in nanomedicine.

Expected Impact



Expected Impact



Immune activation

Good

Vaccine adjuvant
Immunotherapy
of cancer

Bad

Hyper sensitivity
Inflammations

Immune suppression

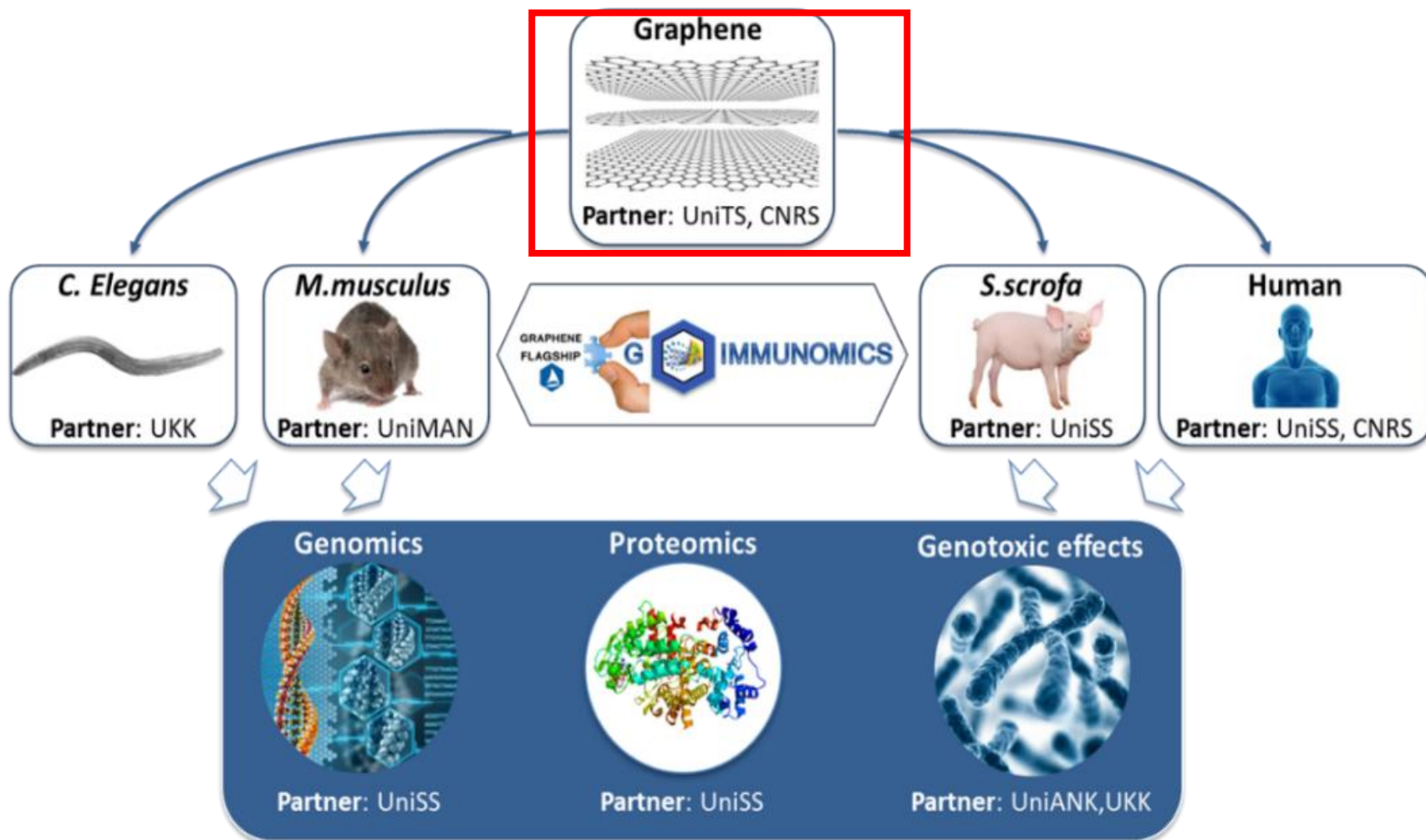
Good

Anti inflammatory
action
No allergic
response

Bad

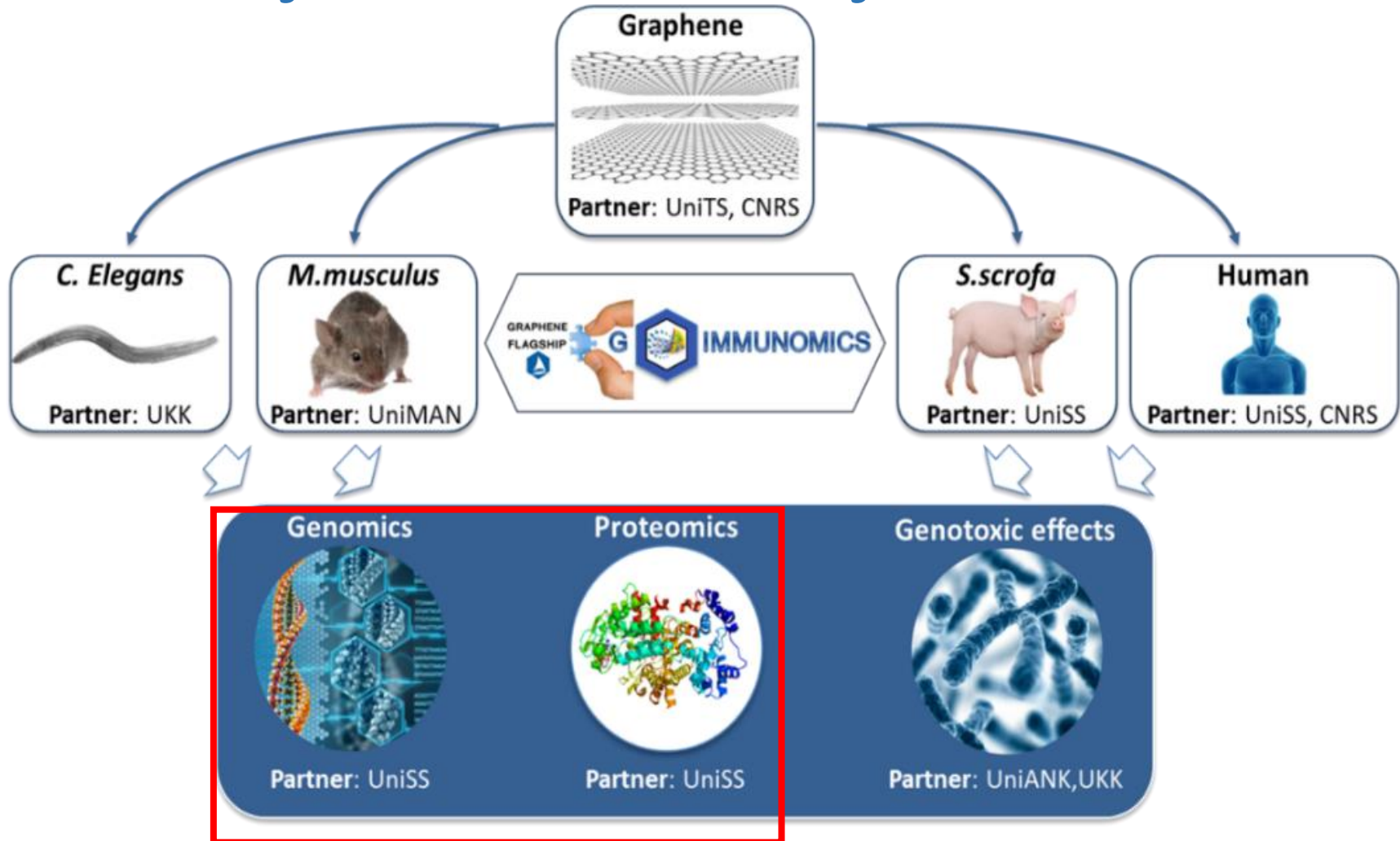
Susceptibility to
Pathogen infections

Project Scientific Objectives



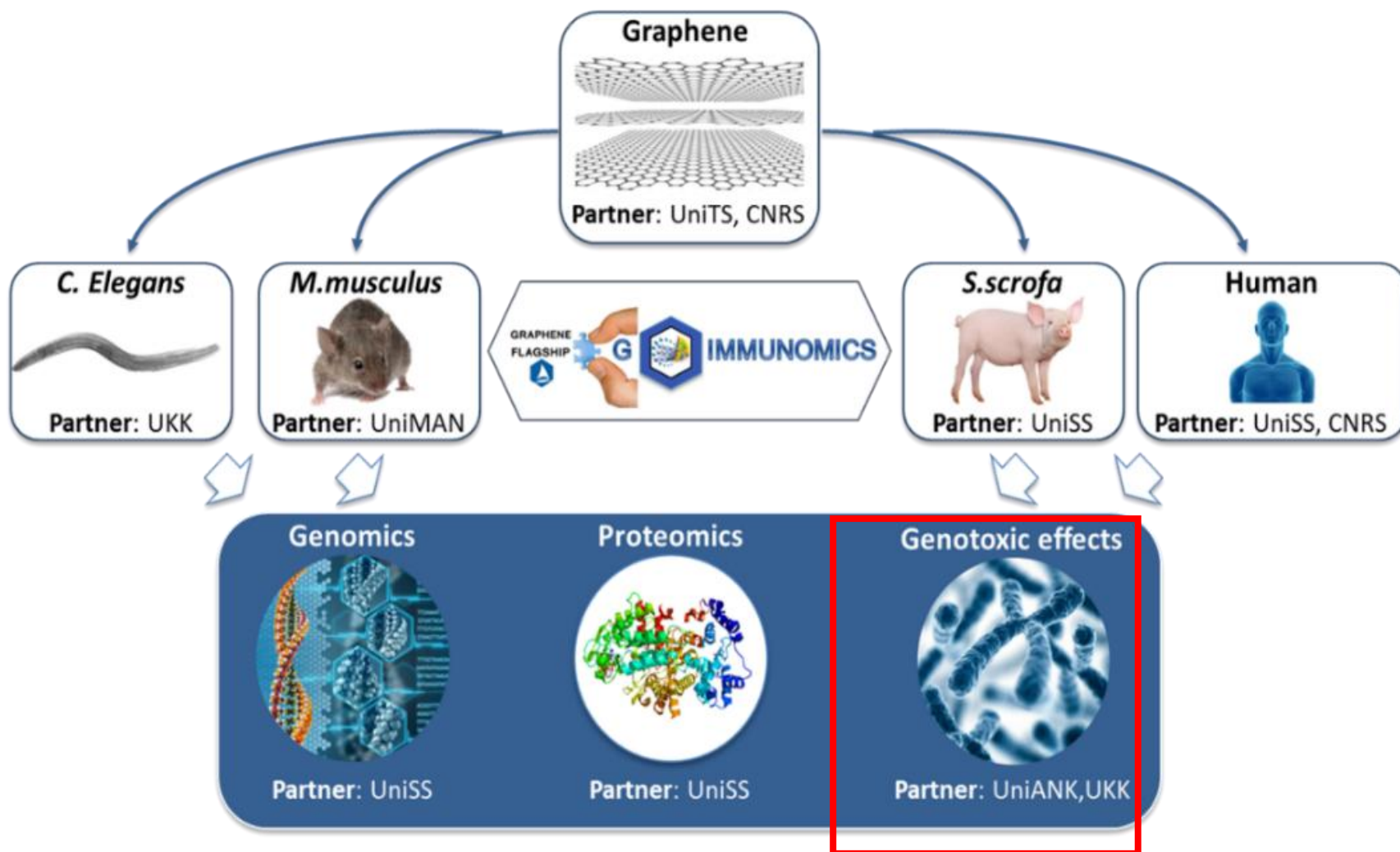
1) Produce highly stable and dispersible pristine and functionalized GFMs such as Exfoliated Graphene (G) and Graphene Oxide (GO) with different lateral size and appropriate functionalizations

Project Scientific Objectives



2) Characterize through high throughput functional immunogenomics and proteomics approaches the immune cell response induced by functionalized graphene on different cell lines (from human, mouse and swine) and primary cells (human, swine, mouse and nematodes)

Project Scientific Objectives



3) Evaluate the genotoxic effects of the selected materials on different species: nematodes (*C. elegans*) and mammals (*M. musculus*, *S. scrofa* and human).

Relevance of the animal model for graphene research purpose

M.musculus



Partner: UniMAN

- Remarkable consistency between gene expression profiles and transcriptional regulators in the mouse and human immune systems (conservatively estimated at 80%)
- Exceptional easiness to produce cancer models in comparison to other species in view of future applications

S.scrofa



Partner: UniSS

- Highly conserved genetic mechanism regulating the immune response and excellent anatomical similarities with human
- Compatibility with human ultrasound probes and waves and MRI systems suitable for the development of graphene-based imaging diagnostic tools

