As primary recyclers, microbes are crucial to global biogeochemical cycles. Yet, in many environments it is not known how many microbial cell membranes are adapted to their environmental niche. The outer membrane is the component of the cell that is in direct contact with its surroundings, therefore, characterizing the membrane lipid structures of bacteria in different ecosystems can be important in understanding how microbial communities may respond to environmental change. Membrane lipids containing the amino acid ornithine in the polar headgroup are common in bacteria, and can be produced or modified in certain species under nutrient limitation, thermal stress, or acid stress. In recent years we discovered novel mono-, di-, and trimethylornithine lipids in northern peatland planctomycetes, and novel hydroxylysine lipids in the soil bacteria *Pseudopedobacter saltans*, using liquid chromatography-high resolution mass spectrometry and (LC-HRMS) and nuclear magnetic resonance (NMR). Culture experiments have revealed that the distribution of trimethylornithine and hydroxylysine lipids changes in response to oxygen and temperature/pH levels, respectively. Further work is needed in the field to confirm if these lipid distribution changes can be used as proxies for microbial community responses to environmental change.