glycine concentration may develop across the cell membrane when $[Na^+]$ and $[K^+]$ in the two phases are appropriately manipulated in circumstances where the spontaneous movements of the ions across the cell membrane appear to provide the energy needed to concentrate the amino acid (Eddy, 1968a,b). Analogous observations have now been made in a modified system containing 2mM-sodium cyanide to inhibit respiration and 10mM-2-deoxyglucose to trap ATP. The accumulation of L-alanine, 2-aminoisobutyric acid, L-leucine, L-phenylalanine and L-methionine has been studied in the modified system at both large and small values of cellular and extracellular $[Na^+]$. The results, though less detailed than those previously obtained with glycine, encourage the view that similar mechanisms are involved in the transport of all these amino acids.

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The 'Active' Accumulation of Tetracycline by *Escherichia coli*

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The tetracycline antibiotics inhibit protein biosynthesis in cell-free preparations from both mammalian and bacterial cells (Franklin, 1963). The selective antimicrobial activity of these drugs *in vivo* may therefore depend in part at least on the curious ability of bacterial cells to accumulate them to high intracellular concentrations by an energy-dependent 'active' process (Izaki & Arima, 1963; Franklin & Godfrey, 1965; Franklin, 1967), which apparently does not occur in mammalian cells (Franklin, 1966).

The 'active' accumulation of a toxic substance not obviously structurally related to any known nutrient is a remarkable phenomenon and it has been found to have a number of unusual features. The initial rate of uptake of $[^3H]$ tetracycline by a tetracycline-sensitive strain of *Escherichia coli* is linearly dependent on the concentration of the drug in the medium, and no trend towards a saturation effect has been found at tetracycline concentrations up to approximately 1mM. Wilbrandt & Rosenberg (1961) pointed out that such linear kinetics do not preclude the possibility of a carrier-mediated transport if it is assumed that the affinity of the postulated carrier for the transported solute is very low.

When *E. coli* cells are incubated with low concentrations of $[^3H]$ tetracycline, e.g. 10 $\mu g./ml.$, the

accumulation of drug reaches a plateau in 7–10min. If the cells are then transferred to drug-free medium the label is rapidly lost from the cells. This exit reaction is markedly temperature-dependent, and is accelerated by the addition of 1mM-2,4-dinitrophenol. In contrast, when cells are preincubated with $[^3H]$ tetracycline at concentrations greater than 50 $\mu g./ml.$, uptake of the drug remains approximately linear for about 1hr. When these cells are transferred to drug-free medium, the rate of the exit reaction is found to be strikingly decreased compared with that in cells preincubated with lower concentrations of drug. Indeed, when the cells are preincubated with 200 $\mu g.$ of $[^3H]$ tetracycline/ml. the exit reaction is negligible, although loss of label from these cells can be readily provoked by dinitrophenol at 37°. It seems probable therefore that the intracellular accumulation of tetracycline above a certain concentration results in a progressive inhibition of the exit reaction. This in turn accounts for the continued uptake of the drug by *E. coli* when the extracellular drug concentration is greater than 50 $\mu g./l.$

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The Degradation of 2-Thiophenecarboxylic Acid by a *Flavobacterium* Species

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The thiophen ring is of restricted distribution in Nature, though a number of polythienyls have been isolated from plants in recent years (Gronowitz, 1963). However, little attention has been devoted to the microbiological dissimilation of thiophen (Knecht, 1961; Isenberg, 1961).

Attempts were made to isolate by enrichment culture micro-organisms able to degrade simple thiophens, but such attempts were unsuccessful. However, by using low (<0.5mM) concentrations of the enrichment substrate, a micro-organism was isolated that was able to grow in a simple mineral-salts medium with thiophen-2-carboxylate as sole source of organic carbon, and was provisionally identified as a *Flavobacterium* sp.

When the organism was grown in succinate medium, washed cells were able to oxidize thiophen-2-carboxylate at 0.1 $\mu mole/mg.$ dry wt. of cells/hr. in the presence of chloramphenicol at a concentra-