greatly increased absorption because of the formation of new CO groups.

We have now compared the absorption spectrum of a genuine serum globulin (ox) with the same protein in the hydrolysed state. 15 c.c. of a salt-free dialysed 4·4 per cent suspension of globulin was dissolved in 180 c.c. $n/12$ NH_4OH–NH_4Cl (pH 8·9) and sterilized by passing through a Berkefeld filter. To 65 c.c. were then added 45 c.c. of a sterilized 0·17 per cent trypsin solution (Merck) and the mixture (A) was left at 0° C. for 72 hours. Genuine serum-globulin is not digested by trypsin, and therefore another sample (65 c.c.) was denatured in a closed bottle 20 min. in a boiling water-bath. After cooling, pH was the same as before. 45 c.c. of the trypsin solution was added and the mixture (B) left at 39° C. for 72 hours. Sulphosalicylic acid gave then with A a large amount of precipitate, but with B only a faint opalescence. The ultra-violet absorption spectra of solutions A and B are shown in the accompanying figure.

The absorption for genuine (A) and for hydrolysed (B) protein is about equal. This seems to be in greater accordance with the classical theory on the structure of proteins than with the cyclol theory.

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[1] Wrinch, D. M., NATURE, 139, 798, 972 (1937).
[2] Cf. Magill, M. A., Steiger, R. E., and Allen, A. J., *Biochem. J.*, 31, 188 (1936).

Mechanism of the Oxidation of Reduced Coenzyme I

THE oxidation in animal tissues of metabolites such as lactic, malic and triosephosphoric acids may be resolved into three component reactions:

(1) Metabolite + coenzyme I → oxidized metabolite + reduced coenzyme I.

(2) Reduced coenzyme I + carrier → coenzyme I + reduced carrier.

(3) Reduced carrier + oxygen → carrier.

It was recently discovered[1,2] that animal tissues contain coenzyme factor (diaphorase), an enzyme which specifically catalyses reaction (2). The chemical nature of the enzyme was not known. The flavoprotein isolated by Straub[3] from heart muscle also catalyses reaction (2) and its properties have convinced us of its identity with the coenzyme factor. Under optimal conditions one molecule of flavoprotein catalyses the oxidation of 8,500 molecules of reduced coenzyme I per minute at 38° (Q_{O_2} = 180,000). The catalytic efficiency and the concentration in tissues of this new flavoprotein are sufficiently high to permit the conclusion that it takes a fundamental role in cellular respiration.

Muscle flavoprotein does not undergo a cycle of oxidation and reduction in the course of its catalysis and therefore cannot act as an intermediate between reduced coenzyme and molecular oxygen. There is evidence that under physiological conditions flavoprotein catalyses the reaction between reduced coenzyme and molecular oxygen via the cytochromes.

Coenzyme factor is present in almost every animal tissue and in several micro-organisms[4]. Correspondingly the amount of the flavin-adenine dinucleotide, that is, the prosthetic group of this flavoprotein, is found to be proportional to the amount of coenzyme factor present in the various sources.

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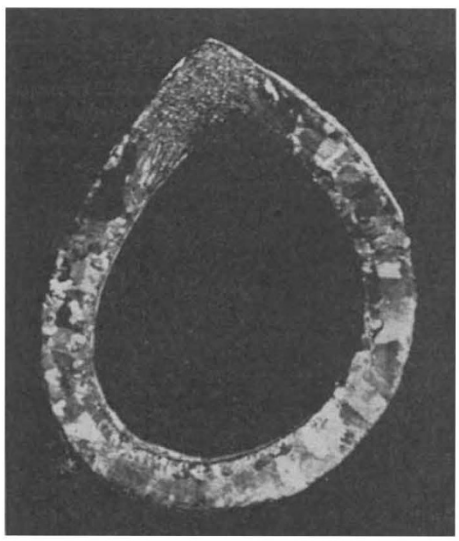
[1] Adler, Euler and Hellstrom, *Sr. Vet. Akad. Ark. Kemi*, 12, 1 (1937).
[2] Dewan and Green, *Biochem. J.*, 32, 626 (1938).
[3] Straub, NATURE, [143, 76 (1939)].
[4] Green and Dewan, *Biochem. J.*, 32, 1200 (1938).

A Roman Water Pipe

THE methods used by the Romans in making their lead water-pipes have been described in detail by Lanciani[1] and Gowland[2]. Briefly, a cast sheet of suitable width is bent around a former, so that the edges come together; the inside is then filled with sand, or similar material, a temporary dam is built on either side of the seam and the welding is effected autogenously by means of molten lead or, occasionally, solder. Cross-sections of pipes, when etched in the ordinary way, betray their mode of fabrication, the coarse, crystalline structure of the weld-metal being particularly noteworthy.



ROMAN LEAD WATER PIPE. MICROGRAPH, NATURAL SIZE.

A pipe from the Roman baths at Augst, near Basel, recently examined by me, was exceptional, in that the weld-metal was extremely fine-grained (see accompanying photograph). Its position and the sharpness of the junction with the pipe-metal seemed to preclude the idea that the fineness of grain was due to deformation of the metal, and this was confirmed by the observation that the fine grain persisted after melting and re-casting. On analysis, the weld-metal was found to contain 0·08 per cent of copper (tin absent) and the sheet- or pipe-metal, 0·11 per cent of copper and 0·06 per cent of tin.