

AS I AM SURE you all know, Aharon Katzir-Katchalsky was one of 25 victims of the massacre at Lod Airport in Tel Aviv on May 30, 1972. Some time ago I was asked by Fred Richards, on behalf of the Biophysical Society, to organize this symposium in his honor and memory. I would like to begin with a few remarks about Aharon and his work. Aharon Katchalsky was unique in many respects. He was an outstanding biophysicist. He also was a highly valued motive force for international scientific cooperation, a man who made many contributions to the role of the International Union of Pure and Applied Biophysics, a man with a deep understanding of the history and philosophy of science. In addition, he was one of the finest lecturers I have ever heard.

Many of you knew him personally and have, I am sure, benefited by discussions with him. He brought superb insight, a keen mind, and great warmth of personality to any subject. From a personal point of view, the many hours he and I spent working on our book in a small office with a big blackboard were among the most stimulating and exciting in my life. I well remember the many times when he finished working through a derivation on that blackboard, stepped back to look at the final result and said, "Ah, it's a beauty." That's an experience many of you have shared, I am sure, because he was always ready and eager to discuss any aspect of biophysics.

Aharon Katzir-Katchalsky was born in Lodz, Poland, in 1913. He arrived in Israel in 1925 and was educated there, receiving his Ph.D. from the Hebrew University in 1940. He then did postdoctoral work with Kuhn in Basel and returned to Israel to The Weizmann Institute, where he served for many years as head of the polymer department. He received many honors and contributed generously of his time to many organizations. For example, from 1962 to 1968 he was president of the Israel Academy of Science and served as president of the International Union of Pure and Applied Biophysics from 1964 to 1969. Aharon's scientific interests and research ranged widely from polymer chemistry to the molecular basis of memory, but his main emphasis was on the application of the principles of physics and physical chemistry to the solution of biological problems. He is best known as the main motivating force behind attempts to apply modern developments of thermodynamics to a consideration of biological problems. It is for this reason that I chose "Thermodynamics of Living Systems" as the title for this symposium; that concept represents to me the main thrust of Aharon Katchalsky's scientific contributions.

At first glance, living systems appear to defy the laws of thermodynamics, particularly the second law, since they tend to produce order, rather than



*Photograph by Peter Fink*

AHARON KATZIR-KATCHALSKY

1913-1972

disorder, with an increase in time. This is true whether one considers an individual living system or the totality of biological evolution. Thus, biological systems have presented an interesting challenge on several levels for those who might wish to apply thermodynamic reasoning to them. Aharon Katchalsky was for many years the leading figure in such attempts. To my mind, the evolution of his own approaches to these problems is, in many ways, parallel to the general attempts to develop thermodynamic descriptions of living systems.

The systems frequently can be characterized as open systems in stationary, time-independent states. It was perhaps natural, then, that Aharon devoted much effort to applying the formalism of linear nonequilibrium thermodynamics to these systems, because this branch of thermodynamics is particularly well suited to the analysis of the steady states of open systems. The approach has provided insight into a variety of special problems, such as transfer of materials across membranes and muscle contraction, as well as some information on the more global aspects of biology. However, it was also clear to Aharon that there were aspects of living systems that lay beyond the realm of the linear thermodynamic approach. He therefore became interested in a related class of steady-state phenomena that occur in systems far from equilibrium, outside the realm of linear thermodynamic analysis—the phenomena known as dissipative structures. The involvement of such phenomena in biological systems remains to be explored fully but there are some interesting implications, indeed, particularly for evolution and morphogenesis. His interest in this kind of system had led Katchalsky in quite a new direction. He had begun to explore something called “network thermodynamics” as a new approach to the description of systems of the type I have mentioned. The technique is more powerful and more general than “classical” nonequilibrium thermodynamics and should be applicable to a much wider range of phenomena.

These few remarks on some of Aharon’s interests should provide a rationale for the nature of the symposium, since in it I have tried to encompass some indication of his range of interests. His work on polyelectrolytes and in thermodynamics led him to an interest in mechanochemistry, the conversion of chemical into mechanical energy and its application to living contractile systems.

So this symposium is meant to honor the memory of Aharon Katchalsky by showing some of the ways in which many approaches to the description of living systems have born fruit and to indicate future possibilities for these approaches.

As an end to this introduction, I would like to remind you once more of the nature of the man whose memory we wish to honor. I think I can best do that by quoting a couple of sentences from an article about him that

appeared in *Nature* just after his death. The description is, to me, painfully accurate, and the words are much more impressive than any I could generate: "He [Aharon Katzir-Katchalsky] was a lecturer of outstanding ability who could make the most hardened experimental scientist believe, at least for a while, that he could understand the niceties of modern thermodynamic reasoning. Whether he was concerned with the most rarified theory, or with a practical demonstration of an ingenious contractile motor that he designed on impeccable physiochemical principles, his infectious charm and the elegance with which he could express himself in any of a host of languages made his lectures a unique experience."

#### EDITOR'S NOTE

This issue of the *Journal* is dedicated to the memory of Aharon Katzir-Katchalsky and consists of papers given at two Symposia of the Joint Meeting of the American Society for Biological Chemists and the Biophysical Society in Minneapolis, Minnesota, June 1974. The papers by F. D. Carlson, A. Essig, and A. Perelson were given at the Katchalsky Memorial Symposium on *Thermodynamics of Living Systems* which was organized by the late Peter F. Curran, and the papers by A. Szent-Györgyi, K. C. Holmes, and S. Inoué were given at the symposium on *Contractile Systems* organized by A. Szent-Györgyi.

The dedication of this issue is the Introduction given by Professor Curran to the Katchalsky Memorial Symposium. Peter Curran, then professor at Yale School of Medicine, died October 16, 1974. We deeply regret his loss. This symposium which he organized so expertly, will stand as a memorial to him as well as to Professor Katchalsky.

I wish to express my appreciation to the authors for their contributions and to Professor Stanley Schultz, University of Pittsburgh, for his assistance in preparing Professor Curran's dedication.