Four positions for post-doctoral researchers

are available as part of a Human Frontier Science Program-funded project to study mirror-image flowers (Barrett, 2002; Jesson & Barrett, 2003). The project seeks to link the molecular and cell-biological basis of left-right asymmetry in the sex-organs of flowers with the ecological consequences of this floral adaptation and to retrace its evolutionary history. A summary of the project is included below.

The duration of the positions is for **three years**, with a **start date** ideally **on 1 October 2021** but negotiable. One position each will be available in the four partner laboratories for this project. Remuneration will be based on the country-specific standards for post-doctoral research salaries.

The post-doctoral researcher in the group of **Spencer Barrett** (**University of Toronto, Canada**) will study the genetic and genomic basis of mirror-image flowers in the genus *Heteranthera*, as well as the ecological consequences of this floral asymmetry for plant-pollinator interactions in *Wachendorfia* and *Cyanella*. The researcher in the group of **Michael Lenhard** (**University of Potsdam, Germany**) will work on the genetic and genomic basis of mirror-image flowers in *Wachendorfia* and *Cyanella*, and the evolution of the genetically determined condition from the random left-right asymmetry in their flowers. The post-doctoral researcher in the group of **Nicola Illing** (**University of Cape Town, South Africa**[*1]) will quantify the movement of pollen between flowers in the field to measure the ecological advantage of mirror image flowers, and investigate the cellular and developmental processes causing consistent left-right asymmetry and their evolution. The researcher in the group of **Eva Deinum** (**Wageningen University & Research, The Netherlands**) will use biophysical and computational modelling to address the structural and cellular causes of helical growth and organ bending to the left or the right.

Candidates should hold a PhD in a relevant field (genetics, genomics, bioinformatics, cell and developmental biology, evolution and ecology, biophysics and computational modelling) and have commensurate research experience as demonstrated by international publications. A passion for plant science, strong motivation, excellent organizational and communication skills are essential.

Please send applications for positions with Barrett, Illing or Lenhard as a single PDF including a CV, a motivation letter explaining which of the four project parts you wish to work on and why, and names and addresses of two references to Michael Lenhard (michael.lenhard@uni-potsdam.de). For the position with Deinum, please apply via this link. Please direct informal enquiries to the individual project partners whose position you are interested in.

Closing date for applications is **30 June 2021**.

[*1] Applicants for the postdoctoral position at UCT must have obtained their PhD in the past 5 years, and may not previously (since achieving the PhD) have held full-time professional or academic positions. No services beyond the scope of the research fellowship are required in return for the Postdoctoral Fellowship award. No benefits or travel allowances are included in the value of the fellowship. The successful incumbent must be prepared to comply with the University's approved policies, procedures and practices for the postdoctoral sector.

The biology of left-right asymmetry- linking structural determinants to ecology and evolution

Project summary

Mirror image flowers of *Wachendorfia paniculata* and *Cyanella alba*. The style is positioned either to the left (A) or right (B) of two of the three anthers in *W. paniculata* flowers. The style is clearly directed either to the left (C) or right (D) in *C. alba* flowers Photo: Nicola Illing

Left-right (LR) asymmetry is a fascinating feature of many plants and animals. Striking examples include the asymmetric placement of internal organs in vertebrate or the left- vs. right-ward coiling of snail shells. Such LR asymmetries raise a number of fundamental questions: (1) How is symmetry broken in a consistent manner to tell left from right? (2) How is this translated into an asymmetric morphology? (3) What is the functional importance of LR asymmetries? (4) How did they evolve? While some of these questions are beginning to be answered in a few animal models, an integrative understanding that would link the molecular and structural determinants of symmetry breaking to their functional impact and their evolution is still missing for any example. Here, we will aim for such an integrative understanding by using the mirror-image flowers of enantiostylous plants as an eminently tractable model. Studying such an LR asymmetry in plants for the first time may also uncover novel molecular mechanisms of symmetry breaking.

In mirror-image flowers the female style is either deflected to the left or to the right of the midline, while one of the male anthers points to the other side. This reciprocal arrangement is thought to result in segregated pollen deposition on pollinators' bodies and thus to promote outcrossing. In three families, a form of mirror-image flowers has evolved where all flowers on an individual are of the same type and the direction of style deflection is under simple genetic control; a dominant vs. recessive allele at a single genetic locus determine right vs. left deflection of the style and of the anther in the opposite direction. In all three families, this has evolved from a state where left- and right-styled flowers occur together on the same plant, providing a clear example for the genetic fixation of an initially variable phenotype. As such, mirror image flowers are an outstanding model for investigating LR asymmetry, as they combine a simple genetic control of directionality with a clear hypothesis for their functional relevance and a plausible scenario for their evolution.

Therefore, to obtain an integrative understanding of LR asymmetry we will (1) elucidate the genetic and chromosomal basis of mirror-image flowers; (2) determine the molecular and structural basis of their symmetry breaking; (3) characterize their cell-biology and development; (4) analyze the functional significance of mirror-image flowers; and (5) investigate their evolution at molecular and ecological levels. Together this will result in unprecedented insight into the biology of LR asymmetry.