

**RESEARCH TOPIC MEM9**  
**Microbiome and transcriptome patterns linked to skin photoaging and melasma**  
**Curriculum MEM**

**Laboratory name**

Laboratory of Mucosal Immunology and Microbiota

**Research Supervisor**

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**Abstract**

The human skin microbiome refers to the diverse community of microorganisms that inhabit the skin's surface. These microorganisms include bacteria, fungi, viruses, and other microbes. The skin microbiome plays a crucial role in maintaining skin health, protecting against pathogens, and contributing to the overall well-being of the human body. Several studies examining the changes in skin microbes across the lifespan highlight the significance of age as a crucial influencing factor and provide evidence for an age-dependent microbial shift.

By combining information about the microbial communities present on the skin (metagenomics) with data on gene expression patterns (transcriptomics), we can gain a deeper understanding of how the microbiome and host cells interact and contribute to skin health and function.

To have a comprehensive view of such microbes-host relationship in photoaging and melasma skin type versus "normal" skin, we will analyze the microbiome and transcriptomic profile obtained from age-matched healthy volunteers. Along this side, the isolation of bacterial strains by "culturomics" techniques, among the different skin types will enable the functional characterization of their properties within the context of skin aging.

**Main technical approaches**

Microbiota analysis, Transcriptomic analysis, Omics integration. Cell and bacterial culture.

**Scientific references**

- [1] R. Jugé et al., "Shift in skin microbiota of Western European women across aging," *J Appl Microbiol*, vol. 125, no. 3, pp. 907–916, Sep. 2018, doi: 10.1111/JAM.13929.
- [2] J. Krutmann, T. Schikowski, A. Morita, and M. Berneburg, "Environmentally-Induced (Extrinsic) Skin Aging: Exposomal Factors and Underlying Mechanisms," *J Invest Dermatol*, vol. 141, no. 4S, pp. 1096–1103, Apr. 2021, doi: 10.1016/J.JID.2020.12.011.
- [3] Y. R. Woo and H. S. Kim, "Interaction between the microbiota and the skin barrier in aging skin: a comprehensive review," *Front Physiol*, vol. 15, 2024, doi: 10.3389/FPHYS.2024.1322205.
- [4] H. J. Kim et al., "Segregation of age-related skin microbiome characteristics by functionality," *Sci Rep*, vol. 9, no. 1, Dec. 2019, doi: 10.1038/S41598-019-53266-3.
- [5] S. Saheb Kashaf et al., "Integrating cultivation and metagenomics for a multi-kingdom view of skin microbiome diversity and functions," *Nat Microbiol*, vol. 7, no. 1, pp. 169–179, Jan. 2022, doi: 10.1038/S41564-021-01011-W.

### **Brief description of the coherence of the project in relation to the PNRR objectives**

There is strong scientific evidence supporting the correlation between the composition of the microbiome and inflammatory processes across all mucosal barriers. Our overall well-being depends on this interaction and on the balance of microbiota biodiversity. Microorganisms play a crucial role in maintaining the proper function of the skin, and any dysbiosis, triggered by environmental factors, could potentially lead to severe skin conditions.

This project aims to investigate how the microbiota composition evolves with age and in response to environmental exposures such as climate, pollution, and UV radiation. By taking an integrated approach, we aim to identify molecular signatures associated with different skin types, allowing for a more comprehensive understanding of the relationship between host-microbe biology and various skin conditions or responses to treatments. Ultimately, this could lead to the identification of potential biomarkers for skin-related issues.

### **N. of months abroad**

6 months

### **N. of months at the company**

6 months, at Istituto Ganassini, Via Carlo Boncompagni, 63, 20139 Milano

### **Type of contract**

PhD scholarship of € 21.000 gross per year awarded by Humanitas University PNRR funds under M.D.M. D.D. N. 630/2024 and cofounded by Istituto Ganassini.

This sum is exempt from IRPEF income tax according to the provisions of art. 4 of Law no. 476 of 13th August 1984, and is subject to social security contributions according to the provisions of art. 2, section 26 and subsequent sections, of Law no. 335 of 8th August 1995 and subsequent modifications.

Borsa di dottorato pari a € 21.000 annui lordi erogata da Humanitas University su fondi da D.M. 630/2024 e cofinanziata da Istituto Ganassini. Importo non soggetto a tassazione IRPEF a norma dell'art. 4 della L. 13 agosto 1984 n. 476 e soggetto, in materia previdenziale, alle norme di cui all'art. 2, commi 26 e segg., della L. 8 agosto 1995, n. 335 e successive modificazioni.