

Changes in *Myxococcus xanthus* pigments induced by phosphate and temperature

F. GONZALEZ, M. ANGELES GOICOECHEA, J.M. ARIAS* & E. MONTOYA
Departamento de Microbiología, Facultad de Ciencias, Universidad de Granada, Granada E-18071, Spain

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Pigment levels have been measured in a number of wild strains and colour mutants of *Myxococcus xanthus*. The non-carotenoid yellow pigment and carotenoid pigment contents changed according to growth temperature and phosphate concentrations in liquid media. The highest content of both types of pigment was observed at 28°C with all strains. A high phosphate concentration depressed pigment content in both wild and mutant strains at all temperatures, except with two colour mutants, where the pigments levels remained unchanged at 28°C and 33°C.

Myxobacteria are the only bacteria capable of multicellular development. Their characteristic red, yellow and orange colours are due to membrane-bound carotenoids. These pigments consist of a mixture of highly unsaturated, acyclic and monocyclic carotenoids (Reichenbach & Kleinig 1984). Carotenogenesis in myxobacteria has been shown to be controlled by both physiological and environmental factors; thus carotenogenesis in *Myxococcus xanthus* is stimulated in many cases, but not always, by light (Kleinig & Reichenbach 1973) and is dependent on the presence of a photosensitizer (Burchard & Dworkin 1966). Genetic elements have also been identified as being involved in the control of carotenogenesis (Martinez-Laborda *et al.* 1986; Martinez-Laborda & Murillo 1989). In addition to carotenoids, myxobacteria contain other pigments, particularly a yellow one, which predominates in dark-grown cells of *Myxococcus xanthus* (Burchard & Dworkin 1966). Inorganic phosphate and temperature are known to suppress the biosynthesis of pigments in other micro-organisms (Martin & Demain 1980). Inorganic phosphate has also

been shown to be involved in the autolysis of *Myxococcus xanthus* (Jones & Barr 1983) and *Myxococcus coralloides* (Gonzalez *et al.* 1987).

We report here on the effects of temperature and phosphate concentration on the pigment content in several *Myxococcus xanthus* strains.

Materials and Methods

BACTERIAL STRAINS

Myxococcus xanthus strains were provided by F.J. Murillo (Department of Genetics, Murcia University, Spain). DK101 (yellow) and DK1050 (yellow) wild strains are standard strains; DK406, DK718, DK2834, MR7 and MR151 strains are red mutants obtained by chemical or u.v. mutagenesis from standard strains (Martinez-Laborda *et al.* 1986).

MEDIA AND GROWTH CONDITIONS

All the myxobacterial strains were grown in the dark in CTT liquid medium containing 1 mmol/l phosphate buffer pH 7.4 (Bretscher & Kaiser 1978) at 25°C, 28°C, 33°C and 37°C by shaking

* Corresponding author.