Toulouse Biotechnology Institute
Bio & Chemical Engineering

Postdoc offer (2 years)
Modeling and simulation of complex nested systems in relation to economic and social sciences

I. General context of the project

The technological, societal and economic transitions required to keep our planet on an acceptable trajectory in terms of global warming, non-exhaustion of material resources, achieving the quality of life desired by human and animal populations, and maintaining biodiversity, are forcing scientists to make considerable efforts to provide reasoned and ambitious decision-making tools. This ambition is based on multiple criteria, which means that we need to think from a variety of scientific viewpoints. This is particularly true in the areas of energy, materials and production engineering, the value chains, the economic and regional dynamics, and the analysis of their environmental and social impacts. The representation of these systems, referred to here as « complex and nested systems » in the sense that their reality is multi-scale in time and space, is a major challenge for the coupling of multi-science knowledges with the aim of understanding their dynamics, in particular to represent trajectories of change.
The proposed work is part of a medium- to long-term dynamic. It is based on projects run by the Occitanie Region (Défi-Clé en Économie Circulaire, Circulades), the University of Toulouse (MUTTEC TIRIS project), and the PEPR Recycling.

II. Objective

The original idea that we would like to explore as part of the postdoc is as follows: do the various methods and approaches developed in our laboratories already include modelling and simulation resources for representing an economy that is not linear, but circular, on several territorial scales?

Examples include simulations of workshops with several unit operations and recycling, developed in Process Engineering, metabolic models, turbulence modelling, population balances, Monte Carlo methods, ...

The idea is to test these tools and methods outside the framework in which they were developed, on issues linked to the Economic and/or Social Sciences, in conjunction with researchers in these fields (LERREPS, MSHT, LISST, TSE, etc.) involved in the projects in which TBI is participating, or more widely with other Circulades laboratories or researchers from the French Interdisciplinary Association for Circular Economy Research (AIFREC).

III. Which profile?

The candidates' scientific background is not crucial. However, they will have a scientific background demonstrating their ability to imagine and manipulate applied mathematical models and to transform them into numerical models enabling intensive simulations.
They will be able to work in interdisciplinary teams, which is necessary to transform concepts from various sciences into models that can be simulated. Written and spoken English is compulsory.
Experience in seeking resources from regional and/or national computing centres to carry out the project in terms

of computing capacity (if necessary) will be appreciated.

IV. How to apply?

The application file, in the form of a single pdf file, must comprise two separate parts:

1. An extended CV including a description of your scientific work and its relevance to the subject of the postdoc i.e. who are you?
2. A work project on the subject of the postdoc written in 1 page recto and verso: i.e. what do you propose to do on the proposed subject?

Successful applicants will be invited to present their CV and project orally.

Send your application file (NAME-First name_PostocEC-TBI.pdf) to :

Prof. Ligia BARNA: lbarna@insa-toulouse.fr
Prof. Pascal GUIRAUD: pguiraud@insa-toulouse.fr