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Effects of Ions on the Activity of Enzyme Systems

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The observed activity of many enzyme systems is a function of the ion population of the medium. Recent kinetic studies from Theorell's laboratory [1-3] have emphasized the role of anions in determining the rates of certain enzyme reactions. In an effort to determine the generality and the order of magnitude of these ion effects, several additional systems have been studied. The activity of the glucose-6-phosphate dehydrogenase system was markedly (as much as six fold) stimulated by low concentrations of various ions, while at higher concentration an inhibition was observed *. The magnitude of the stimulation and the onset of inhibition depended upon an interrelationship between the concentration of the substrate, TPN, and the concentration of the specific ions present. The older experiments [4,5], which indicated only a strong inhibition by phosphate are probably a result of a very low effective concentration of the substrate. Studies with various salts indicated that the observed effects were primarily determined by the particular anion species present. The order of magnitude of stimulation is roughly

$$F^- > PO_4^{=} > Cl^- > Br^- > SO_4^{=} > I^- > SCN^-.$$

Large anions like glycyl-glycine and TPN are poor activators, but the substrate, glucose-6-phosphate is an effective "anion activator". The differences in stimulation produced by various cations was generally related to the magnitude of contribution to the ionic strength of the medium. The overall results favor the concept of a non-specific ionic effect rather than an interpretation which involves a heavy metal requirement [6,7].

The observed activity of certain coupled systems, for example the Zwischenferment-old yellow enzyme system and the succinate oxidase system is also related to the kind and concentration of anions present.

These effects have been interpreted according to the general principles of solvation of chemical reactions.

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* Hans Klenow, Institute of Cytophysiology, University of Copenhagen, has independently observed marked stimulation of this enzyme by various ions. (Personal communication.)

The Variation in the Structure of Water on Gelation

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X-ray diffraction patterns of various gels were studied at 20° C in a Guinier camera employing Cu$K\alpha$ radiation. The intensity curves, obtained in the usual way from photometer determinations of film densities, were corrected for polarization and absorption.