I. **Chemical ecology and multi-modal signaling of host shifts in cycad pollination**

Cycads are an ancient lineage of seed plants with a fossil record extending back over 350 mya. These dioicous gymnosperms form an intimate relationship with their highly specialized mutualistic pollinators. In the genus *Zamia*, Coleopteran pollinators live their entire lifecycle within the pollen cone of their host plant in a mutualism so strict that they go into diapause for the 10 months of the year that their host species is not in cone. Previous research in this lab has shown that plant smell (Volatile Organic Compounds (VOC)) is integral in pushing insects out of the pollen cone and attracting them to the ovulate cone. Further, this push-pull pollination has been shown to be ancient in the lineage of cycads extending back before the rise of flowering plants. Further recent research from this lab revealed the role that cone humidity plays in insect choice and pollination: pollinators displayed an equal attraction to host plant VOC as to higher humidity. Preliminary data suggests that a humidity cue is sufficient to overcome avoidance of a non-host plant behavior by the pollinating weevils. The FFIRE fellow would build on that preliminary data through field studies at the conservation garden, Montgomery Botanical Center in Miami Florida, laboratory behavior and physiology, and chemical ecology. Plant VOC, humidity, temperature and carbon dioxide would be assessed from both the plant production and insect perception perspective. The fellow would work closely with the lab phytochemist and PI on this project and is encouraged to pursue further research questions of personal interest in this system.

II. **Mechanisms and chemical ecology of Magnolia pollination**

Magnolias are another ancient lineage of seed plant and share a number of characteristics with Cycads; they are thermogenic, highly scented, and pollinated by Coleoptera. The FFIRE fellow would help to establish a Magnolia research project in the lab along with the PI, a graduate student and the lab phytochemist. This project has two potential components that could be addressed individually or in concert by the fellow: a phylogenetic analysis of *Magnolia* signaling and/or a comparison of pollination ecology between two target species. The first project would involve collecting floral signals (VOC, humidity, temperature and carbon dioxide) and insect visitors across species of *Magnolia* in the wild and in cultivated gardens. These would be analyzed in a phylogenetic and ecological framework along with morphometric traits gathered from herbaria. The second project involves two comparative species of *Magnolia*, *M. grandiflora* and *M. ovata*. The southern United States is home to the enigmatic *M. grandiflora* and the pollination ecology of this species has been woefully understudied. However, *M. ovata* in Brazil has had a more detailed analysis and serves as an excellent comparative system. The goal would be to describe the pollination ecology and signaling of *M. grandiflora*, visiting multiple sites across Georgia, and to compare it with *M. ovata* in Brazil. This would involve observing pollinator behavior in the field, collecting plant chemistry, humidity, temperature and carbon dioxide cues from the plants, and assessing insect behavior and physiology in the lab. This project would also involve a trip to work with a collaborator, Dr. Thiago André at the University of Brasilia in Brazil and visit field sites in the surrounding cerrado. The fellow would be encouraged to pursue further research questions of personal interest in this system.