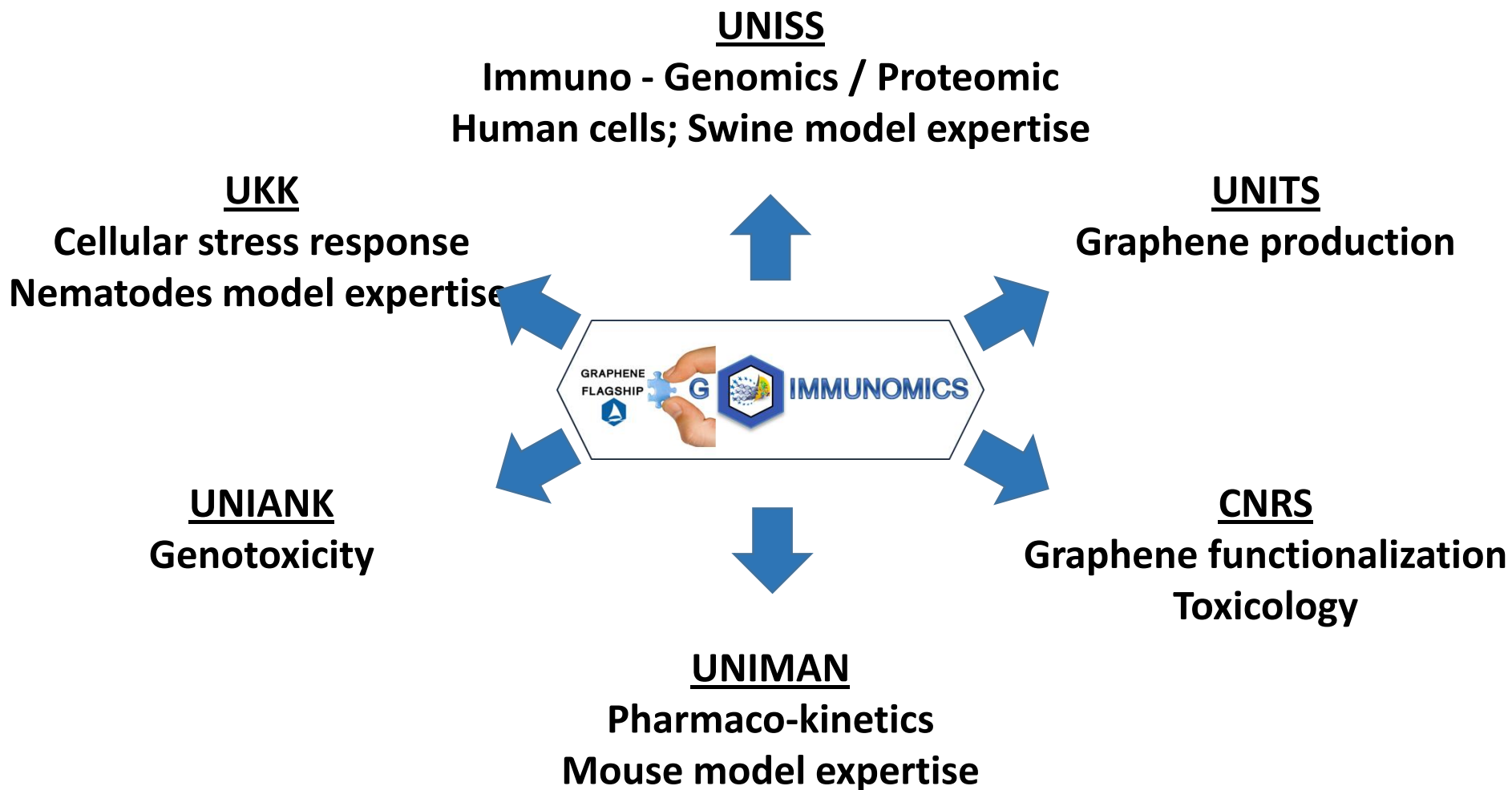
C. Elegans



Partner: UKK

- The innate immune system response of *C. elegans* is initiated by conserved MAP kinase signaling cascades
- The DAF-16/FOXO mediated DNA damage response program induce an innate immune response which is conserved in higher species
- Fast cycle of reproduction

