ΟΜΙΛΙΑ ΤΟΥ Κου ALEX. FLEMING

Mr President, Fellow members of the Academy of Athens.

I have to thank you most sincerely for electing me a member of the Academy of Athens. It is the greatest honour you could bestow on me and I am proud of it. It is no small matter to be elected a member of the Academy in a city which gave learning to an ingorant world and which after thousands of years shows such vitality.

But why have you given me this great honour? It is because of the success of antibiotics in the treatment of many of our common diseases and of my association with Penicillin which was the first of these successful antibiotics. This is not the place to give you a dissertation on the use of antibiotics in the treatment of disease but quite apart from the practical value of antibiotics many scientific workers have made extensive investigations into how a drug like Penicillin acts on a microbe and much interesting scientific information has come out of this work.

We know that in the minute bacterial cell 1/μ or less in diameter there occur the most complicated chemical synthesis to convert the foodstuff with which they are supplied — and this food may consist solely of very simple substances — into the complicated proteins and nucleins which form the body of the living cell. Everyone is agreed that Penicillin acts by breaking one or more of the links in this chain of chemical reactions which constitute the synthesis. In other words it interferes in some way with the metabolism of the microbe. But how does this interfere? There are many gaps in our knowledge, indeed it would be more true to say that we have merely got a glimpse or two into the heart of the problem.

In our Institute in London it was shown by the use of a radio-active penicillin which they prepared that it only requires a comparatively small number of molecules of penicillin to destroy a sensitive microbe like a staphylococcus. It was shown also that the sensitive microbes take up more penicillin than the insensitive ones and that the penicillin which is thus taken up by the microbe is to be found in the «skin» rather than in the interior of the organism. Gale in Cambridge showed that penicillin prevents the passage of glutamic acid through the bacterial wall. There are probably many other disturbances of function.

I, myself, have been interested in the effect of penicillin on the mor-

phology of bacteria which are grown in media containing sub-lethal concentrations of penicillin. Gardner at Oxford some ten years ago showed that many bacteria became swollen up in such circumstances and other workers including myself have extended these observations.

Extraordinary changes in the morphology occur not only in bacteria which are especially sensitive to penicillin but also in those which are relatively insenscitive. My own work has been concerned especially with Proteus Vulgaris which is so insensitive that penicillin is not used for treatment of Proteus infections.

This organism can he grown easily on a drop of agar under a coverslip on a microscope slide at room temperature and its growth can be watched with a phase contrast microscope. When about 5 units per c. c. of Penicillin is put into the agar the first cell division may be normal. one bacillus divides into two which slide round so that they lie side by side. Then the bacteria seem to grow without division. Sometimes they merely elongate and then they have a very marked tendeney to coil themselves just like a spring of a watch.

Proteus is a motile organism and these coils are actively moving but there is one great difference between this movement and the movement seen with normal bacteria. Normal bacteria move in all directions and never remain in the same field of the microscope or the same position of the field. They mix themselves up so much that it is impossible to observe the same organism over a long period. The penicillin induced coils merely rotate but remain in the same spot so they can be watched without difficulty for many hours.

Their movement appears to be stimulated by heat from the microscope lamp. If a heat filter is introduced in the path of the light the movement often stops for a time and when the heat filter is removed it recommences very violently until the organism has apparently used up all its energy then it becomes very sluggish until it has built up fresh stores of energy when it settles down to a regular rate of movement which may be maintained for many hours.

Someday these penicillin treated organisms will be used for physiological experiments on bacteria and tbe effect of a variety of stimuli will be observed. This may lead to a better understanding of the life of bacteria.

It was interesting to see the effect of Penicillin on the growth of

Cholera Uibrio. This is normally a curved bacillus. When grown on a penicillin agar it grows into long serpentine threads but cach element of the thread is curved just as is the normal organism. It appears that growth proceeds up to the point of cell division and the penicillin inhibits this process. Just what this process is we do not know but when it is discovered we shall know more about the action of penicillin.

I have been talking about changes which occur in the morphology of bacteria under the influence of antibiotics but there may be many other changes.

Some most interesting work was done is my laboratory in London by a conntry woman of yours, Dr Voureka. Bacteria were exposed to strong concentrations of antibiotics for a time insufficient to cause death. When they were afterwards grown in the absence of antibiotic it was found that many of them had lost their power to form toxins and their powers of fermentation had been altered as had their resistance to antibiotics. In many instances these changes persisted through many subcultures and it seemed as if exposure to the antibiotic had affected the genes in some way and produced a real mutation.

These are some of the problems on which we are working.

In conclusion I thank you again for admitting me to your academy and for presenting me with the Olive Branch and the insignia.