Postdoctoral Scholar position to study Rules of Life in the Urban Biome

We seek a highly motivated postdoctoral researcher to work on a study of trees and microbes in a new project titled, “Rules of Life in the Urban Biome” (funded by the Keck Foundation). The project will include observational and manipulative experiments in the field and the lab to understand how urbanization impacts both above- and below-ground plant-microbial carbon and nutrient exchange. The postdoctoral researcher will be expected to implement appropriate molecular and biogeochemical tools to resolve the diversity of microbiome biochemistries on whole trees and how they relate to tree growth, mortality, and biogeochemical cycling through ecosystems. This is a Boston-based in-person position that includes coordination and collaboration across lab groups at BU and other U.S. institutions. A synopsis of the project can be found below.

Applicants with expertise in one or more of the listed areas are encouraged to apply:
• Molecular ecology or microbial ecology, with experience generating and analyzing high throughput -omics data.
• Biogeochemistry, including experience handling stable isotopes in field and/or lab-based studies
• Computational expertise, including development and/or implementation of bioinformatics pipelines

Minimum qualifications include:
• A PhD in Biology, Ecology, or a related scientific discipline.
• Research experience in one or more of the following fields, microbiome science, computational biology, biogeochemistry, microbial ecology, molecular biology, microbiology, fungal biology.
• Evidence of scientific productivity in the form of publications in peer-reviewed journals.
• Strong science writing and communication skills.
• Ability to work independently as well as collaboratively as part of team
• Mentoring experience

The postdoc will be expected to carry out work outlined in the project description below and will have the opportunity to develop studies within their specific areas of interest as they relate to urban microbiomes. This position includes potential collaborations with other postdocs and faculty in the BU Biogeoscience Program, Biological Design Center, the Hariri Institute for Computing, the Center for Remote Sensing, and the Institute for Global Sustainability. Pay rate starts at $67,500/year, start date is flexible, and appointment is initially for one year with the possibility to extend for an additional 1-2 years provided acceptable progress.

Interested parties should put the following materials in an to Jenny Bhatnagar (jmbhat@bu.edu) with the subject line, “RoL Postdoc”

• A 1-page cover letter explaining research interests and experience
• A current CV with a list of 3 potential references and their contact info.

Project Synopsis

Cities are expanding around the world, with unexpected impacts on the non-human organisms that live there. Recently, it was discovered that urban trees grow four times faster than rural trees, despite there being a multitude of environmental stressors in cities and the loss of typical belowground mechanisms for nutrient acquisition, stress tolerance, and pathogen protection. It remains a mystery how trees thrive in urban environments without their belowground support system for nutrition and stress tolerance. **The objective of our project is to solve the mystery of accelerated tree growth in cities by determining the mechanisms of nutrient acquisition and stress tolerance for urban trees**. We hypothesize that city trees operate by an alternative "rule of life", where urbanization shifts tree survival strategies from belowground roots to aboveground canopies, such that trees and their phyllosphere microbiomes take advantage of atmospheric pollution as sources of water, nutrients, and stress protection to support faster tree growth in cities. We will test this overarching hypothesis through two aims:

Aim 1: determine urbanization effects on aboveground vs. belowground mechanisms of tree water and N uptake. We will take field-based measurements (Aim 1.1) of (i) N inputs from atmospheric deposition, (ii) natural abundance stable isotopic measurements of $\delta^{15}N$ (for N) and $\delta^{18}O$ and $\delta^{2}H$ (for water) movement from the atmosphere to tree tissues, microbial biomass, and soils, and (iii) a field-based ^{15}N isotopic tracer experiment across a recently established, model urban-to-rural gradient. We will also conduct a whole-tree level ^{15}N tracer and microbiome manipulation experiment in growth chambers (Aim 1.2) to examine the fate of N into specific plant and microbial biochemical pathways using stable isotope probing (SIP) metatranscriptomics.

Aim 2: determine urbanization effects on particulate matter (PM)-O_3-tree physiology relationships. We will quantify relationships between atmospheric PM and O_3 concentrations, leaf-level photosynthesis vs. photoinhibition, and stomatal clogging by PM in the field (Aim 2.1) using a combination of deposition monitoring, photosynthesis measurements, and high-resolution tree leaf surface imaging on trees across our urbanization gradient. To test for direct PM impacts on tree physiology, we will conduct a second growth chamber experiment (Aim 2.2) that simultaneously manipulates ambient O_3 and PM levels and measures impacts on tree leaf photosynthesis, nutrient uptake, and plant growth rates.

The data we generate on how trees cope with or exploit the urban environment has the potential to completely redefine our understanding of how organisms acclimate to a rapidly changing world. If atmospheric pollutants like N or PM in cities provide a source of nutrition and stress protection for city trees, then efforts to improve overall urban air quality could lead to progressive nutrient limitation in urban trees and make them more vulnerable to O_3 phytotoxicity. Our study will provide data that directly informs these types of environmental regulation policies, optimizing them for specific components of air pollution (e.g. PM, N, O_3) at local and regional-scales.