Call Assegni di ricerca 2021 FSC 2014-2020 della Regione Toscana, project *"Nanobiosensors in precision medicine",* acronym NanoPM

Description of the project

This research project involves collaboration between two organizations with complementary skills in order to contribute to two of the crucial junctions for the transition from "evidence based medicine" to "precision medicine", with particular attention to diagnostics. Essential elements of this transition are the replacement of standardized therapeutic protocols with personalized treatments, and a definition of these treatments based on the molecular characteristics of both the pathology and the patient. The proponents identify as essential elements of this new medicine (i) omics and advanced-imaging technologies that allow the profiling of pathology and patient, and (ii) ultra-sensitive detection of the molecular signals characteristic of the various pathologies. By combining the expertise on nanotechnology, bioinformatics and data science of the Science Class of the Scuola Normale Superiore, and those on omics sciences, advanced imaging and bioinformatics of the Fondazione Pisana per la Scienza ONLUS, in this project two central elements of the transition to "precision medicine" are addressed: (i) make the analysis of the large masses of data produced by the molecular profiling processes of patients and pathologies accessible through the development of advanced visualization systems that allow the use of this data by medical personnel without of specialization in bioinformatics and (ii) develop innovative systems for highly sensitive molecular diagnostics by implementing an innovative architecture engineered to irreversibly disassemble following the interaction with the biomarker of interest.

More in detail, the following research activities will be carried out in the project: functionalization of biodegradable/biocompatible polymers with oligonucleotides and their purification; formulation and characterization of hydrogel-based nanostructures based on oligonucleotide-guided aggregation; implementation and optimization of formulation protocols under flow synthesis conditions; evaluation of the stability of the systems obtained in complex matrices (e.g. human plasma).