

Post-doc in mathematical modeling on phenotypic evolution and embryonic development:

1. Job/ project description:

The postdoc could choose between three main research projects:

- a. Mathematical modeling of phenotypic evolution in populations with embryonic development.
- b. Mathematical modeling of gene network and embryonic development evolution.
- c. Mathematical modeling of organ development and their evolution in mammalian teeth or *Drosophila* wing.

The actual project will be chosen together with the candidate depending on his/her interests and skills.

The research will take place in the Isaac Salazar-Ciudad's group in the Center of Excellence in Experimental and computational developmental biology of the Biotechnology Institute of the University of Helsinki.

The job is for 1 year and renewable for 1 extra year.

2. Background:

The process of embryonic development is now widely acknowledged to be crucial to understand evolution since any change in the phenotype in evolution (e.g. morphology) is first a change in the developmental process by which this phenotype is produced. Over the years we have come to learn that there is a set of developmental rules that determine which phenotypic variation can possibly arise in populations due to genetic mutation (the so called genotype-phenotype map). Since natural selection can act only on existing phenotypic variation, these rules of development have an effect on the direction of evolutionary change.

Salazar-Ciudad's group is devoted to understand these developmental rules and how these can help to better understand the direction of evolutionary change. The ultimate goal is to modify evolutionary theory by considering not only natural selection in populations but also developmental biology in populations. For that aim we combine mathematical models of embryonic development that relate genetic variation to morphological variation with population models. The former models are based on what is currently known in developmental biology.

Salazar-Ciudad's group is in close collaboration with Jukka Jernvall's group and other groups within the center of excellence in experimental and computational developmental biology. The center includes groups working in tooth, wing, hair and mammary glands development. In addition to evolutionary and developmental biologists the center of excellence includes bioinformaticians, populational and quantitative geneticists, systems biologists and paleontologists.

“The Academy of Finland's Centres of Excellence are the flagships of Finnish research. They are close to or at the very cutting edge of science in their fields, carving out new avenues for research, developing creative research environments and training new talented researchers for the Finnish research system.”

### 3. Requirements:

The applicant must hold a PhD in either evolutionary biology, developmental biology or, preferably, in evolutionary developmental biology (evo-devo). Applicants with a PhD in theoretical or mathematical biology are also welcome.

Programming skills or a willingness to acquire them is required.

The most important requirement is a strong interest and motivation on science and evolution. A capacity for creative and critical thinking is also required.

### 4. Description of the position:

The fellowship will be for a period of up to 1+1 years (100% research work: no teaching involved).

Salary according to Finnish postdoc salaries.

### 5. The application must include:

- Motivation letter including a statement of interests
- CV (summarizing degrees obtained, subjects included in degree and grades, average grade).
- Summary of PhD project, its main conclusions and its underlying motivation.

-Application should be sent to Isaac Salazar-Ciudad by email:

isaac.salazar@helsinki.fi

No official documents are required for the application first stage but these may be required latter on.

### 6. Deadline:

There is no specific deadline, the position will be filled as soon as a suitable candidate is found.

### 7. Examples of recent publications by Isaac Salazar-Ciudad group.

Brun-Usan M, Marín-Riera M, Grande C, Truchado-Garcia M, Salazar-Ciudad I. A set of simple cell processes is sufficient to model spiral cleavage. *Development*. 2017 Jan 1;144(1):54-62.

-Salazar-Ciudad I, Marín-Riera M. Adaptive dynamics under development-based genotype-phenotype maps. *Nature*. 2013 May 16;497(7449):361-4.

-Salazar-Ciudad I, Jernvall J. A computational model of teeth and the developmental origins of morphological variation. *Nature*. 2010 Mar 25;464(7288):583-6.

### 8. Interested candidates should check our group webpage:

<http://www.biocenter.helsinki.fi/salazar/index.html>

The center of Excellence webpage:

<http://www.biocenter.helsinki.fi/bi/evodevo/ECDev.html>