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BOOK REVIEW

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Franklin M. Harold: The way of the cell. Molecules, organisms and the order of life

Oxford University Press, New York, 2001. 306 pp, 23.5×15 cm (ISBN: 0-19-513512-1) US$ 35

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''Living things differ from non-living ones most pointedly in their capacity to maintain, reproduce and multiply states of matter characterized by an extreme degree of organization.'' Franklin M. Harold, Emeritus Professor of Biochemistry and Molecular Biology at Colorado State University wrote this statement in his earlier book *The vital force*: *a study of bioenergetics* and in this new one he insists this still rings true. With *The way of the cell* (Fig. 1), Harold contributes again to the quest for an answer to the riddle ''What is life?,'' which is one of the major issues that resonated (and still does) through the scientific conversation of the recently ended twentiethth century, especially since Erwin Schrödinger (1887–1961) published his inspiring book that takes that riddle as its title.

''This is not a book about biology, biochemistry or any other finished and finite discipline''– Harold says at the beginning of the preface – ''but about life.'' The whole book is an attempt to conciliate biology with physics. However, the purpose is not to ''reduce'' biology to physics and chemistry, but to gain some insight into the nature of biological order and then try to answer questions such as: how do lifeless chemicals come together to produce those exquisitely ordered structures that we call organisms? How can molecular interactions account for organisms' behavior, growth and reproduction? How did organisms and their constituents arise on an Earth that had nothing, and then diversify into the whole of creatures that enliven each drop of pond water? Harold's purpose is also to assess how far we have gone toward a scientific understanding of life, and this means that here we will find what natural science has to say about the nature of life, not how it appears from the point of view of theology, psychology or epistemology.

In his attempt to explain what life is, Harold focuses on microorganisms because, although the word ''life'' does not conjure up the image of bacteria or protozoa to most of the public (who know them especially as agents of disease), microorganisms represent the simplest level of organization that manifest all the features of the phenomenon of life, as Harold often remarks.

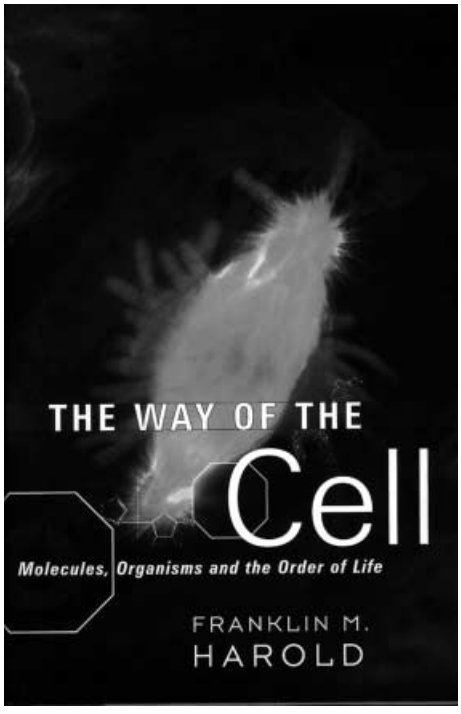

Fig. 1 Franklin M. Harold: The way of the cell. Molecules, organisms and the order of life

The book, written in a synoptic and non-technical style, very simple and clear to facilitate its comprehension by non-graduated students whose reading draws them ''into strange waters'', is organized in 11 chapters. The first comments on that celebrated book by Erwin Schrödinger, which challenged students of his time to bring the study of living organisms fully within the compass of physics and chemistry**;** those writings showing that life, though complicated, is a rational and

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explicable phenomenon. To answer Schrödinger's riddle, a goal must be to identify the essential features that distinguish living creatures from other things. This is what we find in Chapter 2, where life is defined as a quality of the peculiar class of objects called organisms. Chapter 3 draws us into the cell theory, the vision of the cell as the simplest level of organization, present in every organism as the fundamental unit of life. How this conception arose is examined here, and how its meaning has evolved over the past century. As already stated, this chapter focuses on the world of microorganisms, whose manifold forms and lifestyles display the full range of options available to life in its most elementary mode. Chapter 4 is a review of biochemical concepts; the author discusses the building blocks of life– the molecules without which life would not be possible– and what biochemistry and molecular biology can tell us about life. Chapter 5 describes the territory that lies between molecules and cells, in the hope of catching a glimpse of the principles that underlie biological organization. This topic focuses on the knowledge we have about *Escherichia coli* since, although cells exist in almost countless varieties, this bacterium is the one about which we know the most. Reproduction – the capacity of making copies of itself – is a quality that defines living creatures. Thus, Chapter 6 deals with cell division, starting from the basis of one of biology's universal laws: ''Every cell comes from a preexistent cell,'' or ''*Omnis cellula e cellula,*'' proclaimed by Rudolf Virchow (1821–1902) in 1858. But, why does the cell and all organisms built of cells have the form they show and not another one? The answer comes in Chapter 7, where the relationship of function to form and the process that underlies biological morphogenesis are discussed. Chapters 8 and 9 deal with cellular evolution. The former describes the presumed history of life, from the ultimate ancestor to the rise of eukaryotes, whereas the latter discloses the causes that lie behind the universal tree of life, the forces and events that shaped the history of life. Chapter 10 becomes a conclusion of those preceding, and it tries finally to give an answer to the riddle posed at the beginning. Here, it becomes clear to what extent has it been possible to conciliate both the physical and the biological worlds at the present time.

Finally, Harold ends his book with a chapter dedicated to the origin of life, which lets him anchor living organisms securely in the physical world of matter and energy. Furthermore, it is obvious that: ''until we know where we come from, we do not know who we are.''