Masters OR PhD Fellowship to study floral asymmetry

Closing date for application: June 30, 2021

We invite applications for a Masters or PhD Fellowship funded by the [Human Frontiers Science Programme]() (HFSP) to study the developmental basis and ecological importance of left-right asymmetry in the sex-organs of mirror images flowers from two South African endemic plants, *Wachendorfia paniculata* and *Cyanella alba*.

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

This is part of a larger research project led by Prof Michael Lenhard (University of Potsdam), that will study the genetics, ecology and evolution of floral asymmetry, and includes Prof Spencer Barrett (University of Toronto) and Dr Eva Deinum (University of Wageningen). A summary of the project can found below.

The successful candidate will be supervised by Prof Nicola Illing (University of Cape Town) and Prof Bruce Anderson (University of Stellenbosch). Applicants should either have a Honours degree (Masters candidates) or Masters degree (Doctoral candidates) in a relevant field (genetics, genomics, bioinformatics, cell and developmental biology, evolution and ecology).

The Masters Fellowship will have a value of R100 000 (per year) for 2 years.
The PhD Fellowship will have a value of R200 000 (per year) for 3 years.

Both Fellowships will include additional funding for all research related expenses.

Please email applications as a single PDF including a CV and a motivation letter clearly indicating the position (Masters or Doctoral) that you are applying for to Nicola.Illing@uct.ac.za.

Closing date for applications is 30 June 2021.

Enquiries: Nicola Illing or Bruce Anderson

Project summary
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.