2016 **NAS Award** in Molecular Biology

For her discovery of microbial mechanisms underlying geologic processes, thereby launching the field of molecular geomicrobiology and transforming our understanding of how the Earth evolved.

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Microorganisms may be small, but they can shape the chemistry of their environment and affect the Earth on a large scale. Oxygen was largely absent from the planet's atmosphere, for instance, until microbes evolved the ability to produce molecular oxygen from water. The study of these types of Earth-altering microbial reactions is called geomicrobiology. Newman combined her expertise in microbial genetics and microbial biology with her knowledge of geology and mineralization processes to become a leader in this field of study. This area of science, as Newman has shown, is key to understanding the evolution of our planet; she has helped raise awareness that geomicrobiology is also directly relevant to significant global problems, such as climate change and the development of renewable energy.

Newman provided a compelling clue that microbes are major players in geologic processes: She demonstrated that some bacteria in iron-rich environments can use extracellular iron as a dump site for excess electrons by generating extracellular electron shuttles, including a class of metabolites formerly considered to be redox-active antibiotics. That reduces the iron and makes it soluble in water, where it is available for use by other organisms. Early in her research, she also elucidated the genetic underpinning of bacterial respiration of arsenate (salts or esters of arsenic acid) and developed a method for quickly and accurately identifying this metabolism. The technique is currently used in surveying contaminated water in California, Chile, Brazil, and Southeast Asia. Newman has also made major contributions to our knowledge of the formation of stromatolites and magnetite fossils, two important biosignatures in ancient rocks. And the techniques and methods Newman has developed are now widely used by other researchers in this field.