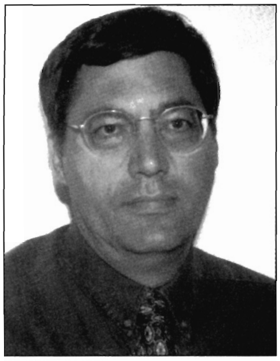
be the most historical of scientists), remain intractable problems. Peter Medawar was equally right to assert that "The history of science bores most scientists stiff." But here is another paradox. According to a 1995 Roper poll for the American History Channel, "The item of greatest interest to the public is the History of Science and Technology." What are we to make of these different perceptions?



FRANCNIS H. CHAPELLE

O.E. MEINZER AWARD

PRESENTED TO FRANCIS H. CHAPELLE

Citation by Don Vroblesky

It is my pleasure and great honor to present the O.E. Meinzer Award to Frank Chapelle. The Meinzer Award is presented to authors whose papers or series of papers represent pivotal advances in the science of hydrogeology or some related field. In Frank's case, the award is for a body of literature that has greatly advanced our understanding of groundwater microbiology.

Frank and I first met as undergraduates at the University of Maryland. We both took jobs with the U.S. Geological Survey in Towson, Maryland, and began attending graduate school. Today we work in the same USGS office in Columbia, South Carolina. Over the years, I have had the great privilege of watching the development of the ideas for which he is being honored today.

In graduate school, we explored rock outcrops on Roy Lindholm's field trips and puzzle over features such as red and green colored sedimentary rock. Frank hypothesized that these and other geologic patterns were the footprints of ancient redox reactions and that the microbial processes were likely involved. These thought processes were a foreshadowing of the path that he would take with his career. Starting in the 1980s, his work demonstrated the enormous impact of microbial processes on the water chemistry of regional flow systems. The source of carbon dioxide in regional groundwater systems had long been a subject of intense speculation. Frank's isolation and examination of microbial populations from these sediments and comparison of stable carbon isotopes demonstrated that the carbon dioxide was derived from microbially mediated reactions.

Although it was becoming increasingly evident that microbial processes in groundwater were extremely important controls in the chemistry of both pristine and contaminated aquifers, microbial investigations were problematic because of the difficulty in aseptically sampling deep subsurface sediments and the fact that microbial processes in laboratory incubations often do not reflect in situ processes. In response, Frank and Derek Lovley developed nonmicrobiological approaches microbial processes, including measurements of dissolved hydrogen gas, which can be used in conjunction with other water-chemistry data, to predict the predominant microbially catalyzed redox reactions. This work constitutes one of the four papers for which he is being honored (Chapelle, McMahon, Dubrovsky, Fuiji, Oaksford, and Vroblesky,1995, Deducing the distribution of terminal electron-accepting processes in hydrologically diverse groundwater systems: Water Resources Research, v. 31, p. 359–371).

Frank put this approach to great use in explaining chemical distributions that had been poorly understood. His work showed that microbial competition for organic substrate was a major factor controlling the distribution of hydrochemical facies and zones of high dissolved iron in the South Carolina Coastal Plain. Even the source of such organic substrate was not understood until Frank and Pete McMahon showed that organic matter was diffusing from confining beds into the adjacent aquifers to support microbial growth. They found that sulfate was diffusing out of the confining beds in sufficient concentrations to maintain sulfate reduction and explain the perplexing lack of sulfate depletion reported previously by others. These and other findings are summarized in the second publication for which he is being honored (Lovley and Chapelle, 1995, Deep subsurface microbial processes: Reviews of Geophysics, v. 33, p. 691–698).

By combining laboratory and field methods, Frank measured biodegradation rates of groundwater contaminants. Such rate estimates are of great importance to investigators attempting to determine the time required for microbial remediation of aquifers. This work constitutes the third paper for which he is being honored (Chapelle, Bradley, Lovley, and Vroblesky, 1996, Measuring rates of biodegradation in a contaminated aquifer using field and laboratory methods: Ground Water, v. 34, p. 691–698).

Perhaps Frank's most important contribution to today's issues has been in the field of contaminant hydrology. Together with his long-time friend and co-author Paul Bradley, he has been in the forefront of elucidating pathways and environments of contaminant degradation, and he is being honored for one of his numerous papers in this field (Bradley, Chapelle, and Wilson, 1998, Field and laboratory evidence for intrinsic biodegradation of vinyl chloride contamination in a Fe(III)-reducing aquifer: Journal of Contaminant Hydrology, v. 31, p. 111–127). Prior to this paper, mainstream thinking was that vinyl chloride degradation was extremely limited under anaerobic conditions. This paper showed that under anaerobic iron-reducing conditions, microbial degradation can be an important depletion mechanism for vinyl chloride.

Frank continues to be a leading researcher in the combined fields of groundwater microbiology and geochemistry. His widely used textbook, *Ground-Water Microbiology and Geochemistry*, now in its second edition, is the first and most comprehensive examination of the contribution of microbial processes to subsurface geochemistry. His most recent book, *The Hidden Sea*, gives a nontechnical overview of groundwater systems and the aura of mystery that often surrounds them.

Response by Francis H. Chapelle

I'd like to thank the Society and its members for considering me for this award. The award has special significance for me because of the deep regard I hold for the work of O.E. Meinzer. He combined the characteristics of a careful, insightful scientist with an ability to make his findings available not only to his colleagues, but to nontechnical laypeople as well. His example is one I have always tried to emulate.

Understanding the importance of microbial processes in groundwater geochemistry has been an important field of endeavor in the last 20 or so years. As is always the case, my own work in this area has benefited greatly from interaction with many teachers, colleagues, and friends. If I hadn't had the privilege of studying with William Back at The George Washington University, I would never have developed an interest in groundwater geochemistry and microbiology. Bill was not a microbiologist. But he had the knack, characteristic of all great teachers, of fostering interests that lay outside his immediate sphere of expertise.

Early on in my career with the U.S. Geological Survey, I was fortunate enough to have the help and support of some truly great scientists, including Mary Jo Baedecker, L. Neil Plummer, and Don Thorstenson. While we didn't always agree on everything (scientists never do), their help and inspiration was more important than perhaps they know. Finally, I have been downright lucky in the friends and colleagues I have had. Don Vroblesky, with whom I went to college and graduate school, is one of the most observant and imaginative people I've ever known. Peter B. McMahon, Paul M. Bradley, and James E. Landmeyer, in addition to being great scientists, have been solid and constant friends. I can't thank them enough.

The field of groundwater microbiology is really in its infancy. The new tools of molecular ecology are presently, and will continue to be in the future, revolutionizing the study of microbial processes in groundwater systems. Even now, most of the microorganisms found in subsurface environments using these tools are entirely new to science, with rRNA sequences unlike any presently in our large (but obviously incomplete) databases. The coming years will demonstrate that much of the microbial diversity present on Earth is sequestered in subsurface environments. Furthermore, it's entirely possible that subsurface environments will prove to have been the cradle of life on Earth, as well as possibly harboring life on other planets or asteroids in our solar system. The next few years are going to be interesting.