



University  
of Basel

Department  
Biozentrum



Swiss Institute of  
Bioinformatics

BIOZENTRUM

The Center for  
Molecular Life Sciences

## Basel Computational Biology Seminar

### 21563 Current research in Bioinformatics II



# Jacopo Grilli

## Macroecological patterns and structure of alternative stable states in microbial communities

Understanding the immense diversity and variation within microbial communities is a central challenge in modern ecology. A powerful approach has been to apply macroecological laws, which reveal that in many complex natural eco-systems, the variation in species' presence and abundance follows simple, reproducible rules. This framework provides a robust baseline for predicting community structure and suggests that species abundances fluctuate around a single equilibrium. However, this picture of a single equilibrium is insufficient for systems known to harbor alternative stable states, such as the human gut microbiome or lab-assembled consortia. In these communities, we observe that individual species exhibit robustly bimodal distributions, indicating they exist in one of two distinct states: high abundance or low abundance. I will show that this binary-like switching is a fundamental, bottom-up mechanism that generates discrete, alternative stable states at the community level. By analyzing the prevalence of species across these states, we discovered that phylogenetically close relatives are significantly more likely to exhibit reciprocal patterns. This suggests that state-dependent competition and exclusion, rather than functional redundancy, is a key driver of community assembly, offering an explanation that connects fine-scale interactions to ecosystem-level patterns.

### Speaker Information

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### Event Details

**Date:** Monday, April 13, 2026

**Time:** 16:15 – 17:15 h

**Location:** Biozentrum, U1.197

**Host:** Ludovico Calabrese

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