Offer #2025-08745

Post-Doctoral Research Visit F/M Inference of a demo-genetic model for sustainable plant resistance

Contract type : Fixed-term contract

Level of qualifications required : PhD or equivalent

Fonction : Post-Doctoral Research Visit

About the research centre or Inria department

The Inria centre at Université Côte d'Azur includes 42 research teams and 9 support services. The centre's staff (about 500 people) is made up of scientists of di?erent nationalities, engineers, technicians and administrative staff. The teams are mainly located on the university campuses of Sophia Antipolis and Nice as well as Montpellier, in close collaboration with research and higher education laboratories and establishments (Université Côte d'Azur, CNRS, INRAE, INSERM ...), but also with the regiona economic players.

With a presence in the fields of computational neuroscience and biology, data science and modeling, software engineering and certification, as well as collaborative robotics, the Inria Centre at Université Côte d'Azur is a major player in terms of scientific excellence through its results and collaborations at both European and international levels.

Context

This postdoctoral position if funded by the ANR (French National Research Agency) **ENDURANCE** *ENhanced DURability AgaiNst Crop Enemies* project,

which brings together partners from INRAE and Inria. This interdisciplinary project combines molecular biology, population genetics, and epidemiological modelling, to determine optimal deployment strategies for plant resistance.

The postdoctoral fellow will join the **MACBES** team (Inria, INRAE, CNRS, Université Côte d'Azur) in Sophia Antipolis and will closely collaborate with **Suzanne Touzeau** (MACBES & M2P2 teams) and **Florence Carpentier** (AgroParisTech & MaIAGE, INRAE) based near Paris.

The postdoctoral fellow will interact with other ENDURANCE partners and the M2P2 team at ISA (INRAE, CNRS & Université Côte d'Azur).

Assignment

Crop protection often remains dependent on chemical pesticides, which are both harmful for the environment and human health. Resistant crops are an agroecological alternative to pesticides, but their extensive use may lead to the emergence/selection of virulent pathogens and resistance breakdown. Devising deployment strategies of resistant crops that are both efficient, i.e. that reduce crop damages, and durable, i.e. that limit the virulent pathogen populations, is hence a major issue.

The postdoctoral fellow will tackle this issue by means of a demo-genetic model, tailored for a specific pathosystem, the phoma stem canker of oilseed rape caused by fungus *Leptosphaeria maculans*. The emergence and development of virulent pathogens may vary according to the genetic determinisms of virulence (molecular mechanisms responsible for the transition to virulence, epistatic interactions, fitness costs), which are studied by other partners of the ENDURANCE project.

The work will be **based on**:

- time-series data of (i) phoma populations and resistance breakdowns, as well as (ii) resistance deployment in oilseed rape crops;
- a stochastic, discrete-time epidemiological model of an haploid monocyclic fungal pathogen, which includes features of the oilseed rape stem canker, such as interactions between resistance and avirulence genes;
- the corresponding C++ code.

The **objectives** of this position are threefold:

1. adapt the model to take into account migration, mutation, and pathotype-dependent virulence costs, based on recent advances in the genetic determinisms of virulence;
2. develop a method to estimate model parameters from historical data, in order to gain deeper insights into the observed dynamics of resistance breakdown;
3. devise durable strategies for the deployment of multiple resistances.

Main activities

Generic activities include: literature review, data processing, reporting, paper writing, participation and presentation in project meetings and in relevant conferences.

Specific activities include:

- dynamical model development,
- programming and numerical simulations (using a computing cluster),
- inference based on simulations (ABC-like method),
- numerical exploration (sensitivity analysis) and optimisation.

Skills

- Background in population dynamics and/or population genetics.
- Expertise in inference and/or optimisation.
- Experience in programming, preferably in C++.
- Knowledge of plant epidemiology would be a plus.
- Proficiency in written and spoken English.

Benefits package

- Subsidized meals
- Partial reimbursement of public transport costs
- Leave: 7 weeks of annual leave + 10 extra days off due to RTT (statutory reduction in working hours) + possibility of exceptional leave (sick children, moving home, etc.)
- Possibility of teleworking and flexible organization of working hours
- Professional equipment available (videoconferencing, loan of computer equipment, etc.)
- Social, cultural and sports events and activities
- Access to vocational training
- Contribution to mutual insurance (subject to conditions)

Remuneration

2788 € per month

General Information

- **Theme/Domain :** Modeling and Control for Life Sciences
- **Town/city :** Sophia Antipolis
- **Inria Center :** Centre Inria d'Université Côte d'Azur
- **Starting date :** 2025-08-01
- **Duration of contract :** 1 year, 6 months
- **Deadline to apply :** 2025-04-27

Contacts

- **Inria Team :** MACBES
- **Recruiter :**
  Touzeau Suzanne / suzanne.touzeau@inria.fr

About Inria

Inria is the French national research institute dedicated to digital science and technology. It employs 2,600 people. Its 200 agile project teams, generally run jointly with academic partners, include more than 3,500 scientists and engineers working to meet the challenges of digital technology, often at the interface with other disciplines. The Institute also employs numerous talents in over forty different professions. 900 research support staff contribute to the preparation and development of scientific and entrepreneurial projects that have a worldwide impact.

The keys to success

- Expertise in simulation-based inference.
- Modelling skills in population dynamics or population genetics.
- Marked interest in biological applications and motivation for interdisciplinary work.
- Good communication skills to ensure a smooth collaboration with Florence Carpentier.

Warning : you must enter your e-mail address in order to save your application to Inria. Applications must be submitted online on the Inria website. Processing of applications sent from other channels is not guaranteed.

Instruction to apply

Defence Security :
This position is likely to be situated in a restricted area (ZRR), as defined in Decree No. 2011-1425 relating to the protection of national scientific and technical potential (PPST).Authorisation to enter an area is granted by the director of the unit, following a favourable Ministerial decision, as defined in the decree of 3 July 2012 relating to the PPST. An unfavourable Ministerial decision in respect of a position situated in a ZRR would result in the cancellation of the appointment.

Recruitment Policy :
As part of its diversity policy, all Inria positions are accessible to people with disabilities.