# DCC project 2020-2021

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The student shall acquire knowledge and competencies on the *design* of a Distributed Coordinated Model and the *development* of corresponding MAS (Multi-agent Systems) for a given problem.

Given a *real problem* the student shall reach the four objectives:

1. **identify the agents** of the system and **characterize the environment** where agents interact;
2. **define a model as a collection of interactive agents**. It should be a simplified, *formally or semi-formally* approximation of the systems's behaviour of the given problem;
3. **implement the model as a simulation** within the NetLogo or Repast platform;
4. **write the report describing the study, the model and the solution adopted**. It is important to highlight what foundational theories guided the choices made along the project work.

**The exam** consists of a 20 minutes presentation of the work done. Lecturer and Tutor ask questions related to the design and specification choices and theories beyond the solution proposed.
The date of the exam can be fixed by appointment with the Lecturer, anyway after delivering the report and the implementation to the Lecturer and Tutor.

## *Real problem:* **idiotypic network (IN)**

**The problem** for the academic year 2020-2021, regards a biological system called Idiotypic Network among antibodies whose goal is the maintenance of immunological memory.

**The model** can be obtained as a specialisation of Conways game of life model.
**The implementation** in NetLogo or Repast must be available trough a web site or a compress folder containing all the code necessary to run the model.

## *Main steps for studying the* **IN behaviour**

**The Project** consists of three phases, each of which ends when the student present the state of the art of the development.

**I phase:**
Implement Conway's *game of life* model in the NetLogo or Repast platform.
**Bibliography:** 1. Michael Wooldridge. Multiagent system. 2nd Ed.
2. https://en.wikipedia.org/wiki/Conway
**Output**: MAS for Conway's *game of life* simulated in NetLogo or Repast

**II phase:**
Specialize Conway's *game of life* model adding the behaviours of Idiotypic Network. This implies to identify and specify the roles and the interaction rules of antibodies.
**Input** the algebraic specification of the real system.
**Bibliography:** 1. G. Parisi. A simple model for the immune network. Proc. Natl. Acad. Sci. USA, vol. 87, pp. 429-433, 1990
2. E. Merelli et al.. Topological Characterization of Complex Systems: Using Persistent Entropy. Entropy, vol. 17, 2015
**Output:** MAS of Idiotipyc network simulated in NetLogo or Repast

**III phase:**
Simulation of the Idiotypic Network interaction among antibodies for maintaining the immunological memory.
**Input:** agent-based model
**Bibliography:** E. Merelli et al.. Topological Characterization of Complex Systems: Using Persistent Entropy. Entropy, vol. 17, 2015
**Output:** MAS of Idiotipyc network during the reaction to an antigen for maintaining the immunological memory simulated in NetLogo or Repast