ARCHAEBACTERIAL GENETICS

METHANOGENS MAY FIX NITROGEN

MINNEAPOLIS, Minn.—Some methane-producing anaerobes may be able to fix diatomic nitrogen. If so, the finding could have some minor effect on the design of anaerobic digestors. But, more important, elucidating this new metabolic pathway could illuminate the genetic similarities and differences between the two great categories of prokaryotes—archaebacteria and eubacteria.

At Argonne National Laboratory's "First Symposium on Biotechnological Advances in Processing Municipal Wastes for Fuels and Chemicals," scientists from the Institut Pasteur (Paris) reported that DNA from four strains of methanogenic archaebacteria hybridizes with the principal nitrogen-fixing (*nif*) genes of both a bacterium and a blue-green alga. At the same meeting, an unrelated group from the University of Iowa (Iowa City) reported direct evidence of nitrogen fixation in a marine methanogen.

Institut Pasteur's Lionel Sibold described his group's efforts to find possible homologies between the genes of four archaebacteria (*Methanobacterium ivanovi, Methanococcus voltae, Methanosarcina barkeri,* and *Methanobacterium thermoautotrophicum* strain ΔH) and selected eubacterial genes (*Escherichia coli*, the blue-green alga Anabaena, *Bacillus subtilis, Rhizobium japonicum,* and *Klebsiella pneumoniae*). Sibold's group found hybridization only with the three nitrogenase-producing genes of Klebsiella and Anabaena. The three genes—designated *nif* H, D, and K—seem to be highly conserved in all known nitrogen-fixing organisms; each codes for one of the polypeptides composing nitrogenase, the enzyme that reduces N_2 to NH_3.

The Institut Pasteur group concluded conservatively, "Though no nitrogenase activity was detected in whole cells or crude extracts, our results indicate that certain *nif*-like genes may be present in methanogens." Meanwhile, N. Belay, R. Sparling, and L. Daniels of the University of Iowa were working on *Methanococcus thermolithotrophicus*, a methanogen found in hot-water vents on the floor of the Mediterranean Sea. The researchers noted that work done three decades ago with impure methanogenic cultures suggested that the microbes might be able to obtain nitrogen from the atmosphere. Since *Mc. thermolithotrophicus*'s natural environment is poor in NH_4^+, they attempted to grow the organism with dinitrogen as its only source of nitrogen. The culture grew well, though it prefers an NH_3 metabolism. (When the culture was deprived of NH_3 and given only N_2 to live on, growth stopped for some time before resuming at a lower rate.)

In another breach of the genetic barrier dividing archaebacteria from eubacteria, John Reeve reported that his group at Ohio State University (Columbus) had cloned fragments of DNA from several methanogens (*Ms. barkeri, Mc. vannielli,* and *Methanobrevibacter smithii*) into *E. coli*. The archaebacterial genes were, perhaps contrary to expectation, expressed in *E. coli*, despite differences between the two in basic genetic mechanics.

—Douglas McCormick