

almost constant lack of funds. Such eloquent descriptions of the "facts" of historical archaeology are rare indeed, and from historians they are almost unknown.

Breen has done an exemplary job of telling the histories of East Hampton, New York, and in the process of discovery has done an equally masterful job of illustrating how historians and even historical archaeologists work. In this book readers will learn insights into the soul of the historical profession itself, and in the process they also will learn a good bit about East Hampton history. All in all, the journey of exploration charted by Breen makes the book a ticket well worth the price.

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*Ben Franklin Stilled the Waves: An Informal History of Pouring Oil on Water, with reflections on the ups and downs of scientific life in general.* By Charles Tanford. (Durham: Duke University Press, 1989. x + 227 pp. \$33.50.)

With a title this long, one might expect to have a good idea of what the book holds in store, but with this book, one is in suspense to the end. The author's background provides a clue. Charles Tanford is a physiologist specializing in biological membranes. Tanford's book ends by describing Evert Gorter and F. Grendel's 1925 paper arguing that cell membranes are made up of two layers of lipid molecules. The history of science leading up to this understanding of cell membranes gives the book its direction.

In 1773, Benjamin Franklin put a teaspoon of oil on the pond at Clapham Common. It spread out to cover nearly half an acre of water. Franklin's experiment is an appropriate starting point for Tanford because, as we now know, the oil spread out to form a layer one molecule thick. With some simple arithmetic, we can derive the approximate dimensions of a molecule:

$$(1 \text{ teaspoon}) / (\frac{1}{2} \text{ acre}) \approx 5 \text{ cc} / 2,000 \text{ m}^2 \\ \approx 10 \mu\text{g}^{-7} \text{ cm}$$

Franklin did not make the calculation—an omission Tanford thinks worthy of a Ph.D.

dissertation—and the significance of the experiment was lost for a hundred years. Lord Rayleigh (John William Strutt) and, independently, Agnes Pockels, a German woman without academic position, resurrected Franklin's experiment in the late 1880s. At that time, it provided one piece of evidence for the existence of molecules—a measurement of their size.

Franklin's experiment is also an appropriate starting point because it raises the question of why oil spreads so rapidly so far. This issue was not resolved until Irving Langmuir's 1917 work on molecular monolayers. Langmuir showed that one end of an oil molecule could attract water while the other end repelled water. Conceptually it is a short step to put two layers of such molecules together with the ends that repel water facing out. The result is a membrane capable of preserving a cell's integrity in an aqueous environment. Historically, it took another sixty years—to the 1970s—for this model of cell membranes to become generally accepted.

Tanford writes for the general public, and his book has many of the advantages and disadvantages that such scientific histories usually have. Tanford's book is an easy enjoyable read. Tanford brings out the striking aspect of Franklin's experiment: Does such a tiny amount of oil really spread so far? One is tempted to do the experiment for oneself. Tanford devotes a good portion of the text to detailing the changing social context of scientific life from Franklin's day to the present. It is a pity, however, that an author who can be sensitive to the social context of science can be so insensitive to the intellectual context of science. Many times the reader finds Tanford wondering why the "obvious" next step was not taken. At no point does Tanford make clear that the existence of atoms and molecules is an astounding inference that required a vast amount of scientific work to be plausible. Tanford's social commentary also can irritate. We are reminded that "there have also been a few 'lady scientists' burning with the same desire to know and understand the natural world around us."

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