

Cells, Gels and the Engines of Life

by Gerald H. Pollack (Ebner and Sons, Seattle, USA, 2001, 305 pp.) US\$ 49.50 hardcover, US\$ 27.95 paperback.
ISBN 0 9626895 2 1.

Reading this book title may prevent the scientist in physics or mechanics from going further, leaving it to biologists. This would be regrettable since it is accessible to all publics with basic physical knowledge interested by the mechanisms of life.

The main goal of the author is to draw the reader's attention to the mechanisms involved in biological cell, besides the well known rules or dogma learnt in college. All along the text, he exposes a whole description of cells' main functions revisited by the gel properties attributed to several of its components. Although initially expert in physiology, the author expresses his understanding in polymer science, especially in the interactions between gels and surrounding water or compounds.

To be sure to keep the reader awake and tempted in knowing the end of the story, the first section deals with a systematic controversy about the well established laws concerning cells features such as membranes as continuous barrier, ions pumps and channels, . . . At the beginning of each chapter, the author provides some piece of history in biology, to explain where does some current wisdom come from. This is mainly interesting and useful for the non specialist reader and could appear oversimplified for the biologists. Then, these basic foundations are roughly handled by critics on the experimental conditions leading to them, on their interpretations, or by other experiments. All of the results provided are clearly referenced in the extensive bibliography. At the end of this section, many questions arise and push the reader to go further to discover how the author will explain with his "novel" theory the phenomena that yet appear in cells.

Before answering this question, the second section aims at giving a new look on cell components: water is not simply a solvent, but can be found under a structured state, which provides it with new characteristics. Solutes (charged or not) should be considered via their physicochemical interactions with their close neighbour molecules. Hence, solubility, diffusivity and membrane permeability depend more on hydrated radius than on molecular weight. Last, but not least, the cytoplasm (substance inside the cell membrane) presents the behaviour of a gel. These chapters also permit the author to settle the bases of the next part.

In the third section, the key point is finally exposed: most of the phenomena occurring in a cell could be due to gel phase transition. This central part explains what is a phase transition in gels, highlighted with examples from current life and very expressive drawings.

From this hypothesis, basic cells functions such as secretion, action potential, transport (selective or not), division, muscle contraction are investigated looking for phase transition behaviour or hints leading to such an explanation. Some of these chapters are very convincing. It leads to mechanisms much simpler than those conventionally proposed until now. It is all the more tempting to accept such a theory that relies on well documented experiments at the cell level but also on other applications where the same mechanisms are observed. For instance, secretion could be compared to drug release obtained from polymers under defined outer conditions. A last chapter leaving the reader more sceptical concerns energy, and appears too specialised when compared with the previous topics.

Finally, after having disturbed the fundamentals and proposed a new concept to explain cell functions, the author closes the loop by bringing both approaches closer. Sort of reconciliation is proposed, since the observed mechanisms can be explained by the gel theory.

The originality of this book is first to put in a single theory observations and results presented by several teams on very different subjects. Second, it opens the mind on features occurring out of the biological field. The new concept held here of considering several cell components as gels arises from the curiosity and the multidisciplinary approach followed by the author. The book is didactic and illustrations are very clear, albeit sometimes too simplistic. The purpose is certainly to push the reader to more complex and detailed papers. Some of the assumptions need to be criticised or confirmed, but deserve to attract more chemists, biochemists or physicists to get involved in the study of biological phenomena that nature has achieved.

Cécile Legallais

*UMR CNRS Biomechanics and Biomedical Engineering
Université de Technologie de Compiègne*

*BP 20529
60205 Compiègne
France*

E-mail address: cecile.legallais@utc.fr (C. Legallais)