CoCo Seminar Series
Fall 2026

[Extra CoCo Seminar]
From Molecular Networks to Diet: Identifying Synergistic Vitamin Effects in Myocardial Infarction

Dr. Andrés Aldana, Postdoctoral Research Associate, Universidade Católica Portuguesa, Portugal

Thursday October 22, 2026 11:00 AM - 12:00 PM EDT
Hybrid (EB-C3/CASCI Lab & Zoom; meeting link available on http://coco.binghamton.edu/)

Cardiovascular disease emerges from interactions spanning molecular, physiological, and nutritional scales, yet nutritional research commonly evaluates dietary components as isolated variables. Here, we integrate molecular interaction, epidemiological dependency, and food composition networks to identify collective vitamin effects associated with myocardial infarction, hypothesizing that vitamins act as coordinated perturbations across coupled biological and dietary systems. At the molecular scale, we identify a statistically significant disease module within the human interactome. Network proximity analyses show that different vitamins preferentially align with distinct cardiovascular endophenotypes, suggesting that vitamins collectively modulate cardiovascular pathology through coordinated regulation of complementary disease processes. At the population scale, Gaussian graphical models inferred from patient dietary, biomarker, endophenotype, and comorbidity data reveal a dependency structure linking vitamin intake, circulating vitamin levels, pathological endophenotypes, comorbidities, and myocardial infarction risk. We identify synergistic vitamin groups associated with coordinated modulation of phenotypes leading to MI, highlighting collective nutritional effects not observable under reductionist analyses of individual nutrients. Finally, we show that foods self-organize into clusters with distinct vitamin composition profiles, revealing structures in nutritional space that can be leveraged to derive protective dietary patterns. Together, these results demonstrate how multiscale complex systems frameworks can translate molecular mechanisms into realistic population-level dietary interventions and identify synergistic nutritional strategies to reduce chronic disease risk.

Dr. Andrés Aldana is a postdoctoral researcher at Universidade Católica Portuguesa, working at the intersection of network science, artificial intelligence, and computational biology. He holds a Ph.D. in Biomedical Sciences from the National Autonomous University of Mexico (UNAM) and previously conducted postdoctoral research at the Barabási Lab at Northeastern University and Harvard Medical School. His research focuses on understanding the molecular mechanisms of complex diseases through network medicine and AI, with particular emphasis on identifying therapeutic targets, drug repurposing, and developing computational approaches for precision medicine.

For more information, contact Akshay Gangadhar (agangadhar@binghamton.edu).
http://coco. binghamton.edu/