ESE 200 Advanced Topics in Environmental Science and Engineering – "*Trends in the Microbial Metabolism of Biogenic Trace Gases & Volatiles*", *6 units (2-0-4), third term.* Critical review and discussion of both older literature and recent research studies, focused on the microbial consumption of biogenic trace gasses and volatiles. Grading: Pass/Fail. Instructor: *Leadbetter.*

The biosphere is both source and sink to a diversity of trace gasses and volatiles. Many of these are relevant to understanding global C, S, & N cycles, as well as to climate change. Importantly, the sources and sinks of these reactants often do not co-occur in the same location and time. In almost all cases, biological consumption is a microbial process. And yet, there are many reasons to believe that that we remain in our infancy in our understanding the exact nature of the species at play, much less the biochemical catalysts they encode. Here, we will consider how our understanding of microbial consumption processes in the environment has been progressing, as well as what approaches might be taken to push the field further along.

FORMAT: There will be a single, 2-hour class meeting every week, with reading assignments before hand. We will dissect and discuss a handful of papers at each session, identifying the details behind breakthroughs, as well as possible future research vistas. Each student will be assigned a topic to research and provide discussion leadership for one of our class meetings during the quarter. This will include providing a short, annotated bibliography covering recent relevant studies. Students will also periodically be assigned short, focused scientific writing assignments, e.g. for the purpose of re-writing, for improved clarity, poorly composed paragraphs encountered in the literature, or for a change in audience.

Examples of topics for analysis and discussion include: the microbial utilization or co-metabolism of H_2, CO, CH_4, CS_2, OCS, DMS, N_2O, NO, and isoprene. Reconciling the kinetic attributes of activities observed in various environments with those of cultivated laboratory strains. Advances in the cultivation of novel microbes with representative activities. The analysis of novel aspects of the pathways, proteins, and genes involved. The application of gene and genome based approaches to reveals new facets of the true breadth and nature of these processes.

- What is the annual budget for this compound?
- Have estimates for emission rates or the overall contribution from biogenic sources changed?
- In what environments does meaningful consumption occur?
- What are key kinetic attributes of such environmental sinks?
- Is the face of this activity known, that is, the species and their key attributes that are responsible?
- How have relevant microbes been cultivated? What have been some of the pitfalls to retrieving representative pure cultures? What have been the breakthroughs?
- Have challenges been framed correctly and reasonably (and what does that mean)?
- Has environmental genomics shed any new light into the matter?

LOCATION & TIME: North Mudd 212, Wednesday 7:00-9:00pm (unless there is a consensus change).

INSTRUCTOR: Jared R. Leadbetter - N. Mudd 208 - x4182 - JLEADBETTER@CALTECH.EDU