Master's (1 or 2) research project
The "resurrection" of ancestral proteins that contributed to the origin of the flower.

Contact: M. Charlie SCUTT, CNRS Researcher.
E-mail: Charlie.Scutt@ens-lyon.fr Web-site: http://www.ens-lyon.fr/RDP/spip.php?rubrique4&lang=en
Tel: 04 72 72 86 03 Address: Reproduction et Développement des Plantes (RDP, UMR 5667), Ecole Normale Supérieure de Lyon, 46 allée d'Italie, 39364, Lyon Cedex 07.

Project outline

We are interested in the 150-million-year-old origin of the flowering plants, an event famously described by Charles Darwin as an "abominable mystery". Recent whole-genome comparisons have shown that the origin of the flowering plants was shortly preceded by a genome duplication event. We postulate that many of the paralogous genes generated in this event acquired novel functions which contributed to the origin of the flower.

The master's student involved in this project will study the biochemical properties of key regulatory proteins that were present in the flowering plant lineage over 150 million years ago, just before the origin of the flower. He/she will begin by using specialized phylogenetic programs to reconstruct the ancestral, pre-angiosperm sequences of four transcription factors that control present-day flower development (Fig A). Genes encoding these ancestral proteins will be synthesized and the proteins themselves expressed in *E. coli* for further study. The student will compare the *in vitro* DNA- and protein-binding characteristics of these "resurrected" ancestral proteins to those of their present-day descendents in species that occupy key phylogenetic positions at the base of the flowering plant clade (Figs B and C). We expect through this novel evo-devo approach to identify molecular changes that contributed directly to the origin of the flower, thus providing an important part of the answer to Darwin's abominable mystery.

The master's student to be appointed will work closely with one principal investigator and two post-doctoral researchers at the ENS-Lyon, and will also collaborate with Dr Raquel Tavares at université Lyon-1, who will advise on bioinformatics, and with Prof. Roberto Solano's team in Madrid, who will derive position weight matrices describing protein-DNA interactions (Fig D). The student will obtain a thorough training in several important aspects of molecular biology and bioinformatics. The precise extent and content of the project can be modified to suit all formats of Master's 1 and 2 courses, according to the time allocated. We particularly encourage applications from master's students that are interested in pursuing their studies to doctoral level.

Figures: **A** Phylogenetic "resurrection" of an ancestral plant transcription factor. **B and C** Basal flowering plant species *Amborella trichopoda* and *Trithuria submersa*. **D** The DNA-binding preferences of a plant transcription factor.