Özgür Yüksel

M.Sc. Biotechnology

ozguryuksel@live.com | +45 52 60 96 90 | o-yuksel.github.io

Education

M.Sc. Biotechnology 2018–2021
Yeditepe University, Istanbul **GPA: 4.00/4.00**
Thesis: "Game-Theoretical Analysis of Cooperation and Cheating in Lipase-Producing *Yarrowia lipolytica* Subcultures"
(Supervisor: Assoc. Prof. Dr. Emrah Nikerel)

B.Sc. Genetics and Bioengineering 2012–2017
Yeditepe University, Istanbul

Research Experience

Independent Research 2022–Present

- **Emergent Cooperation Through Evolving GRN Architecture:** Evolved gene regulatory networks that discover conditional cooperation in the Prisoner's Dilemma without pre-specified strategies. Demonstrated that adding an internal gene expands accessible solution space (4 to 14 motifs), reduces mutational distance to cooperation (3.4 to 1.9 steps), and increases success rate (12% to 32%). Two distinct architectures emerge from identical initial conditions through early stochastic commitment.
- **Developmental Bias and Evolutionary Trajectories:** Multi-lineage GRN simulation introducing the "Forecast Horizon" concept, the point where evolutionary prediction reliability degrades.
- **Modes of Adaptation:** Simulation showing transition between genetic assimilation and phenotypic plasticity as environmental change rate varies.

Master's Thesis Research 2018–2021

- Developed a structured kinetic model integrating Monod growth equations with evolutionary game theory to analyze frequency-dependent selection in microbial public goods games.
- Designed the Stable State Finder algorithm using successive forward simulations to identify evolutionarily stable states when analytical solutions are not feasible.
- Identified game regime transitions and optimal fermentation conditions for cooperation.

Undergraduate Research 2016–2017

- Developed spatial stochastic (lattice-based) and non-spatial deterministic evolutionary game models to investigate electrical signaling in bacterial biofilms.

Technical Skills

Mathematical: ODEs, stochastic processes, dynamical systems, stability analysis
Theoretical: Evolutionary game theory, G-function dynamics, adaptive landscape modeling
Computational: Python, MATLAB, agent-based / population / spatial / temporal modeling
Biological: Gene regulatory networks, microbial ecology, evo-devo, cancer evolution

Publications & Presentations

Yüksel, O. (2025) "Escaping the Prison: Emergent Cooperation Through Evolving GRN Architecture." *Preprint.*

Yüksel, O. (2025) "Exploring the Design Space of Adaptive Polymorphism Models Through the Production-Regulation Framework." *Preprint.*

Yüksel, O. (2025) "Reciprocal Negative Feedbacks Stabilize an Emergent Polymorphism in a Cross-Feeding Microbial

Consortium." *Preprint.*

Yüksel, O. & Nikerel, E. (2024) "Game Theoretical Analysis of Cooperation and Cheating Among Lipase Producing *Candida rugosa*." *Preprint.*

Yüksel, O. (2022) Oral presentation, Ecology and Evolutionary Biology Symposium, METU Ankara.

Yüksel, O. & Nikerel, E. (2019) Poster presentation, Health Informatics and Bioinformatics Symposium, Izmir.

All papers available at: https://o-yuksel.github.io

Additional Training

Dynamical Systems and Chaos (Santa Fe Institute, 2023)
Machine Learning (Stanford/Coursera, 2022) | Reinforcement Learning (Georgia Tech, 2022)
Duolingo English Proficiency: Advanced (135)