Report seeks to integrate microbes into climate models

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The models used to understand how Earth's climate works include thousands of different variables from many scientific including atmospherics, oceanography, seismology, geology, physics and chemistry, but few take into consideration the vast effect that microbes have on climate. Now, a new report from the American Academy of Microbiology, "Incorporating Microbial Processes into Climate Models", offers a plan for integrating the latest understanding of the science of microbiology into climate models.

"Climate scientists and microbiologists usually work in isolation from each other, and yet their work is intimately connected. Microbes are critical players in every geochemical cycle relevant to climate. The sum total of microbial activity is enormous, but the net effect of microbes on climate-relevant gases is currently not known," says Edward DeLong of the Massachusetts Institute of Technology, who co-chaired the report with Caroline Harwood of the University of Washington.

The past two decades have witnessed an explosion in scientific recognition of the diversity of the microbial world. New DNA-sequencing technologies spurred by the Human Genome Project have made it technically and economically possible to sequence the collective DNA from whole microbial communities. This approach, called metagenomics, has revealed a previously undreamed-of degree of diversity in the microbial world. These microbial community analyses many "'omics" approaches, such as proteomics and metabolomics, that together provide a detailed picture of community function, potential and

change over time.

The report is based on a colloquium convened by the Academy in 2011. Experts in diverse disciplines in microbiology as well as computational and climate modeling participated in the meeting designed to identify specific efforts and activities that will lead to improved integration of microbial biology, biogeochemistry, and climate modeling.

"While the gap between these disciplines is daunting, the need to bridge it is urgent and the science and technology needed to begin to do so is within reach," says Harwood.

The report suggests a multipronged approach, breaking the challenge into manageable parts. The first recommendation is to choose a few specific biogeochemical cycles that are important, microbially driven and tractable to serve as demonstration projects. Specifically, the report identifies methane, carbon storage and nitrous oxide.

Other recommendations include:

- Assess current data collection methodologies and develop a monitoring/data collection strategy
- Implement validation processes to integrate data collection, modeling and experimentation
- Facilitate and provide incentives for collaborations and interdisciplinary training
- Address technology needs

"There is clear evidence that microbes can have an enormous impact on climate.. In light of the increasingly urgent need to understand and find ways to mitigate climate change, the centrality of microbes in global biogeochemical cycles, can no longer be ignored," says DeLong.

More information: A full copy of the report and more detailed recommendations can be found on the Academy website at bit.ly/aamclimate