

Unit Name

Biological Complexity Unit
Professor Simone Pigolotti

Collaborations

Daniel Busiello, University of Padua, Italy, Non-equilibrium nature of cyclic first passage time (whole FY)
Izaak Neri, King's College London, UK, Amendable decisions in living systems (whole FY)

Students Supervised:

- Samuel Cyrus Cure (PhD Student)
- Gabriele Farne (Research Intern)
- Luis Santiago Kuhl (Research Intern)
- Irene Pellini (Research Intern)
- Masanao Igarashi (Research Intern)
- Mario Buehler (Research Intern)

Scholarly Contributions and Creative Productions (by Faculty)

Journal Article

1. Klann, M.; Miura, S.; Lee, S.-H. H.; Vianello, S. D. D.; Ross, R.; Watanabe, M.; Gairin, E.; Liang, Y.; Hutto, H. W.; McCluskey, B. M.; Herrera, M.; Solnica-Krezel, L.; Besseau, L.; Pigolotti, S.; Parichy, D. M.; Kinoshita, M.; Laudet, V.
Cell-Cell Communication as Underlying Principle Governing Color Pattern Formation in Teleost Fishes. *Nature communications* 2026, 17.
2. Bauer, M.; Goyal, A.; Goyal, S.; Reddy, G.; Chakrabarti, S.; Desai, M. M.; Gilpin, W.; Grilli, J.; Husain, K.; Jain, S.; Jolly, M. K. K.; Kawaguchi, K.; Koseska, A.; Lin, M.; Narlikar, L.; Pigolotti, S.; Raju, A.; Shrinivas, K.; Siddharthan, R.; Stephens, G. J.; Tiffeau-Mayer, A.; Vaikuntanathan, S.
Unifying Theories in High-Dimensional Biophysics: Approaches, Challenges and Opportunities. *NPJ systems biology and applications* 2025, 12, 43.
3. Zhou, P.; Kasai, R. S.; Fujita, W.; Tsunoyama, T. A.; Neyama, H.; Ueda, H.; Yokoyama, T.; Sakamoto, M.; Pigolotti, S.; Fujiwara, T. K.; Kusumi, A.
Single-molecule Characterization of Opioid Receptor Heterodimers Reveals Soluble μ - δ Dimer Blocker Peptide Alleviates Morphine Tolerance. *Nature Communications* 2025, 16.
<https://www.nature.com/articles/s41467-025-64695-2>
4. Zhou, P.; Tsunoyama, T. A.; Kasai, R. S.; Hirose, K. M.; Kalay, Z.; Aladag, A.; Fujiwara, T. K.; Yokoyama, T.; Sakamoto, M.; Kise, R.; Yanagawa, M.; Inoue, A.; Pigolotti, S.; Kusumi, A.
Single-molecule Methods for Characterizing Receptor Dimers Reveal Metastable Opioid Receptor Homodimers That Induce Functional Modulation. *Nature Communications* 2025, 16.
<https://www.nature.com/articles/s41467-025-64694-3>
5. Cure, S.; Pflug, F. G.; Pigolotti, S.

Fast and Exact Stochastic Simulations of Epidemics on Static and Temporal Networks. PLoS computational biology 2025, 21, e1013490.

6. Pigolotti, S.; Rold'an-Vargas, S. 'andalo. Inspection Paradox and Jump Detection in Glassy Systems. Phys. Rev. E 2025, 112, 035415.
7. Ross, R.; Masucci, G. D.; Lin, C. Y.; Iglesias, T. L.; Reiter, S.; Pigolotti, S. Hyperdisordered Cell Packing on a Growing Surface. Phys. Rev. X 2025, 15, 021064.
8. Cure, S.; Pflug, F. G.; Pigolotti, S. Exponential Rate of Epidemic Spreading on Complex Networks. Phys. Rev. E 2025, 111, 044311.

Presentation at Conference

1. Pigolotti, S. Statistical Physics of Growing Systems. Extremal Statistics in Biology 2025.
2. Pigolotti, S. Statistical Physics of Growing Systems. International Centre for Theoretical Sciences (ICTS) 2025.
3. Pigolotti, S. Exponential Growth in Biology: From Microbial Cultures to Human Epidemics. OIST-KEIO SHOWCASE TALK Series 7- Science meets Society: Frontiers in Interdisciplinary Approaches to Life Sciences, Tokyo, JAPAN 2025.

Seminars

1. Pigolotti, S. "Genome Replication in Growing Populations", Tohoku University, September 30. 2025.
2. Pigolotti, S. "Statistical Physics of Growing Systems" ISTA, Austria, June 16. 2025.
3. Pigolotti, S. "Statistical physics of Growing Systems" King's College London, February 13, 2026.

Scholarly Contributions (by Unit Members)

Name of Unit Member	Type	Title	Outlet	Publisher	Year Pub
Florian Pflug	Journal Article	Genomic GC bias correction improves species abundance estimation from metagenomic data	Nature Communications	Nature	2025
Debsuvra Ghosh	Poster Presentation at Conference	Modelling Proliferating Nematic Cell Colonies in Confining Geometries	Soft and Liquid Matter Physics: Past, Present and Future		2025