## Master Internship Proposal

**Title**: ***Discovering experimental plans to obtain predefined elements in biological systems***

**Advisor**: Christine Froidevaux (LRI/INRIA)

In collaboration with Sarah Cohen-Boulakia (LRI/INRIA), Anne Poupon (INRA Tours, BIOS) and, members of the NII group (Japan)

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**Location**: LRI (Univ. Paris Sud, CNRS & INRIA), Orsay ; **Duration**: 3-6 months

**Keywords*:*** systems biology, inference of signalling networks, knowledge-based reasoning

### Context

This internship is done in the context of a current collaboration between INRA and INRIA which aims to help the understanding of signalling pathways involving G protein-coupled receptors which are excellent targets in pharmacogenomics. Large amounts of experiments are available in this context while globally interpreting all the results remains a very challenging task for biologists. Exploiting the very numerous and heterogeneous data available is crucial in this context. We have proposed a method that mimics the scientist's reasoning, modelling it by means of logical expert rules. We have thus started the development of a knowledge-based method using the SOLAR system (designed in K. Inoue group at Tokyo) to automatically construct signalling pathways (represented as networks) by deduction from the data.

### Work

We are interested in discovering the alterations necessary to obtain pre-defined elements in the network. The goal of the master internship will be to help scientists determining the experiments to be conducted in order to get additional new pieces of knowledge about the signalling network they study. Such a process will based on hypothetical reasoning, also called abductive reasoning, and should be able to satisfy constraints imposed by biologists.
More particularly, the work to be done in this internship can be decomposed into 3 steps:

- The abductive module of SOLAR will be tested within the design of the LHR (Luteinizing hormone receptor) signalling network using data collected from the BIOS group). A list of functionalities which are currently missing in this abduction module compared to the biologists' needs should be established.
- A new abductive process able to satisfy constraints on the facts used such as minimal cost of the experiments, or use of reliable facts, will be designed.
- The impact of each positive change (added element) on the network will be studied in order to consider the possibility of adding new elements implying minimal changes of the rest of the network.

**Required skills**: General bioinformatics skills are expected. Skills in system biology and logic models will be appreciated.

### Reference

D. Heitzler, P. Crépieux, A. Poupon, F. Clément, F. Fages and E. Reiter, Towards a systems biology approach of G protein-coupled receptor signalling: challenges and expectations, C R Biologies 332(11):947-57, 2009.