not additive. The stimulation of activity by tryptophan or cortisol was not inhibited by actinomycin D.

It appears that around the time of weaning L-serine dehydratase synthesis is stimulated after cortisol release, but that then the increased dietary intake of glucose associated with weaning lowers the cortisol-stimulated activity. Subsequent increase of activity is effected by the increased intake of amino acids (perhaps specifically tryptophan) that is also associated with weaning (see Snell & Walker, 1972); this effect may operate at the translational level of enzyme synthesis.

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- Evered, D. F. & Roffe, L. M. (1971) *Comp. Biochem. Physiol. B* **39**, 377-381
 Goswami, M. N. D., Boulekbache, H. & Meury, F. (1972) *Comp. Biochem. Physiol. B* **41**, 323-330
 Greengard, O. & Dewey, H. K. (1967) *J. Biol. Chem.* **242**, 2986-2991
 Inoue, H., Kasper, C. B. & Pitot, H. C. (1971) *J. Biol. Chem.* **246**, 2626-2632
 Snell, K. & Walker, D. G. (1972) *Biochem. J.* **128**, 403-413
 Vernon, R. G., Eaton, S. W. & Walker, D. G. (1968) *Biochem. J.* **110**, 725-731
 Yeung, D. & Oliver, I. T. (1971) *Comp. Biochem. Physiol. A* **40**, 135-144

Enzyme Adaptation for Glycerol Utilization in Neonatal Rats

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The changes in hepatic glycerol kinase (EC 2.7.1.30) and glycerol 3-phosphate dehydrogenase (EC 1.1.1.8) activities during the development of the rat were described by Vernon & Walker (1970). Factors that regulate these changes and their relationship to the normal physiological events have now been investigated. Low activities of both enzymes are detected in the foetal liver at 18 days gestation, and these activities rise fourfold during the following 4 days and then continue to rise more rapidly after birth. The effect of starvation on prematurely delivered, full-term and 6h-old pups that have suckled once was examined, the animals being maintained in a humidicrib at 37°C for 24h and the hepatic activities then measured. These were 60% lower in the experimental animals than in normal suckled litter mates.

Increased activity of glycerol 3-phosphate dehydrogenase can be observed 5h after injection of thyroxine, cortisol or glycerol *in utero*, but glycerol kinase activity is increased only by thyroxine. In-

jections of neither glucagon nor dibutyl cyclic AMP (6-*N*,2'-*O*-dibutyladenosine 3':5'-cyclic monophosphate) have any effect on these enzymes. Administration of cortisol or glycerol to 5-day-old animals resulted in similar rises 24h later in both glycerol kinase and glycerol 3-phosphate dehydrogenase activities, but thyroxine had no effect.

Glycerol utilization in liver slices from animals of various ages incubated *in vitro* was examined by measuring the incorporation of ¹⁴C from [U-¹⁴C]-glycerol into CO₂, liver lipids and liver glucose + glycogen. Less than 0.5% incorporation into CO₂ was found for suckling rats, but this rises for weanling animals. Incorporation into glucose is by far the greatest in slices from animals 0-2h old. By 1 day *post partum* this has fallen through a minimum and then rises again to a new maximum at 15 days (Vernon & Walker, 1970). Incorporation of radioactivity into total liver lipids was very low throughout the whole suckling period.

These studies suggest that gluconeogenesis from glycerol may be important in the immediately newborn animal. Blood glycerol concentrations at this time measured by the method of Sheath (1970) are high, then decrease for several hours until normal suckling causes a fresh rise in them.

Prevention of the normal rise in glycerol kinase and glycerol 3-phosphate dehydrogenase activities by starvation and the failure of attempts at prenatal induction with glucagon suggest that postnatal hypoglycaemia is not involved in regulation of these enzymes, and that their development is related to as yet unknown suckling or associated factors.

Sheath, J. B. (1970) *Clin. Biochem.* **3**, 339-341

Vernon, R. G. & Walker, D. G. (1970) *Biochem. J.* **118**, 531-536

Enzyme Synthesis and Adaptation of Hepatic 'Malic' Enzyme

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The adaptive behaviour of rat hepatic 'malic' enzyme (EC 1.1.1.40) has been characterized sufficiently, both in the adult (Wise & Ball, 1964; Tarentino *et al.*, 1966) and in the developing postnatal animal (Vernon & Walker, 1968*a,b*; Hemon, 1968; Lockwood *et al.*, 1970), to indicate that similar physiological stimuli are involved in both adaptive and developmental phenomena.

A radio-immunological technique was developed to monitor changes in rate of hepatic 'malic' enzyme synthesis, relative to total soluble protein (Schimke & Doyle, 1970), during both adaptation and develop-