A propos du centre ou de la direction fonctionnelle

Grenoble Rhône-Alpes Research Center groups together a few less than 650 people in 37 research teams and 8 research support departments.

Staff is localized on 5 campuses in Grenoble and Lyon, in close collaboration with labs, research and higher education institutions in Grenoble and Lyon, but also with the economic players in these areas.

Present in the fields of software, high-performance computing, Internet of things, image and data, but also simulation in oceanography and biology, it participates at the best level of international scientific achievements and collaborations in both Europe and the rest of the world.

Conte et contexte du poste

This project takes place within a longstanding collaboration between two teams, MOSAIC (https://team.inria.fr/mosaic) and Signal (http://www.ens-lyon.fr/RDP/spip.php?rubrique20), from the Plant Development and Reproduction laboratory http://www.ens-lyon.fr/RDP, located at ENS de Lyon, Lyon France.

Mission confiée

Context

Plant organs make up patterns, sometimes very conspicuous, along their stems, called phyllotaxis. Research in the past two hundred years has uncovered part of the mechanisms that can explain the emergence of these phyllotaxis patterns. At a macroscopic scale, organs that are generated at the top of plant axes (in the so called meristem containing a group of always dividing stem cells) in a regular and sequential manner. Organ are assumed to inhibit the formation of new organs in their immediate neighborhood and a new organ can form when the meristem growth pushes stems cells sufficiently far away from already existing organs to escape their inhibition. It has been shown that this simple lateral inhibition process may induce a vast majority of the phyllotaxis patterns observed in nature.

In the last 20 years, phyllotaxis research started to uncover the potential molecular and mechanical actors behind this abstract understanding. Auxin, a plant hormone, was found to be at the origin of the organ inhibition fields. This hormone is required to initiate organs at the apex, but as young organs consume auxin, they prevent the formation of new organs by depleting auxin in the organo-genetic zone, until this zone gets sufficiently far from existing organs, due to growth, to escape their inhibition. First molecular models were proposed ten years ago to model the dynamics of organ initiation in the meristem. For this, these models made key assumptions in the way auxin is transported from cell to cell in the meristem. This led to a first view of the molecular and cellular mechanisms responsible for phyllotaxis. In the recent years, our teams (Signal and MOSAIC) have shown using new quantitative bio-sensors of auxin that this first view is in disagreement with auxin measured distributions and therefore not correct (Galvan-Amupuida et al. 2020).

Aim of the PhD project

The objective of the thesis is to revisit completely the hypotheses underlying this first molecular view of phyllotaxis in light of the recent data obtained on auxin concentration dynamics in the meristem by our teams and to propose new hypotheses and computational model that can explain the observations. The model will integrate a quantitative description of the cell network making up the meristem, cell-to-cell transport mechanisms, growth dynamics and cellular division as well as gene regulatory networks controlling this system. The model will build up on our previous models of phyllotaxis (Stoma, 2008, Refahi, 2016, Godin 2020) and on a wide range of experimental data at the shoot apex continuously acquired by the Signal team.

References


Informations générales

- Thème/Domaine : Biologie numérise
- Ville : Lyon
- Centre Inria : CRI Grenoble - Rhône-Alpes
- Date de prise de fonction souhaitée : 2021-10-01
- Durée de contrat : 3 ans
- Date limite pour postuler : 2021-05-30

Contacts

- Equipe Inria : MOSAIC
- Directeur de thèse : Godin Christophe / Christophe.Godin@inria.fr

A propos d'Inria

Inria is the institut national de recherche dédié aux sciences et technologies du numérique. Il emploie 2600 personnes. Ses 200 équipes-projets agiles, en général communes avec des partenaires académiques, impliquent plus de 3500 scientifiques pour relever les défis du numérique, souvent à l’interface d’autres disciplines. L’institut fait appel à de nombreux talents dans plus d’une quarantaine de métiers différents. 900 personnels d’appui à la recherche et à l’innovation contribuent à faire émerger et grandir des projets scientifiques ou entrepreneuriaux qui impactent le monde. Inria travaille avec de nombreuses entreprises et a accompagné la création de plus de 180 start-up. L’institut s’efforce ainsi de répondre aux enjeux de la transformation numérique de la science, de la société et de l’économie.

L’essentiel pour réussir

The selected candidate should have a taste for pluridisciplinary subjects, modeling in biology, excellent skills in mathematics and programming. In addition, s/he should possess a strong sense of rigor and method and feel at ease in an environment with high scientific dynamics.

Consignes pour postuler

Important information concerning the COVID-19 epidemic: in case the rules by the French government and Inria related to the epidemic make it impossible for the candidate to physically start the position at Inria Grenoble, the position will start with teleworking.

Sécurité défense :

Ce poste est susceptible d’être affecté dans une zone à régime restrictif (ZRR), telle que définie dans le décret n°2011-1425 relatif à la protection du potentiel scientifique et technique de la nation (PPST). L’autorisation d’accès à une zone est délivrée par le chef d’établissement, après avis ministériel favorable, tel que défini dans l’arrêté du 03 juillet 2012, relatif à la PPST. Un avis ministériel défavorable pour un poste affecté dans une ZRR aurait pour conséquence l’annulation du

**Principales activités**
- Review of cell-based models of phyllotaxis and auxin transport
- Participating to meristem imaging and analysis with biologists
- Conception of models of phyllotaxis at cellular resolution
- Implementation of the models (python, C++)
- Paper writing and communication at conferences

**Compétences**
Technical skills and level required: A master level is required in several of the following domains: mathematical modeling, dynamical systems, scientific programming (Python), ODE/PDE, bio-physics, applied mathematics, computer science.

Languages: English

Relational skills: The candidate will have to work in a strongly pluridisciplinary domain.

**Avantages**
- 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 two days per week 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
- Social security coverage

**Rémunération**
Monthly salary after taxes: around 1596.05€ for 1st and 2nd year. 1678.99€ for 3rd year. (medical insurance included, income tax excluded).

**Politique de recrutement**: Dans le cadre de sa politique diversité, tous les postes Inria sont accessibles aux personnes en situation de handicap.

**Attention**: Les candidatures doivent être déposées en ligne sur le site Inria. Le traitement des candidatures adressées par d'autres canaux n’est pas garanti.