The intensity of protein synthesis in different tissues corresponds to the concentrations of RNA in the tissues. Thus in cardiac muscle the rate of protein synthesis and the concentration of RNA are in each case higher than in skeletal muscle. Changes in RNA concentration can occur very rapidly in response to food intake. We have shown, for example, that, in liver, heart and skeletal muscle of rats on cyclic feeding schedules, periodic changes in RNA concentration occur in all three tissues. That such changes can effect a change in protein synthesis is shown by parallel alterations in the rate of muscle protein synthesis and RNA concentration. Also, the loss of RNA that occurs when food is withdrawn is equally rapid from liver, heart and skeletal muscle.

The control of protein breakdown in different tissues is in no way understood. Changes in the amount of dietary protein can cause immediate changes in either direction in the breakdown rate of arginase, whereas the breakdown rate of albumin responds only slowly to changes in dietary protein. A decrease in the rate of breakdown represents an energetically economical way of increasing the mass of protein. Evidence that such a mechanism occurs has been reported by Young *et al.* (1971) during the rapid catch-up growth of skeletal muscle that occurs on re-feeding after protein depletion. We have reported decreases in the specific activities of two proteolytic enzymes in rat skeletal muscle during similar periods of catch-up growth (Millward, 1972).

It is therefore obvious that protein breakdown and synthesis are equally important in controlling the concentration of tissue protein. These results and current work on the problem will be discussed.

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Measurement of the Synthesis of Liver-Produced Plasma Proteins with Particular Reference to Dietary Protein and Amino Acid Supply

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Production of plasma proteins by the liver can be measured *in vivo* (a) indirectly, by following the metabolism of injected radioactively labelled protein molecules, or (b) directly, by the [^{14}C]carbonate method. *In vitro*, use may be made of the isolated perfused liver, liver slices or isolated liver cells, and a direct assay of protein production by immunological means can be applied. The advantages and disadvantages of the various techniques will be discussed, with particular reference to the adaptation of albumin production to protein or amino acid deprivation. *In vivo*, it can be shown that albumin synthesis falls rapidly in the face of such deprivation, and a similar response can be demonstrated with the isolated perfused liver or isolated liver cells removed from rats subjected to a low-protein diet. These findings will be discussed in relation to changes in liver mass, cell size and polyribosome structure.

Influence of Amino Acid Supply on Protein Synthesis by Rat Liver *in vitro*

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The rate of protein synthesis in rat liver is sensitive to changes in the availability of amino acids. This has been shown *in vivo* (Wunner *et al.*, 1966), in a perfusion system (Jefferson & Korner, 1969) and with a cell-free preparation (Baliga *et al.*, 1968). I have studied the effects of changes in amino acid supply in a liver-slice incubation system and have shown that the protein-synthetic activity of cell-free systems subsequently prepared from the incubated tissue is elevated after exposure to high concentrations of amino acids (Clemens & Korner, 1971). Further, this effect is localized in the cell-sap fraction of the liver and may represent an effect of amino acids distinct from the stimulation of polyribosome formation reported by others.

Liver slices were prepared from male Sprague-Dawley rats (100–120g) that were either fed *ad lib.* until death or starved overnight (16h). The tissue was incubated for 1h in a medium containing either normal plasma concentrations of 20 amino acids or six times these concentrations (Clemens & Korner, 1970). Post-mitochondrial supernatants, ribosomes