sequence information may be obtained by using mass spectrometry.

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Patterns of Microbial Threonine Catabolism: a Survey

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A total of 75 micro-organisms capable of growth on L-threonine as the major source of carbon and nitrogen has been isolated from soils and other materials. A survey of catabolic routes has included growth, micro-respirometric and enzymic measurements.

The occurrence of L-threonine aldolase in extracts of threonine-grown isolates (Morris, 1969) was rare (six cases). L-Threonine dehydrogenase (Neuberger & Tait, 1960), the synthesis of which was induced (specific activities up to 2000 nmol/min per mg of protein), predominated in most cases (46). Sixteen isolates possessed enzymes acting on threonine that were either of low activity (less than 50 nmol/min per mg of protein) or undetectable when assayed under standard conditions. A fourth group of four isolates possessed only low threonine dehydrogenase activity but relatively high L-threonine dehydratase (deaminating) activity (Umbarger & Brown, 1957), which was constitutive. Another group (three isolates) possessed both threonine dehydrogenase and threonine dehydratase activities.

Classification of isolates was carried out by using numerical taxonomic procedures (Sokal & Sneath, 1963), and they were identified by standard diagnostic testing methods. To date, genus names have been assigned to the one-third of the isolates examined in detail. The largest group of strains was made up mostly of *Brevibacterium* spp., which possessed high threonine dehydrogenase activity after growth on L-threonine. Named strains, e.g. *Brevibacterium divaricatum* N.C.I.B. 9379 and *Brevibacterium linens* N.C.I.B. 8546, also grew well on threonine medium supplemented with 0.05% of yeast extract, and possessed high threonine dehydrogenase activity. Other

isolates in the same group included *Achromobacter* and *Flavobacterium* species.

Isolates with apparently low enzyme activities towards L-threonine, suspected to utilize novel routes of threonine catabolism or possess enzymes with atypical properties, included *Pseudomonas*, *Alcaligenes* and perhaps *Corynebacterium* species.

The further metabolism of the C₂ fragments of threonine catabolism catalysed by threonine aldolase or by threonine dehydrogenase plus 2-amino-3-oxobutyrate-CoA ligase (McGilvray & Morris, 1969; Blackmore & Turner, 1971) was also studied. Measurements of glyoxylate carboligase and serine dehydratase activities, diagnostic of routes for glycine catabolism via the glycerate pathway and the serine pathway respectively, permitted further subdivision of the isolates. One isolate, metabolizing threonine via 2-oxobutyrate and propionate, appeared to employ a constitutive 'biosynthetic' threonine dehydratase (Umbarger & Brown, 1957) to catalyse the initial step. Preliminary results of the survey show strong correlation between classifications according to classical taxonomic procedures on the one hand and enzymic analysis of catabolic pathways on the other.

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Utilization of Pairs of Substrates by Bacterium N.C.I.B. 8250 Growing in Batch Culture

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The induction and co-ordinacy of the enzymes involved in mandelate oxidation by bacterium N.C.I.B. 8250 have been the subject of previous investigations (Kennedy & Fewson, 1968a,b; Livingstone & Fewson, 1971). We have now used the patterns of growth on pairs of substrates as indications of other aspects of control such as repression and permeation.

Diauxic growth was observed when cells previously grown on benzoate were inoculated into benzoate+mandelate-salts medium. Benzoate was utilized first, and mandelate oxidation started only after the disappearance of benzoate. Inoculation of cells