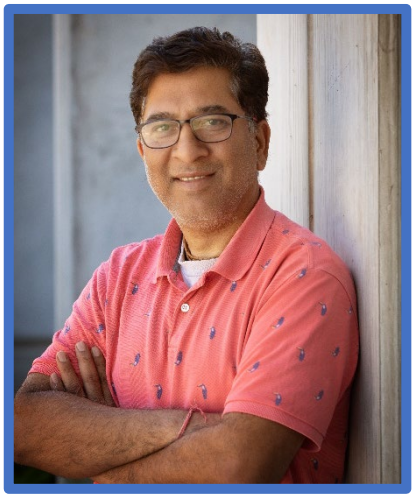
CASE WESTERN RESERVE UNIVERSITY

CIVIL AND ENVIRONMENTAL ENGINEERING DEPARTMENT SEMINAR



DR. RAMESH GOEL

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Date: Thursday, December 4th, 2025

Time: 4:00pm – 5pm EST

Online via Zoom Here, or view in Bingham, Vose Room #138

Microcoleus toxic mats threatening human and animal health in streams: ecophysiology and genomic plasticity

Abstract: Benthic cyanobacteria, particularly *Microcoleus*, are increasingly implicated in harmful algal blooms due to their production of neurotoxins. Their ability to proliferate in nutrient-poor freshwater systems poses growing ecological and public health concerns. In May 2023, extensive *Microcoleus* growth was documented in a small tributary of the Virgin River near the Temple of Sinawava. Benthic mats were collected from six sites across rock and sand substrates, along with substrate material and downstream water samples. Our objectives are to determine how *Microcoleus* persists in low-nutrient environments, assess interactions between toxic and non-toxic cyanobacteria and associated bacteria, and evaluate benthic community diversity and growth drivers using metagenomics. LC-MS/MS analysis showed consistent detection of anatoxin-a (377.13 ± 18.05 µg/g) and dihydro-anatoxin-a (5.15 ± 0.3 µg/g) in all benthic samples, while homoanatoxin-a and derivatives were absent. Water samples contained ATX (0.377 µg/L), and low chlorophyll-a levels indicated benthic, not pelagic, origins. Metagenomics revealed cyanobacteria comprised >60% of all mat communities, dominated by *Microcoleus*, with <5% eukaryotic algae. Resampling in October showed a complete community shift, with no detectable *Microcoleus* or ATX. Monoclonal *Microcoleus* strains isolated earlier in 2023 are being analyzed to compare laboratory and environmental genotypes. Future work will integrate metagenomics and gene-expression profiling to elucidate mechanisms of *Microcoleus* growth, toxin production, and microbe–microbe interactions that facilitate toxic benthic cyanobacterial blooms.

Bio Dr. Ramesh Goel is Professor of Environmental Engineering at the University of Utah. Prior to Joining the U, he was Research Associate at the University of Wisconsin, Madison. Dr. Goel obtained his Ph.D. In Environmental Engineering from the University of South Carolina in 2003. Dr. Goel " multidisciplinary research integrates **environmental microbiology, sustainable process engineering, and ecosystem resilience** to address grand challenges related to water scarcity, climate change-induced harmful algal blooms, nitrogen cycling, microbiome, emerging pollutants, and environmental health. Dr. Goel's work has appeared in leading journals such as *Nature Communications, Environmental Science & Technology, Water Research,* and *Bioresource Technology*.

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