

Next-generation bionanotechnology: From functional nanomaterials to human-on-chip platforms

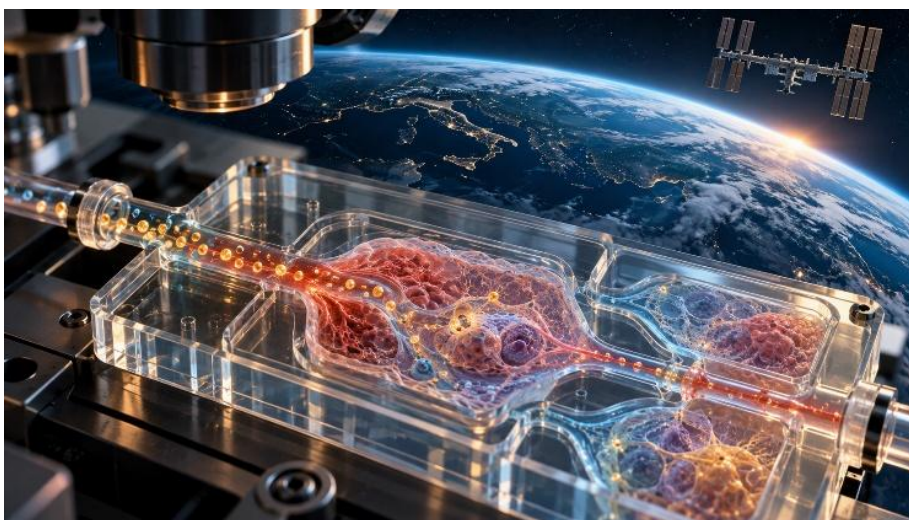
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What happens when materials are designed to interact with living cells, respond to their environment, and help us understand disease? This talk explores three connected frontiers of bioengineering. First, smart nanomaterials can carry therapeutic agents, influence cellular responses, and open new possibilities for more targeted treatments [1]. Second, organs-on-chip recreate key features of human tissues in miniature, offering ways to study disease and test interventions in settings that better reflect the body [2]. Third, experiments in microgravity reveal how cells and tissues change beyond Earth, providing insights into astronaut health and fundamental biological processes [3, 4]. Drawing on research conducted both in the laboratory and aboard the International Space Station, the talk will show how these approaches can inform one another: advanced tissue models help us investigate the effects of spaceflight, while the challenges of space inspire new tools for medicine on Earth. Together, nanomedicine, organs-on-chip, and space research illustrate how intelligent materials may bring us closer to more precise therapies and a deeper understanding of human health.

References

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Gianni Ciofani (born in La Spezia, Italy, on August 14th, 1982), Ph.D., is Senior Researcher Tenured at the *Istituto Italiano di Tecnologia* -Italian Institute of Technology, IIT- (Pontedera, Italy; since 2019), where he is Principal Investigator of the Smart Bio-Interfaces Research Unit (since 2017) and Coordinator of the Center for Materials Interfaces (since 2021). He has been Associate Professor at the Polytechnic University of Torino (Torino, Italy; 2015-2019), and Visiting Professor at Waseda University (Tokyo, Japan; 2021) and at the Pontifical Catholic University of Rio de Janeiro (Rio de Janeiro, Brazil; 2024).

His main research interests concern smart nanomaterials for nanomedicine, microphysiological systems, and nanomedicine in altered gravity conditions. He is coordinator or unit leader of several projects (about 6.7 MEur granted): in particular, he was awarded a Starting Grant and three Proof-of-Concept Grants by the European Research Council (ERC). Thanks to grants from the Italian Space Agency and the European Space Agency, he had the opportunity to carry out four experimental campaigns onboard the International Space Station. In 2018, his real-scale model of the blood-brain barrier was highlighted in the Annual Report on the ERC Activities and Achievements.

Gianni Ciofani is author of about 220 papers on international journals (WoS *H*-index 60), 3 edited books, and 20 book chapters, and delivered about 100 invited talks/lectures in international contexts. He has been consistently ranked in the Stanford University's list of "World's Top 2% Scientists" since 2020 (Elsevier data). He serves as Panel Member / Reviewer for many funding agencies (including ERC, Swiss National Science Foundation, French National Research Agency, National Science Center of Poland), for about 200 international journals, and as Editorial Board Member of *Biomedical Materials*, *Bioactive Materials*, *International Journal of Nanomedicine*, *Journal of Physics: Materials*, *Nano Trends*, and *Scientific Reports*; he is Editor-in-Chief of *BMC Biomedical Materials Science*, Co-Editor-in-Chief of *Nanomedicine*, and Specialty Chief Editor (Nanobiotechnology) of *Frontiers in Bioengineering and Biotechnology*. Since 2026, he serves as a Member of the European Space Agency's Human Spaceflight and Exploration Science Advisory Committee. During his career, he held courses at the Polytechnic University of Torino, at Waseda University, and at the Pontifical Catholic University of Rio de Janeiro, and is currently holding a course for Ph.D. students at the Sant'Anna School of Advanced Studies (Pisa, Italy); he is / has been supervisor of about 50 M.Sc. students and 25 Ph.D. students.

He is co-founder (2022) and Scientific Advisor of "Kidaria Bioscience SRL", an IIT spin-off company dedicated to the preparation and characterization of cosmetic and nutraceutical products based on natural-derived active ingredients. He is also co-founder (2021) and member of the executive committee of "ERC in Italy APS", a non-profit association of ERC awardees born to promote fundamental and frontier research in Italy.

Gianni Ciofani is Knight of the Order of Merit of the Italian Republic, appointed by the President of the Italian Republic (2022), and Corresponding Member of the Ligurian Academy of Sciences and Letters (2025).