AMMINISTRAZIONE CENTRALE AREA RELAZIONI INTERNAZIONALI PROJECTS & MOBILITY OFFICE



Università degli Studi di Padova

Organising institution	Università degli Studi di Padova Dipartimento di Fisica e Astronomia - DFA Prof. Amos Maritan
Visiting Professor	Aleksandra Walczak Ecole Normale Superieure, France
Course Title	A quantitative view of the adaptive immune system: data and theory
and Description	This series of four seminars would like to show students of physics, and other "hard" sciences how to tackle the study of the immune system in a quantitative way. The immune repertoire responds to a wide variety of pathogenic threats. It is a highly dynamical and diverse system that protects us against many challenges, including the ones that did not exist when we were born. In this series of lectures, this complex system will be discussed from different perspectives: data, models and ideas of optimal encoding. Immune repertoire sequencing experiments give us insight into the composition of these repertoires. It will be shown that the functioning of the repertoire relies on statistical properties, statistical analysis is needed to identify responding clones. In lecture 1 it will be shown how statistical inference can be used to explain how the diversity of the immune system is generated. In Lecture 2, methods will be presented for learning the dynamics and response of immune repertoires to describe the repertoire level response to the SARS-CoV-2, among other perturbations. More generally in these two lectures, it will be shown how immune repertoires provide a unique fingerprint reflecting the immune history of individuals, with potential applications in precision medicine. In lecture 3, the idea that a well-adapted repertoire should be tuned to the pathogenic environment to reduce the cost of infections will be theoretically expanded. A Bayesian approach for predicting the optimal repertoire that minimizes the cost of infections contracted from a given distribution of pathogens will be discussed . In lecture 4, An attempt will be made to connect back to data discussing the genotype-phenotype map, as well as discuss the evolution of pathogens under selection pressures coming from immune systems.
Period	01/04/2021 – 10/06/2021
Course Level	Master Degree courses in Physics and Physics of Data