

Team name and photography:

Miguel A. Fortuna



Computational Biology Lab

Department of Ecology and Evolution

Estación Biológica de Doñana (EBD-CSIC)

Brief description:

Our computational biology lab harnesses evolution by engineering species interactions to help fight human diseases.

Group Members:

Miguel A. Fortuna (PI)

Francisco J. Borrallo-Vázquez (Graduate Student)

Raúl Ortega (Computer Technician)

Research topics:

Digital organisms are self-replicating computer programs that evolve within a user-defined computational environment. Some of them are parasites (i.e., like viruses infecting bacteria) that need others (their hosts) to survive and make copies of themselves. By studying coevolutionary interactions between parasites and their hosts *in silico*, we complement *in vitro* and *in vivo* approaches on the current use of phages to treat antibiotic resistant bacteria (i.e., phage therapy).

Recent articles:

- Fortuna, M.A., Beslon, G., and Ofria, C. (2022). Digital evolution: insights for biologists. *Frontiers in Ecology and Evolution*, 10:1037040.

<https://doi.org/10.3389/fevo.2022.1037040>.

- Fortuna, M. A., Barbour, M.A., Zaman, L., Hall, A.R., Buckling, A., and Bascompte, J. (2019). Coevolutionary dynamics shape the structure of bacteria-phage infection networks. *Evolution*, 73-5: 1001-1011.

<https://doi.org/10.1111/evo.13731>

- Fortuna, M.A., Zaman, L., Andrea, W., and Bascompte, J. (2017). Non-adaptive origins of evolutionary innovations increase network complexity in interacting digital organisms. *Phil. Trans. R. Soc. B*: 372:20160431.

<http://doi.org/10.1098/rstb.2016.0431>

- Fortuna, M.A., Zaman, L., Ofria, C., and Wagner, A. (2017). The genotype-phenotype map of an evolving digital organism. *PLoS Comput. Biol.* 13(2): e1005414.

<https://doi.org/10.1371/journal.pcbi.1005414>

- Fortuna, M.A., Zaman, L., Wagner, A.P., and Ofria, C. (2013). Evolving digital ecological networks. *PLoS Comput. Biol.* 9(3): e1002928.

<https://doi.org/10.1371/journal.pcbi.1002928>

Research projects:

- Fortuna, M.A. (PI). Evolving phages in silico by engineering ecological interactions to treat antibiotic-resistant bacterial infections. Ministerio de Ciencia e Innovación Consolidación Investigadora. CNS2022-135959. 01/07/2023 - 30/06/2025. 198.922 €.

- Fortuna, M.A. (PI) and Zaman, L. (co-PI). Harnessing evolution by engineering ecological interactions to treat antibiotic-resistance bacterial infections. (CSIC-iLink). Consejo Superior de Investigaciones Científicas (CSIC). LINKA20396. 01/01/2022 - 31/12/2023. 24.000 €.

- Fortuna, M.A. (PI). Harnessing evolution by engineering ecological interactions to fight human diseases. Junta de Andalucía. P20_00765. 01/10/2021 - 31/12/2022. 71.750 €.

- Fortuna, M.A. (PI). The coevolving Web of Life. Ministerio de Ciencia e Innovación-Plan Estatal PID2019-104345GA-I00. 01/06/2020 - 31/05/2024. 163.350 €.

Doctoral Thesis:

None yet.

Web site:

<https://fortunalab.org>