

RESEARCH ACTIVITY SHEET

2025 PhD selections

YOUR DETAILS

* Name & Surname

Marino Zerial

* Affiliation HT

PHD PROJECT DETAILS

* Title of the proposed project

Biochemical and biophysical approaches to study receptor endocytosis and endosomal membrane fusion

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

The Zerial Group studies endocytosis, from its molecular mechanisms to implications in cell and tissue organisation. Endocytosis is an essential process serving multiple key cellular functions, such as nutrient uptake, signal transduction, and defence against pathogens. In endocytosis, a plasma membrane patch is internalised, forming a transport vesicle containing cargo from the extracellular space. Transport vesicles bud off from the plasma membrane and eventually fuse with a target cellular compartment. Transport vesicles must be highly selective in recognising the correct target membrane for fusion to ensure correct cargo delivery. In this process, Rab proteins direct the vesicle to a specific spot on the target membrane, where tethering proteins recognise the vesicles and bring the cargo closer to the and targeting membrane. Finally, SNARE proteins mediate membrane fusion. The Zerial Group has pioneered the functional analysis of the Rab family of small GTPases in intracellular transport, focusing on Rab5. Rab5 and its effector proteins play a key role in endosomal membrane fusion. The PhD candidate will adopt a unique interdisciplinary approach, developed by the Zerial Group, which combines biochemical and biophysical methods with advanced light microscopy, cell biology, and computer-aided three-dimensional reconstruction of tissues to study the compartmentalisation of proteins on endosomal membranes and how this controls receptor endocytosis and endosomal membrane fusion. By reconstituting synthetic endosomes that recapitulate the functional properties of the cellular organelles, the candidate will elucidate the molecular mechanism of receptor endocytosis and endosomal membrane fusion.

* Indicate the main research area for the project described above Molecular Biology

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

* Provide up to 3 key words for project:

Endocytosis, Membranes, Endosomes

YOUR LABORATORY ACTIVITIES DETAILS

* Main topic/s of the lab

Endocytosis and trafficking, membranes and organelles, cell polarity, liver morphogenesis and physiology, targeted drug delivery.

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

The Zerial Group studies the molecular mechanisms of cell and tissue organisation. The research in the Zerial Group crosses biological scales and disciplines to decipher protein interactions within the endosomal fusion machinery, define the processes that establish hepatocyte polarity and understand the biophysics of liver tissue formation. Finally, the Group exploits its knowledge of the delicate interplay between forces, molecules and cells to design innovative strategies for drug delivery.

* Recent bibliography (max 5 references)

1. Schuhmacher, J.S., Tom Dieck, S., Christoforidis, S., Landerer, C., Davila Gallesio, J., Hersemann, L., Seifert, S., Schäfer, R., Giner, A., Toth-Petroczy, A., Kalaidzidis, Y., Bohnsack, K.E., Bohnsack, M.T., Schuman, E.M., and Zerial, M. (2023). The Rab5 effector FERRY links early endosomes with mRNA localisation. *Mol Cell* 83, 1839-55.
2. Quentin, D., Schuhmacher, J.S., Klink, B., Lauer, J., Shaikh, T.R., Huis In 't Veld, P.J., Welp, L.M., Urlaub, H., Zerial, M., and Raunser, S. (2023). Structural basis of mRNA binding by the human FERRY Rab5 effector complex. *Mol Cell* 83, 1856-71.
3. Singh, A., Soler Blasco, J.A., Lauer, J., Grill, S.W., Jahnel, M., Zerial, M., and Thutupalli, S. (2023). Two-component molecular motor driven by a GTPase cycle. *Nat Phys.* 19, 1185-1192
4. Cezanne, A., Lauer, J., Solomatina, A., Sbalzarini, I.F., and Zerial, M. (2020). A non-linear system patterns Rab5 GTPase on the membrane. *Elife* 9, e54434.
5. Franke, C., Repnik, U., Segeletz, S., Brouilly, N., Kalaidzidis, Y., Verbavatz, J.M., and Zerial, M. (2019). Correlative single-molecule localization microscopy and electron tomography reveals endosome nanoscale domains. *Traffic* 20, 601-17.

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

4 members. Zhansaya Bauyrzhanova (PhD Student); Marta La Bruna (PhD Student); Ilaria Raimondi (Technician); Chiara Ticli (Postgraduate Fellow)

Institutional page link

<https://humantechnopole.it/en/research-groups/zerial-group/>

Lab website link, if any

<https://zeriallab.org/>

Social media links, if any

None

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

None