# RESPONSE Summer School 3-7 July 2017

# Agent-Based Modelling

## Prof. Frank Schweitzer (ETH Zurich)

- organizer: DFG funded **Research Training Group RESPONSE** (Biological Responses to Novel and Changing Environments)

  https://biologie.uni-greifswald.de/forschung/dfg-graduiertenkollegs/research-training-group-2010/

- venue: **University of Greifswald**, Germany

- **5 days intensive course**: morning: 10 lectures (a 90 min), afternoon: individual ABM projects (10 units a 90 min)

- 3 ECTS (recommended), certificate of attendence, **no tuition costs**

**Aims and objectives**

This full featured course on Agent-based Modeling (ABM) allows participants *with no prior experience* to understand concepts, methods and tools of ABM, to apply them in their master or doctoral thesis. ABM is introduced as a bottom-up approach to understand the complex dynamics of social systems, which include biological and ecological systems. Agents are the basic constituents, representing e.g. individuals, animals, cells, organisms. Agents are characterised by their internal states (e.g. activity, healthiness, preference, strategy), their ability to perceive and to change the environment and to interact with other agents. Given certain rules for the agents, we are interested to model the collective dynamics on the systemic level. This requires us to formalize the description of agents and to quantify the impact of parameters (e.g. of the environment) on the collective behavior.

**Detailed description**

**A: Lectures**

*I: Agent-based modelling (ABM):* who needs it?, comparison with other modeling approaches, advantages, disadvantages and pitfalls, programming platforms, formalization

*II: Agents with discrete internal states:* examples: dead/alive, active/passive, healthy/infected, Boolean dynamics, cellular automata, invasion dynamics, consensus formation, failure cascades

*III: Agents with continuous internal states:* examples: reputation, fitness, energy depot, stochastic dynamics, active matter, communication, mobility

*IV: Spatial interaction:* segregation dynamics, migration, collective motion, swarming, spatial competition, trail formation, aggregation

## B: Projects

Participants learn how to program and to simulate an ABM, using state-of-the-art tools like *jupyter notebook.*They are guided through the installation and complete sample simulations, before turning to their own project. This can be an ABM related to their master or doctoral thesis, but also a freely chosen project. Collaboration in small groups is encouraged. An assistant will be present during the week, to support their learning. A short report about the chosen project needs to be submitted by end of July.

## Application procedure

Applications for the summer school should be submitted to the coordinator of the research training network (email to: kerstin.wulf1@uni-greifswald.de). They should include a one-page motivation letter (in PDF) that provides also information about the scientific background of the applicant and how ABM is planned to be included into the applicant's research.

The **deadline** for applications is **10$^{st}$ June 2017**.

## Costs

Participating in the workshop will be free of costs. Travelling and accommodation cannot be covered. Costs for childcare can be refunded but need to be indicated in advance.