INVESTIGATIONS ON THE GENETIC CONTROL OF VIRULENCE IN SALMONELLA TYPHIMURIUM

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SUMMARY

S.typhimurium strains may be characterised on the basis of their lethal capacity for mice. The introduction of a few bacteria of virulent strains into the peritoneum of mice is sufficient to kill a high proportion of animals. Avirulent strains require in excess of a million bacteria to produce the same effect. Since virulence is a stable property it may naturally be asked whether the expression of this property is under genetic control. If such a control were to be established, then the search for the biochemical differences between virulent and avirulent bacteria would be placed on a sound basis.

Advantage was therefore taken of the existence of genetic recombination mechanisms in Salmonella to investigate the problem.

In *S.typhimurium* strain C5, the loss of virulence of a leucine-requiring mutant was found to be unassociated with its growth requirement since the virulence of prototrophic transductants of the mutant was similar to that of the mutant. Immunologic studies of the mutant and its parental strain suggested that the difference in virulence may be due to a difference in some antigenic component other than the heat stable "O" somatic antigen complex of the two strains. In addition, the mutant was found to be unable

to multiply in the mouse peritoneum as rapidly as the parental virulent strain.

Attempts to develop a suitable recombination system between virulent and avirulent strains of S.typhimurium were unsuccessful. Subsequently an avirulent strain of S.abony was found to act as a chromosomal donor to the virulent strain C5 of S.typhimurium. An analysis of the hybrids arising from such crosses, showed that the segregation of two genetic loci - aviA and aviB was responsible for the expression of virulence intermediate between that of the donor and the recipient. It was further established by backcross experiments that both aviA and aviB were necessary for the expression of complete avirulence, characteristic of S.abony. On the basis of segregational analysis of the hybrids, aviA was mapped near the locus for streptomycin resistance/sensitivity while aviB was mapped adjacent to the locus for inositol utilization/non-utilization. The loci are separated by about 25 % of the bacterial chromosome.

Studies of the genetics of partial virulence between two S.typhimurium strains where the donor was partially virulent while the recipient was avirulent, were obscured because of anomalies associated with the analysis of linkage in hybrids.

The two-gene control of the difference in virulence between S.abony and S.typhimurium strain C5 is discussed in relation to previous work along similar lines.