Tecnologie Convergenti per i Sistemi Biomolecolari Converging Technologies for Biomolecular Systems	
Progetto di ricerca **Research project**	*"Microbial stimuli and the mobilization of immunoregulatory hematopoietic stem cell precursors: implications for host-microbe interaction"*
Tipo/Type	Borsa finanziata dal Dipartimento di Biotecnologie e Bioscienze
Borse/Scholarships	1
Abstract	Microbial signals exert a significant regulatory effect on systemic immunity, partially through modulation of hematopoietic stem and progenitor cells (HSPCs) within the bone marrow microenvironment. Emerging evidence indicates that microbial-derived components, particularly structural elements such as lipopolysaccharides (LPS), shape the fate and the functional specialization of HSPCs by skewing differentiation trajectories towards immunoregulatory phenotypes. This PhD project aims to investigate the impact of discrete microbial stimuli on the mobilization, transcriptional programming, and immunomodulatory capacities of hematopoietic stem cell precursors under both homeostatic and infectious conditions. Emphasis will be placed on: 1) The impact of microbial LPS structural variations (e.g., hypo-acylated forms) on HSPCs and TLR4-mediated signaling pathways within the bone marrow. 2) Investigating the mechanobiological responses of the bone marrow microenvironment niche in response to microbial stimuli, with a focus on inflammation-induced spatial and structural remodeling of hematopoietic niches. Utilizing antibiotic-treated murine models alongside genetically engineered bacterial strains, complemented by single-cell transcriptomic profiling and *in vivo* lineage tracing of HSPCs, the candidate will systematically map the functional outcomes of host–microbe interactions on hematopoietic ontogeny. Moreover, he/she will evaluate the potential of bacterial-derived molecules to restore immune tolerance in models of inflammatory disease. Collectively, this work seeks to elucidate the immunoregulatory mechanisms by which microbial cues govern HSPC mobilization and maintain microbe-host homeostasis. These insights may lay the foundation for novel therapeutic strategies that manipulate microbial signals to correct immune imbalances in autoimmunity, infection, and cancer.
Tutor	Prof. Simone Domenico Guglielmetti