Consortium Expertise

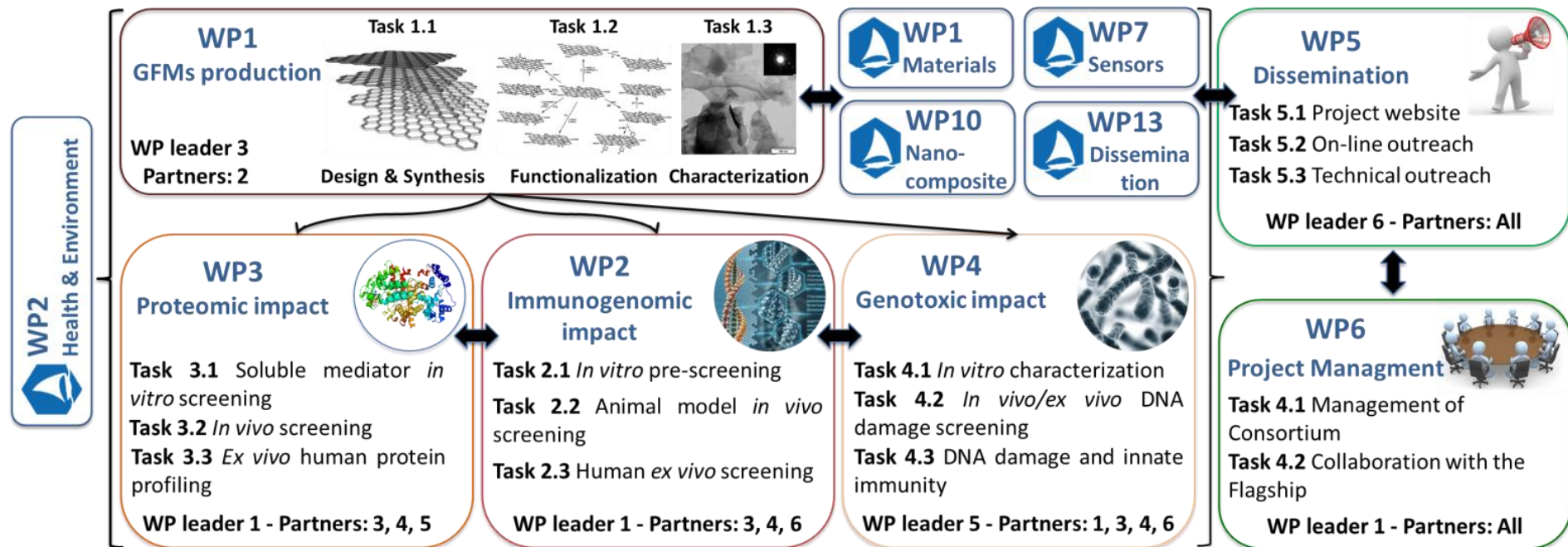


Partnership Disciplines

The partnership covers multidisciplinary expertise that combines

Genetics
Bioinformatics
Immunology
Pharmacology
Chemistry
Nanotechnology
Biochemistry
Toxicology
Cell biology
Toxicology
Biology
Haematology
Molecular Biology
Cell Biology
Molecular Biology

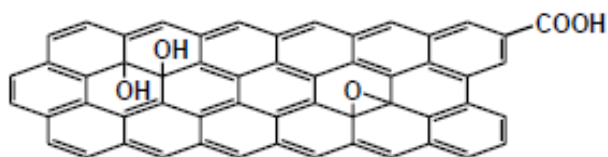
G-IMMUNOMICS Work Plan



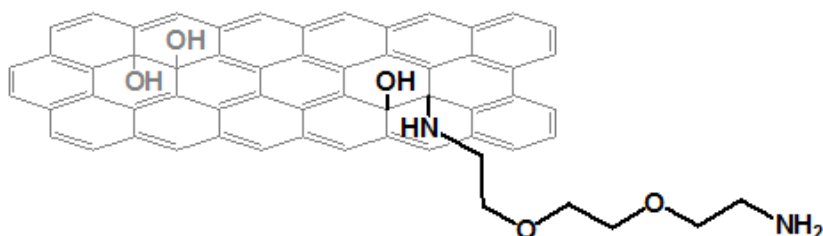
Synergies with Flagship Core Project

FLAGSHIP WPs	Collaborations with flagship partners
WP2- Health and Environment	A. Bianco, CNRS (FR)
	K. Kostarelos, UNIMAN (UK)
	M. Prato, UniTS (IT)
	E. Vazquez, UCLM (SP)
WP10 – Nano-composite	V. Palermo, CNR-ISOF (IT)
	X. Feng, TU DRESDEN
WP13 Dissemination	Whole Flagship consortium

A Work In Progress



**Graphene
oxide= GO**



**Graphene oxide+ amidation=
GONH₂**

Dissemination



Graphene 2016 Conference
19-22 April *Genoa Italy*

Graphene Week
13-17 June *Warsaw Poland*