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# Supervisor Expression of Interest
# MSCA-IF Marie Sklodowska Curie Action-Individual Fellowship

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| **Supervisor name:** | Giancarlo Terraneo |
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| Department Name:<br>Research topic:<br>(https://www.polimi.it/en/scientific-research/research-structures/departments/) | Department of Chemistry, Materials and Chemical Engineering "Giulio Natta" (CMIC)<br><br>Materials synthesis, structure-properties relations, functional and advanced materials, molecular architecture and nanomaterials |
| MSCA-IF Research Area Panels | X CHE_Chemistry<br>☐ ECO_Economic Sciences<br>☐ ENG_Information Science and Engineering<br>☐ ENV_Environmental and Geosciences<br>☐ LIF_Life Sciences<br>☐ MAT_Mathematics<br>☐ PHY_Physics<br>☐ SOC_Social Sciences and Humanities |
| Politecnico di Milano Areas: | ☐ Cultural Heritage<br>☐ Smart Cities<br>☐ Territorial Fragilities<br>X Health<br>☐ Industry 4.0 |
| Brief description of the Department and Research Group (including URL if applicable): | The project will be based at the Department of Chemistry, Materials and Chemical Engineering "Giulio Natta" (CMIC, https://www.cmic.polimi.it/en/) of Politecnico di Milano, and Laboratory of Supramolecular and Bio-Nanomaterials (https://www.suprabionano.eu/). The Department offers chemical lab facilities and instrumentations such NMR facility, XRD facility and microscopy facilities with all the necessary equipment to conduct relevant analyses foreseen in the project. Specifically SBNLab possesses unique expertise in synthetic organic and fluorine chemistry, as well as in crystal engineering, materials synthesis, molecular recognition, supramolecular chemistry and nanomedicine |

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| | with state-of-the-art instrumentation for crystal structure determination. |

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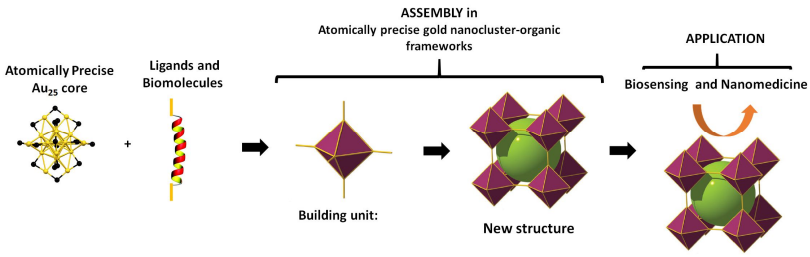
| **Brief project description:**<br>**(max 1 page)** | The project aims to develop a new generation of metal-organic systems using as building units functionalized atomically precise gold nanoclusters and explore their functionalities in the field of nanomedicine and biosensing (Figure).<br>$Au_{25}(SR)_{18}$ nanoclusters are attractive for biological and biomedicine applications. The wide excitation wavelength range of metal nanoclusters offers multiplexing capability. This is highly desirable for the development of applications of metal nanoclusters for biosensing, fluorescent biological imaging, and biomedical research.<br>Gold is particularly appealing for use as electron microscopy markers owing to its strong electron-scattering capability. Compared to larger plasmonic nanoparticles, ultrasmall metal nanoclusters (NCs) are significantly less disruptive; for example, nanocluster-labeled proteins can retain the biological functions of the proteins.<br>The project will require the following intermediate scientific goals:<br>1. functionalize atomically precise gold nanoclusters with specific ligands able to create a geometrically well-oriented and well-ordered organic monolayer around the gold core.<br>2. use these hybrid inorganic-organic nanosystems as structural building units for the assembly of 3D frameworks and architectures.<br>3. explore the properties of the atomically precise gold nanocluster-organic frameworks in the context of biosensing and nanomedicine.<br>The functionalization of the nanocluster will be done by either direct Au-S bonding or linker-mediated coupling with biomolecules such as DNA, peptides, polysaccharides, and proteins. In addition the project will also study the absorption, biodistribution, metabolism, and excretion (ADME) properties and the pharmacokinetic (PK) properties of atomically precise $Au_{25}(SR)_{18}$. Part of the project will be focused on the design of multifunctional nanocomposites that can be used for cancer cell imaging, diagnostics, and therapy (theranostics). By exploiting avidin−biotin or antibody−antigen interactions, metal nanoclusters can be used to stain the cell surface.<br>  <br> |