Book Reviews

Fleming as Bacteriologist

Alexander Fleming. The Man and the Myth. GWYN MACFARLANE. Harvard University Press, Cambridge, Mass., 1984. xvi, 304 pp. + plates. $20.

The discoverer of penicillin has been the subject of several biographies since his death in 1955. The Alexander Fleming they present has evolved in the telling. André Maurois in 1959 wrote of a "shy man with his burning faith in the capital importance of a piece of research, trying in vain to persuade." In 1970, Ronald Hare presented a Fleming who apparently did nothing with his discovery from 1928 until it was taken up by Howard Florey and his group in Oxford in 1940. Recently Hare has found laboratory notebooks from this period, which show that Fleming and his group did attempt to isolate penicillin but that the project was dropped. Gwyn Macfarlane has put together this and other new material to present a new interpretation of the life of Fleming. He seeks to explain some of the seeming mysteries that have collected around Fleming, in particular the mystery of the 12-year gap.

Macfarlane's Fleming is a bacteriologist, a man whose pride is in his neat and clever bench technique, in the identification of bacterial species, and in the development of means of isolating species by differential culture. His paper announcing the discovery of penicillin was titled, "On antibacterial action of cultures of penicillin with special reference to their use in the isolation of *B. influenzae*." Fleming used his penicillin medium for years to isolate this organism.

One of the most attractive features of Macfarlane's account is his interest in bacteriological technique. He thinks that none of the previous biographies have paid it enough attention: indeed, recent historiographic style has tended to avoid technique as a problem area. But Macfarlane's Fleming is a man who works and plays at the bench.

It is in Fleming's benchwork that Macfarlane finds the explanation of his lack of interest in developing penicillin clinically. Using the "slide cells" that he had developed to test the effectiveness of disinfectants, he found that penicillin was harmless to blood cells and highly effective against bacteria but slower to act than his disinfectants. It was also less active in the presence of serum, and pieces of tissue were not cleared of bacteria. In vivo, however, penicillin was cleared from the circulation within half an hour. Fleming's lack of interest in the therapeutic possibilities of a substance with these properties is quite logical. But, as Macfarlane points out, he did not try its effectiveness in protecting an infected animal.

J. C. Sheehan, the Massachusetts Institute of Technology chemist who synthesized penicillin and its analogues in the 1950's, writing of Fleming in 1982, says simply that Fleming was a bacteriologist and not a clinician. Macfarlane takes essentially the same point of view but elaborates it with sympathetic insight.

His analysis of Fleming's thinking is subtle and perceptive. He suggests that Fleming's omission of the in vivo protection test was a consequence of the residual influence of Sir Almroth Wright, under whom Fleming worked for many years at St. Mary's Hospital Vaccination Department. It was Wright's claim that "one experiment suffices, if properly performed, to establish the truth of a principle." To Macfarlane, a laboratory man himself, this is an outrageous generalization in a biological science. He brings his own bench experience into his interpretation.

It is Macfarlane's insights into the life of the laboratory that make this book so pleasing to read. He has already produced an equally significant study of Howard Florey and the Oxford group of penicillin workers. Perhaps his next book will be on laboratory studies of blood clotting and clinical hemophilia. He is uniquely qualified to write it.

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Cartoon of Alexander Fleming by Ronald Gray. [From *Alexander Fleming: The Man and the Myth*]

A Botanical Explorer

Frank N. Meyer. Plant Hunter in Asia. ISABEL SHIPLEY CUNNINGHAM. Iowa State University Press, Ames, 1984. xviii, 317 pp., illus. $29.95.

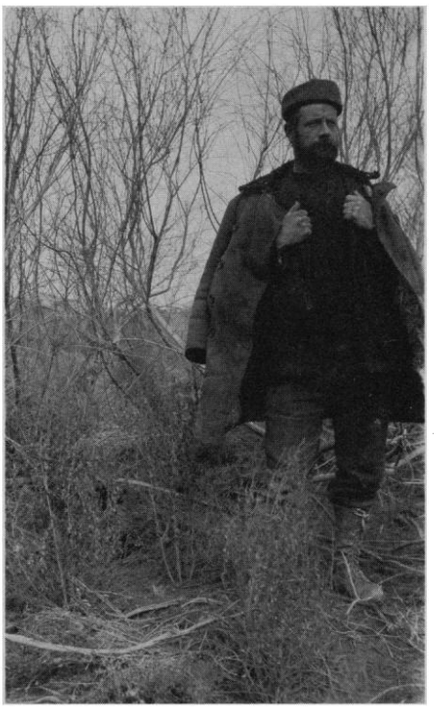
Frank Meyer is known to plant breeders and professional horticulturists as one of the small band of explorer-collectors who, working in that short interval in the late 19th and early 20th century when temperate Asia was briefly open to Western travelers, are responsible for more plant introductions to the West than all others put together. But to the public interested in plants he is almost unknown. In part this is because Meyer, an employee of the United States Department of Agriculture, concentrated his attention on useful plants, though his contributions to ornamental horticulture are far from insignificant.

