Symposium on

Emerging Techniques in Biophysics

CHAIRMAN: SIR GORDON SUTHERLAND

NATIONAL PHYSICAL LABORATORY

TEDDINGTON, GREAT BRITAIN

INTRODUCTION

The choice of "emerging techniques in biophysics" as the subject of one of the principal sessions of this Congress was determined by the desire of the organisers not only to enable biologists to learn about new applications of physics and physical chemistry to biology, but also to emphasise the rapidly growing interest of physicists and physical chemists in biological problems. Although the interest of physicists in biological problems is by no means new (cf. Helmholtz) it was, until recently, a rather rare phenomenon. The application of physics to biological problems was normally left to the biologist and it was unusual for a trained physicist to change his field of work. Biology is now attracting a reasonable fraction of the ablest young physicists (especially in the United States) and this drift is likely to continue. The macroscopic biological groundwork has been done and the biologist has in many cases reached the molecular level in trying to understand some of the most fundamental problems in biology. The physicist can, therefore, pick out an individual problem for study where he is on familiar ground since to him it is a matter of indifference whether the atoms and molecules, whose interactions he is studying, are part of a biological system or part of an inanimate object. The principal difference is that the biological system frequently presents the more challenging and intriguing problems.

Since a number of theoretical physicists are now taking an active interest in biological problems while many biologists, having heard of the successes of quantum mechanics in physics and physical chemistry, are wondering whether similar successes might follow from its application to biology, we have as our first topic "Quantum Mechanics in Biology". The speaker, Professor H. C. Longuet-Higgins, is well known for his work on the application of quantum mechanics to chemical and physico-chemical problems. The biologists will be relieved to know that he is not suggesting that you all learn some quantum mechanics. Indeed, he has been careful to point out that only in a few limited areas is quantum mechanics likely to have a *direct* impact on biology. His warning that any biological phenomenon, which is particularly puzzling at the molecular level, is unlikely to be due to a quantum mechanical effect, is timely.

Next, we have Professor M. Calvin on "Electron Paramagnetic Resonance in Biology". He will give a description of a new and very powerful technique for studying systems containing free or unpaired electrons. The mechanism of many biological processes certainly depends on the presence of such electrons, which are also especially important in the irradiation of biological material. There is little doubt that this work represents the first steps in the application of a very powerful physical technique for the study of a wide variety of biological problems.

The third paper, by Professor G. Eisenman, deals with the mechanism of cation selective glass electrodes. The importance of an understanding of their mode of

operation need not be emphasised to biologists interested in the measurement of cellular and membrance potentials.

Finally, Professor C. H. Townes, who was responsible for the invention of the maser (a very ingenious device which is used to amplify very short radio waves) will describe some possible applications of the optical maser or "laser" in biology. This device (which was also first suggested by Professor Townes) produces extremely monochromatic, coherent radiation at certain wavelengths in the red and near infra-red part of the spectrum. The intensity of this source is much higher than that available from the usual non-coherent sources of radiation in this region. It is likely to have some important applications in microscopy, in micro-surgery and in the investigation of cell structure. It is still in the development stage and many difficult problems have to be solved by the physicists in order to extend the range of wavelengths over which it can operate to the violet and near ultra-violet part of the spectrum. The rate of this development can certainly be accelerated by the biologist finding an urgent need for an ultra-violet "laser". One of the purposes of this Congress is to stimulate just such an interaction between physics and biology.

SIR GORDON SUTHERLAND