UNIVERSITY OF LEICESTER

SCHOOL OF BIOLOGY

DEPARTMENT OF GENETICS - RESEARCH INTERESTS

Professor R.H. Pritchard (S.I. Ahmad, I.R.Beacham, John Collins, Susan Hollom, H.G. Nandadasa, A. Zaritsky)

The main interest is in the nature of the biological clock which ensures that the frequency of chromosome replication in bacteria keeps in step with the growth rate. There are three approaches to this problem being used. (1) A study of the genetics and biochemistry of the uptake and metabolism of DNA precursors. (2) A physiological study of the way in which changes in the velocity of replication of the chromosome alter the composition of cells. (3) The isolation and analysis of mutants of E.coli and of episomes which infect E.coli, which disturb the control of DNA synthesis.

See PRITCHARD, R.H., BARTH, P.T & COLLINS, J. (1969) Control of DNA Synthesis in Bacteria. Symp. Soc. Gen. Microbiol. No. XIX, Microbial Growth, pp.263-297.

AHMAD, S.I. & PRITCHARD, R.H. (1969) Molec. Gen. Genetics, 104, 351-359.

Dr Jennifer Dee (P.J. Hartley, Dr R.T.M. Poulter, A.E. Wheals)

The Myxomycete (true slime mould), Physarum polycephalum, is being studied by genetical techniques. This organism exhibits interesting morphogenetic changes during its life-cycle and can be handled easily by standard microbiological techniques. It has been for some years a popular tool with Biochemists because of the abundant syncytial growth, easy culture on synthetic media and naturally synchronized mitosis of the plasmodial stage. The genetics of the organism has been largely neglected. Work in progress here includes the isolation of mutants; investigations of the effects of mutations on different stages of the life-cycle; senescence; the control of DNA replication.

See DEE, J. (1966) Genet. Res. Camb. 8, 101-110.

POULTER, R.T.M. & DEE, J. (1968) Genet. Res. Camb., 12, 71-79.

DEE, J. & POULTER, R.T.M. A gene conferring actidione resistance and abnormal morphology on Physarum polycephalum plasmodia. Genet. Res. Camb., (In press)

Dr Simon Hardy

The mechanism of assembly of ribosomes in E.coli is being investigated by the isolation and analysis of mutants defective in this process. The isolation of eukaryote ribosomal mutants will also be attempted.

Dr I.B. Holland (R. Buxton, V. Darby, Dr E.M. Holland, A.C.R. Samson, Dr B.W. Senior)

Functional organization of the bacterial cell membrane. The bacterial membrane in addition to its osmoregulatory properties appears to provide an essential matrix upon which such complex processes as DNA replication, energy transfer and possibly protein synthesis proceed and are controlled. These processes are located in specific centres on the membrane and we are studying the mode of action of some antibacterial proteins, colicins, which may interact with such centres.

The mechanism whereby colicins appear to induce a molecular rearrangement in the cell membrane is being studied by physical and biochemical techniques including membrane fractionation and electron microscopy.

Colicin E2 binding to the cell surface causes inhibition of cell division and induces rapid degradation of the cell chromosome. The nature of the nuclease involved, the mechanism of its activation and the mechanism of DNA breakdown is being investigated.

Inclusion/contd.

Inclusion of colicin E3 in the cell membrane leads to rapid inhibition of protein synthesis and defective ribosomes accumulate. Polyribosome metabolism in vivo and in vitro is being studied to determine the precise step in ribosome function which is blocked in the presence of E3.

Mutants specifically resistant to E2 have been isolated which have defective cell membranes, which in turn leads to disturbance of several aspects of DNA metabolism. Genetic analysis and physiological studies of such mutants are now being used to determine the precise nature of the altered membrane subunit and its normal functional role.

HOLLAND, I.B. (1968) J. Mol.Biol., 31, 267-275.

HOLLAND, I.B. & THRELFALL, E.J. (1969) J.Bacteriol., 97, 91-96.

HOLLAND, E.M. & HOLLAND, I.B. (1969) Kinetics of DNA breakdown and of inhibition of cell division induced by colicin E2 in Escherichia coli. Proc. Soc. Gen. Microbiol., 56th Meeting, p.9.

HOLLAND, I.B. DNA replication in Bacteria. Sci. Prog., Oxf. (1970) vol.58 (Spring issue)

Dr C.F. Roberts (Dr Susan Armitt, P.A. Fantes)

The general problem of the regulation of protein synthesis in Eukaryotes with special reference to the filamentous fungus Aspergillus nidulans. Genetic or biochemical techniques applied to questions of the regulation of enzyme synthesis and cellular content. Experimental systems at present being used are enzymes of the glyoxylate cycle (in collaboration with Professor H.L. Kornberg) and alcohol dehydrogenase.

See ROBERTS, C.F. (1969) Enzyme lesions in galactose non-utilising mutants of Aspergillus nidulans. Biochim. Biophys. Acta, (In press).

DAY, P.R. & ROBERTS, C.F. (1969) Genetics, 62, 265.

ROBERTS, C.F. (1967) Genetics, 55, 233.

Dr Robert Semeonoff

It is now obvious that the degree of genetic variability in natural populations is extremely large, and that in theory natural selection could maintain these numerous polymorphisms.

It is asked if this is in fact the case. If a population is amenable both to ecological investigation and genetic analysis, the nature of any selective forces can be examined, and an estimate of their intensity obtained. On the other hand, it should also be possible to discover the extent to which purely stochastic processes contribute to genetic variability.

The genetic structure of a population is obviously important, and knowledge of this should contribute to a fuller understanding of ecological phenomena.

See LEWONTIN, R.C. & HUBBG, J.L. (1966) Genetics, 54, 595-609.

MILNE, H. & ROBERTSON, F.W. (1965) Nature, 205, 367-369.

KING, J.L. (1967) Genetics, 55, 483-492.

SEMEONOFF, R. & ROBERTSON, F.W. (1968) Biochem. Genet. 1, 205-227.

PETRAS, M.L. (1967) Evolution, 21, 259-274. (1st of a series of 4)

Dr B.M. Wilkins

During the last few years a number of bacterial mutants have been isolated which are defective in genetic recombination. These mutants are being exploited to find out more about the stages involved in the recombination process, their

sequence/P.T.O.

sequence and the variety of recombinant structure which are formed.

Recombination is also involved in restoring the integrity of the bacterial genome following the replication of damaged regions in the parental molecules. This aspect of DNA repair is being studied by inducing damage with radiation and chemicals and examining the structures which are formed in both repair-defective and recombination-deficient bacterial mutants.

Finally studies will be initiated to investigate an aspect of the relationship between prophage and the host bacterium; the mechanism by which viral development is induced in lysogenic bacteria.

See HOWARD-FLANDERS, P., RUPP, W.D., WILKINS, B.M. & COLE, R.S. (1968) Cold Spring Harbor Symp. Quant. Biol., 33, 195-205.

WILKINS, B.M. (1969) J.Bacteriol., 98, 599-604.

November, 1969.