not affect the absorption rate of the highly water-soluble carbamates. This is in agreement with previous work (Levy & Perala, 1970). It was shown that the Tween 80 maintained all carbamates in solution throughout the experiment. The amount of carbamate remaining in the tissue after the incubation was also determined and a similar trend was observed.

The same pattern was established for the absorption of these carbamates through skin.

In the gut-sac system butyl carbamate showed optimal lipophilicity for absorption. Contrary to the hypothesis of previous investigators (Schanker, 1960), any further increase in compound lipophilicity resulted in a decrease in absorption. The validity of these findings *in vivo* remains to be elucidated.

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Levy, G. & Perala, A. (1970) *J. Pharm. Sci.* **59**, 874

Schanker, L. S. (1960) *J. Med. Pharm. Chem.* **2**, 343

Wilson, T. H. & Wiseman, G. (1954) *J. Physiol. (London)* **123**, 116

The Effect of Increasing Concentrations of Potassium Chloride on Rat Liver Lysosomes

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In muscle, and possibly in other tissues, phosphorylated compounds provide the bulk of the negative charge that balances intracellular cations (Harris, 1960) and, during freezing, these salts will increase in concentration within the cell irrespective of whether ice forms intracellularly or extracellularly. As lysosomes are known to be damaged by freezing and thawing (Sellinger *et al.*, 1960), and we decided to study the effect of increasing concentrations of salt on these organelles. However, the intracellular anionic composition of most cells is unknown, and since determinations of the composition are likely to be affected by the time required to arrest metabolic reactions (Wollenberger *et al.*, 1960; Lowry *et al.*, 1964) we opted to study the effect of increasing concentrations of KCl.

The latency of acid phosphatase and β -glucuronidase in homogenates of rat liver was found to decrease progressively on exposure to concentrations of KCl between 0.13 and 1.5M in spite of the fact that the concentration of sucrose was maintained at 0.25M. These latencies were determined solely with Triton X-100, and the response could have been due to disruption of the lysosomes or to an alteration in the permeability of the lysosomal membrane that would allow access of substrate to enzymes still within the lysosomal membrane. However, we were also able to demonstrate the decrease in latency when centrifuga-

tion (300000g-min) was used to determine free acid phosphatase, and it appears that lysosomes are actually disrupted by exposure to high concentrations of salt.

The early work on rat liver lysosomes showed that they were freely permeable to salts such as NaCl and KCl (Berthet *et al.*, 1951), but our own studies and those of Lloyd (1971) indicate that these salts penetrate the rat liver lysosomal membrane relatively slowly. Consequently the disruptive effect of high concentrations of KCl on rat liver lysosomes could be due to transient osmotic pressure gradients that will arise when the concentration of KCl is lowered, but we cannot exclude a direct effect on the lysosomal membrane.

Cryoprotective agents lower the concentration of salt that is in equilibrium with ice at any given temperature (see Farrant & Woolgar, 1970), and they could therefore protect cells against damage during freezing by preventing the disruption of lysosomes. However, compounds such as glycerol and dimethyl sulphoxide have also been shown to have a deleterious effect on lysosomes (Lee, 1971, 1972), and this could be one of the mechanisms of toxicity of cryoprotective compounds.

Berthet, J., Berthet, L., Appelmans, F. & de Duve, C. (1951) *Biochem. J.* **50**, 182

Farrant, J. & Woolgar, A. E. (1970) *Frozen Cell Symp.* **1969** 97

Harris, E. J. (1960) *Transport and Accumulation in Biological Systems*, 2nd. edn., Butterworths, London

Lee, D. (1971) *Biochim. Biophys. Acta* **233**, 619

Lee, D. (1972) *Biochim. Biophys. Acta* **266**, 50

Lloyd, J. B. (1971) *Biochem. J.* **121**, 245

Lowry, O. H., Passonneau, J. V., Hasselberger, F. X. & Schulz, D. W. (1964) *J. Biol. Chem.* **239**, 18

Sellinger, O. Z., Beaufay, H., Jacques, P., Doyen, A. & de Duve, C. (1960) *Biochem. J.* **74**, 450

Wollenberger, A., Ristau, O. & Schoffa, G. (1960) *Pflügers Arch. Gesunde Physiol.* **270**, 399

Lysosomal Localization of Enzyme-Containing Liposomes Injected into Rats

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Liposomes with entrapped material have been proposed as carriers for enzyme or drug administration (Gregoriadis *et al.*, 1971; Gregoriadis & Ryman, 1971, 1972). Our experiments with liposomes containing ^{131}I -labelled albumin or *Aspergillus niger* [^3H]amyloglucosidase have shown that injection of such liposomes into rats results in their