INTRODUCTION

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The great interest in biochemical oscillations derives from the fact that only recently has it become recognized that biochemical systems can generate self-sustained oscillations. Studies over the past decade have clearly shown that relatively simple enzyme reaction systems with appropriate coupling mechanisms for activation and inhibition, as well as suitable input and output rates, can generate oscillations with a wide variety of periods and waveforms. This discovery has revolutionized the study of the biological systems and has opened the way for their understanding at the molecular level. In addition, the availability of technical methods to analyze these instabilities has tremendously stimulated both theoretical and experimental work.

The experimental field of biochemical oscillations began with the measurement of intracellular components in studies of photosynthesis. The observation of cyclic changes in the concentrations of phosphoglycerate and ribulose diphosphate in 1955 led, in 1958, to a detailed kinetic theory of the self-oscillating mode of the dark reactions of photosynthesis. In non-photosynthetic cells the direct readout of intracellular components, such as NADH, showed overshoots (1952, 1954) and oscillations (1957) in glycolysis. In 1964 nearly continuous oscillations of NADH-fluorescence were reported in yeast cells. This observation was followed by the demonstration of continuous glycolytic oscillations in a cell-free system of yeast (1966). The development coincided with the observation of oscillatory ion movements in mitochondria (1965) where different metabolic functions, as well as components of the respiratory chain, displayed sustained periodic behavior.

The frequencies of biological rhythms cover a bandwidth of over ten orders of magnitude which reflects the temporal organization of the living world. It is interesting to see that the biochemical oscillations now fill the gap between

the circadian oscillations and the neural frequencies observed in biological systems. Therefore, it was only proper that communication should be opened between those interested in biochemical oscillations and others who focused their attention on the numerous periodic phenomena such as diurnal rhythms, the circadian clock and other periodic activities of biological systems.

This volume of contributed papers is one result of the communication between researchers of various nationalities in the two fields. The papers summarise the major view points from a number of laboratories and clearly illustrate the present situation of the field from both a theoretical and experimental standpoint.