

**RESEARCH ACTIVITY SHEET** 

2025 PhD selections

## YOUR DETAILS

\* Name & Surname

Nicola Segata

\* Affiliation - Universita' di Trento, CIBIO

## PHD PROJECT DETAILS

\* Title of the proposed project

High-resolution computational metagenomics for the study of the transmission of the human microbiome

\* Short description of the project (up to 300 words)

The research program is part of the project "UE HE ERC MICROTOUCH Segata" GA n. 101045015 CUP E63C22001400006. The researcher will develop computational software methods for better identification and characterization of individual strains of bacteria, fungi, and viruses within metagenomic data. Part of the work will also consist in applying the new tools to various large-scale metagenomic datasets, including new cohorts from the MICROTOUCH project and publicly available data, to investigate the transmission of microbial strains between individuals and its potential link to non-communicable diseases. All developed methods will be made open-source.

\* Indicate the main research area for the project described above - computational metagenomics and microbiome research

If needed indicate a second research area for the project described above - Biomolecular science

\* Provide up to 3 key words for project:

metagenomics, strain transmission, microbiome

## YOUR LABORATORY ACTIVITIES DETAILS

\* Main topic/s of the lab

computational metagenomics

\* Short description of the lab activity (up to 500 words)

Next generation computational metagenomic tools. The potential of metagenomics is only partially expressed due to computational challenges. We are working on novel methods to profile microbiomes at increased resolution (e.g. strains) and perform large-scale comparative genomics on uncharacterized microbes.

Integrative and machine learning meta'omic approaches. We develop new machine learning tools to cope with the variability and dimensionality of microbiome profiles and provide clinically relevant signatures by integrating complementary meta'omic approaches (e.g. metatranscriptomics or metaproteomics).

Microbiome-pathogen interaction in human infections. The role of the microbiome in the acquisition and development of infections is largely unknown. By coupling longitudinal pathogen/microbiome sequencing we aim to understand how the microbiome can modulate the virulence profile and antibiotic resistance of human infections.

Microbiome transmission. We study how microbes can be transmitted between different environments with specific focus on how members of the microbiome are vertically transmitted from mothers to infants at birth and horizontally between family members or individuals sharing the same environment.

\* Recent bibliography (max 5 references)

- Fackelmann, G., Manghi, P., Carlino, N., Heidrich, V., Piccinno, G., Ricci, L., Piperni, E., Arrè, A., Bakker, E., Creedon, A. C., Francis, L., Capdevila Pujol, J., Davies, R., Wolf, J., Bermingham, K. M., Berry, S. E., Spector, T. D., Asnicar, F., & Segata, N. (2025). Gut microbiome signatures of vegan, vegetarian and omnivore diets and associated health outcomes across 21,561 individuals. Nature Microbiology, 10, 41–52.
- Blanco-Míguez, A., Beghini, F., Cumbo, F., McIver, L. J., Thompson, K. N., Zolfo, M., Manghi, P., Dubois, L., Huang, K. D., Thomas, A. M., Nickols, W. A., Piccinno, G., Piperni, E., Punčochář, M., Valles-Colomer, M., Tett, A., Giordano, F., Davies, R., Wolf, J., ... Segata, N. (2023). Extending and improving metagenomic taxonomic profiling with uncharacterized species using MetaPhIAn 4. Nature Biotechnology, 41, 1633–1644.
- Valles-Colomer, M., Blanco-Míguez, A., Manghi, P., Asnicar, F., Dubois, L., Golzato, D., Armanini, F., Cumbo, F., Huang, K. D., Manara, S., Masetti, G., Pinto, F., Piperni, E., Punčochář, M., Ricci, L., Zolfo, M., Farrant, O., Goncalves, A., Selma-Royo, M., ... Segata, N. (2023). The person-to-person transmission landscape of the gut and oral microbiomes. Nature, 614, 125–135.
- Piperni, E., Nguyen, L. H., Manghi, P., Kim, H., Pasolli, E., Andreu-Sánchez, S., Arrè, A., Bermingham, K. M., Blanco-Míguez, A., Manara, S., Valles-Colomer, M., Bakker, E., Busonero, F., Davies, R., Fiorillo, E., Giordano, F., Hadjigeorgiou, G., Leeming, E. R., Lobina, M., ... Segata\*, N., Asnicar\*, F. (2024). Intestinal Blastocystis is linked to healthier diets and more favorable cardiometabolic

 Dubois, L., Valles-Colomer, M., Ponsero, A., Helve, O., Andersson, S., Kolho, K. L., Asnicar, F., Korpela, K., Salonen, A., Segata\*, N., & de Vos\*, W. M. (2024). Paternal and induced gut microbiota seeding complement mother-to-infant transmission. Cell Host and Microbe, 32(6), 1011-1024.e4.outcomes in 56,989 individuals from 32 countries. Cell, 187(17), 4554–4570.

\* Group composition: total members, and roles distribution (PhD, postdoc, technician, etc.)

25 members: 10 PhD students, 11 postdocs, 3 pre-doc, 2 research assistants

Institutional page link

https://www.unitn.it/en

Lab website link, if any

http://segatalab.cibio.unitn.it/index.html

Social media links, if any

If you prepare a video to promote your lab/project, please include the link below