CC/NUMBER 4
JANUARY 27, 1992

This Week's Citation Classic®

Marshall K C. *Interfaces in microbial ecology.* **Cambridge, MA: Harvard University Press, 1976. 156 p.** [School of Microbiology, University of New South Wales, Kensington, NSW 2033, Australia]

The philosophy embodied in this monograph was a consideration of bacteria as living colloidal particles. An attempt was made to relate both the biological and physical properties of bacteria to their behavior in natural habitats, particularly in relation to their propensity to adhere to, and grow, at solid-liquid, gas-liquid, and liquid-liquid interfaces. Most emphasis was placed on aquatic and terrestrial environments, but one chapter was devoted to specific adhesion of microorganisms to animal, plant, and microbial host cells. [The *SCI*® indicates that this book has been cited in more than 230 publications.]

Bacteria at Interfaces

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Having time to reflect on one's past and future research is a luxury rarely attained by busy academics. During a restful sabbatical leave from the University of Tasmania in 1969 and 1970 at Ralph Mitchell's laboratory, Harvard University, I realized that much of my work in the past, along with some planned for the future, involved the behavior of microorganisms at interfaces. These studies included microbial manganese oxidation in hydroelectric pipelines,[1] clay-bacterium interactions,[2] adhesion of marine bacteria to solid surfaces,[3] effects of cell surface hydrophobicity on bacterial orientation at interfaces,[4] and the effects of electrolyte concentration on bacterial sorption-desorption processes in sediments.[5]

It was suddenly obvious that, in most natural habitats, microbial activity was dictated by a wide variety of interfaces. These include soil-water, air-water, anaerobic fermentation gas-water, sediment-water, and host tissue-water interfaces. After jotting down some primitive thoughts on the subject, I was invited to give a short talk to summer students at the Woods Hole Marine Biological Laboratory course in microbial ecology. This was the first time I had publicly expressed my views on the importance of interfaces in microbial ecology. That experience convinced me to continue exploring the broader implications in this area. On my return to the University of Tasmania, I began work that would evolve into a general concept of bacteria as living colloidal particles and integrate their biological and physical properties in order to explain their behavior at interfaces. I submitted an outline of my ideas to Harvard University Press and was encouraged by receiving a contract from the publisher to expand my concepts into the form of a monograph.

At that point, I was appointed to the chair of microbiology at the University of New South Wales, and the subsequent upheaval resulted in some delays in the preparation of the manuscript. Once submitted, I was most impressed by the cooperation I received from Harvard University Press in the editing and final production of the monograph. Publication of the monograph in 1976 soon led to regular invitations to speak on the ecology of bacteria at interfaces at international scientific meetings. It is with a great deal of satisfaction that I now find the concepts expressed in this monograph as essentially taken for granted.

1. **Tyler P A & Marshall K** C. Microbial oxidation of manganese in hydro-electric pipelines. *Anton. Leeuwenhoek Int. J. Gen. M.* 33:171-83, 1967.
2. **Marshall K** C. Interaction between colloidal montmorillonite and cells of *Rhizobium* species with different ionogenic surfaces. *Biochim. Biophys. Acta* 156:179-86, 1968.
3. **Marshall K C, Stout R & Mitchell R.** Mechanism of the initial events in the sorption of marine bacteria to surfaces. *J. Gen. Microbiol.* 68:337-48, 1971. (Cited 290 times.) [See also: **Marshall K** C. Adhesion of marine bacteria. Citation Classic. *Current Contents/Agriculture, Biology & Environmental Sciences* 23(2):8, 13 January 1992.]
4. **Marshall K C & Cruickshank R.** Cell surface hydrophobicity and the orientation of certain bacteria at interfaces. *Arch. Microbiol.* 91:29-40, 1973.
5. **Roper M M & Marshall K** C. Modification of the interaction between *Escherichia coli* and bacteriophage in saline sediments. *Microbial Ecol.* 1:1 -13, 1974

Received August 8, 1991