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**Seminar of the Department of Mathematics and Statistics, University of Cyprus**

Room: 037, ΣΘΕΕ01. Date: 05/04/2017 Time: 11:00

**Speaker :** Giles Hooker (Cornell University)

**Title :** Goodness of Fit in Differential Equation Models: Misspecified Rates or Misspecified States?

**Abstract:**

This talk considers the statistical evidence for evolution in laboratory-based ecological experiments. We examine data from a chemostat experiment in which algae are grown on nitrogen-rich medium and rotifers are introduced as a predator. The resulting data exhibit dynamics that do not correspond to those generated by classical ecological models. A hypothesized explanation is that more than one algal species is present in the chemostat.

We assess the statistical evidence for this claim in terms of three potential causes of lack of fit for standard differential equation models for this system: (i) unmodeled stochastic forcing, (ii) mis-specified functional forms and (iii) mis-specified state variables.

Here the proposed explanation of multiple algal species corresponds to hypothesis (iii).

Tests between these hypotheses are achieved by representing lack of fit in terms of time-varying parameters and assessing the relationship between these time varying parameters and existing state variables with statistical significance assessed through bootstrap and permutation methods. While our tests suggest that observed dynamics are well-matched by multiple-species models, alternative causes for lack of fit cannot be ruled out. We conclude with an examination of the use of control theory to design inputs into chemostat systems to improve parameter estimation and power to detect missing components.