Isabel Cunningham has attempted to redress this. Between the lines of her book it is clear that it has been a difficult task. The author has become a dedicated admirer of her subject, an apologist for his not inconsiderable shortcomings. All the same, Meyer's prowess as a plant explorer is amply vindicated; he emerges as the most courageous of the Western botanists in temperate Asia, indomitable yet meticulous, vying only with the most intrepid of the Russians. The work of a long-term plant explorer in remote and

foreign lands, beyond the limits of reliable government, requires a very particular kind of personality. Meyer, this book implies, was an archetype. From his youth he was introverted, sensitive yet taciturn, and could only achieve contentment, and then but fleetingly, in isolation and in continuous battle against fatigue, danger, filth, and the unpredictability of other people.

Meyer's life could lend itself either to an adventure story for a general readership or to a carefully documented history for professionals. Unfortunately, Meyer apparently left too little record for either to be fully achieved. Whereas his British contemporaries Wilson, Farrar, and Kingdon-Ward clearly delighted in recounting their seemingly more modest exploits in yarns that remain rollicking to this day, Meyer shrank at writing, and his diaries are so terse that they give little information to the plant scientist or the biographer. He rarely, it seems, described the geology or the geomorphology of the areas he visited, or even the plant communities from which he collected, beyond brief and generalized statements. Neither do we have a penetrating portrait of any of his companions. We are left, then, with what patently was uppermost in his mind: his triumph over mud, cold or heat, the appalling conditions in the inns, transport difficulties, and the unpredictability of the people of the country he lived in for over seven years but whose lingua franca, Mandarin, he never brought himself to learn. Also, we learn of the tedious weeks that Meyer spent in recording, labeling, packing, and transmitting his tons of collected material. In this Meyer was the master, and the first to successfully transmit scion material from China to the United States. It is not surprising to learn that the destruction of one of his major collections in a hurricane after its arrival at Galveston had a permanent effect on him. We end, then, with admiration for the extraordinary courage of the man and for his considerable attainments, and a deep sympathy for the unhappy condition that drove him on. But we have no clear picture of the land he explored, of its people or their customs, or of the terrain, the vegetation, or the growing conditions in which his introductions had flourished in nature.

The book, nonetheless, has indeed been written principally as an adventure story for the general reader. For reasons beyond the biographer's command, it has only partially succeeded. More use might perhaps have been made of Meyer's photographic archive, now at the National Arboretum, to elaborate the text. More regrettably, though, only a general documentation of Meyer's lasting contribution to agriculture, forestry, and horticulture has been provided. Of particular value, for instance, would have been a list of potentially important discoveries that failed to make it to the United States or to survive here and of the localities where they might yet persist. The main account of Meyer's journeys does make mention of outstanding plants as they were discovered or collected, and a useful chapter describes the more successful of his introductions in the United States. Also, one appendix provides a sample list of Meyer's introductions with his own brief annotations; and a second attempts to record the whereabouts of known survivors of those species that have never entered general cultivation. The author explains that a comprehensive dossier would be impracticable. Why? Have the record-keepers really done such disservice to the work of this brave man? If so, here is an object lesson in the unreliability of ex situ conservation, either of whole plants or of seed banks, and of the importance of nature preserves in agricultural development.



Frank Meyer in a "veritable jungle of *Tamarix* bushes," Chinese Turkestan, 18 February 1911. [From *Frank N. Meyer: Plant Hunter in Asia*; U.S. Department of Agriculture collection, National Arboretum]

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Biogeochemistry

Microbial Geochemistry. W. E. KRUMBEIN, Ed. Blackwell Scientific, Palo Alto, Calif., 1983. xii, 330 pp., illus. $60.

Microbial geochemistry is the branch of microbial ecology concerned with the elemental cycles of the biosphere. Though the origins of the subject can be traced to Winogradsky and Beijerinck early in this century, it is only relatively recently that great progress has been made in assessing rates of microbially mediated processes in natural habitats. The result is the development of microbiogeochemistry into a mature interdisciplinary field.

In prefatory and introductory chapters Krumbein develops the philosophical basis for the study of biogeochemistry. The heart of the book contains more pragmatic information on elemental cycles. Blackburn emphasizes the process of organic nitrogen mineralization in his treatment of the nitrogen cycle. He notes that the nitrogen, sulfur, and carbon cycles are intimately related to one another in anaerobic sediments. Nitrate serves as an oxidizing agent for sulfide and sulfate serves as an oxidizing agent for methane but not for ammonium. The ultimate result in marine sediments is the oxidation of organic carbon to carbon dioxide accompanied by the accumulation of ammonium.

A chapter on the sulfur cycle by Jørgensen also emphasizes marine sediments. From a microbiological perspective the sulfur cycle is particularly fascinating because of the tremendous diversity of the bacteria that utilize sulfur in its various oxidation states. Jørgensen suggests that such bacteria may rapidly oxidize sulfur to the elemental (S^0) state. Elemental sulfur is not chemically oxidized and can be stored internally or externally by cells and subsequently oxidized as an energy source when sulfide has been depleted.

The well-balanced and thorough chapters on iron and manganese geochemistry by Nealson are especially pleasing. As Nealson notes, iron occurs largely in the oxidized state in most nonsedimentary parts of the biosphere. It is an essential element for virtually all living organisms (with the interesting exception of the lactic-acid bacteria), but, because of the low solubility of the oxidized form, microbes have evolved specific biochelating agents (siderophores) for capturing and taking it up into the cells. Utilization of reduced iron as an energy source appears to be a rare event confined to certain acidophilic iron bac-