described initially by Dr A. S. Dion and Dr G. J. Herbst (University of New Hampshire) in their work on the development of *Drosophila*. Dr J. R. Fresco (Princeton University) described the conversion of an inactive form of tRNA to an active configuration by three molecules of spermidine per molecule of the nucleic acid. Dr P. S. Leboy (University of Pennsylvania) indicated that polyamines could activate a tRNA methylase.

A developmental event involving an increase in RNA always parallels synthesis of spermidine. Dr A. Raina (University of Helsinki) and Dr S. H. Snyder (Johns Hopkins University) have shown that the early synthesis of spermidine and RNA in regenerating rat liver is anticipated by the specific stimulated synthesis of ornithine decarboxylase and of its product, putrescine. Dr A. E. Pegg (Courtauld Institute, London) and Dr H. G. Williams-Ashman (University of Chicago) have solved the problem of spermine synthesis by demonstrating a double-headed enzyme which decarboxylates S-adenosyl methionine in the presence of putrescine, and then transfers an aminopropyl moiety to putrescine and spermidine to form spermidine and spermine, respectively.

Dr C. M. Caldarera (University of Bologna) demonstrated similar correlations in embryonic systems. These enzymes are reported to have the shortest half lives (less than thirty minutes) of any described in mammalian tissues; this seems to relate to their rapid disappearance when rapid growth ceases. The finding that neither enzyme is produced in anucleolate *Xenopus laevis* suggests a possible integration of nucleolar function in the elaboration of both the ribosomal RNA necessary for growth and the polyamines tied to that RNA.

PROTEINS

Links in the Tissue

from a Correspondent

MEMBERS of the Collagen Club met on April 3 at the Meat Research Institute, Langford, to discuss the chemistry of the cross link in connective tissue proteins. In collagen and elastin intermolecular cross links in particular confer valuable physical properties. Dr S. M. Partridge (MRI) spoke about cross linkages in elastin. It was Partridge and his colleagues, of course, who in 1963 isolated the amino-acids desmosine and isodesmosine from hydrolysates of bovine ligamentum nuchae and, later, of aorta. On the basis of analytical data and electron microscopy, Partridge suggested that a suitable model for elastin was an arrangement of hydrophobic globular "pro-elastin" particles of mass 67,000, connected to each other by desmosine molecules. Such a model would account for results obtained by Dr D. P. Mukherjee (Massachusetts Institute of Technology), who has examined the visco-elastic properties of elastin. Dr S. O. Anderson (University of Cambridge) had studied heat changes of elastin on stretching and his findings could also be explained by Partridge's proposed particulate structure.

In spite of considerable differences in chemical composition and properties between elastin and collagen, Dr R. A. Grant (ARC Institute of Animal Physiology, Babraham) claimed evidence for similarities in the primary structure of these two proteins. When heat-shrunk collagen was treated with elastase and the released neutral peptides were subjected to fingerprinting, the pattern obtained resembled that of elastase-treated elastin, but was different from that of elastase-treated ovalbumin and of bovine serum albumin. Elastase-treated collagen α_1 and α_2 chains also gave similar patterns. Grant suggested that elastin and collagen contained certain common amino-acid sequences.

Although various interchain cross links have been postulated for collagen, those derived from lysine aldehyde are well established. Dr A. J. Bailey (MRI) provided evidence that this type of linking occurred intermolecularly. As in elastin, a lysine residue was first converted by amine oxidase to aldehyde. The aldehyde could react with a group of another residue suitably positioned to form an interchain cross link. Various cross links could therefore be produced, some of which were labile and would not survive hydrolysis conditions. If, however, they were reduced with borohydride the cross links were converted to stable derivatives. Hydrolysis followed by amino-acid analysis would reveal the presence of a new amino-acid derived from the reduced cross link, which if identified would provide evidence for the nature of the original cross link. If tritiated borohydride was used for reduction, measurement of radioactivity in the amino-acid chromatogram peaks would provide a measure of the number of residues involved in cross linking. As an example, the production of hydroxylysino-norleucine after reduction indicated that the native cross link was formed by a hydroxylysine-derived aldehyde condensing with an amino end group of a lysine side chain to form a Schiff base.

Dr L. J. Fowler (MRI) described experiments which could provide important information about the biosynthesis of lysine-derived cross links. In lathyritic animals, collagen has a deficiency of cross links when analysed by the procedure described by Bailey. However, when bone collagen from lathyritic chickens was incubated with extracts of healthy chicken tibia and femur, a large increase of lysine aldehyde-derived constituent was observed, presumably due to amine oxidase extracted from the normal tissues. Similar results were obtained when lathyritic pig collagen was incubated with extracts of normal pig tissue. This type of experiment could be used for examining inhibition or enhancement of amine oxidase activity.

When collagen is irradiated with ultraviolet light it fluoresces bluish white, and some think that this is due to cross links derived from tyrosine residues. Mr C. McDevitt spoke about his work with Dr W. G. Armstrong at the Royal Dental Hospital, directed at isolating and examining this fluorescent material. Starting from ox femur collagen, they fractionated the fluorescent material in alkaline hydrolysates, but it was not dityrosine (which is fluorescent and present in resilin) because it differed in spectral characteristics and chromatographic properties. Tyrosine was probably involved, however, because when rats were fed on radioactive tyrosine, the fluorescent fraction from their collagen was radioactive and resembled that from the ox femur. The latter seemed to contain acidic groups and its chemical properties and mass spectra suggested that it was a derivative (probably pyrophosphate) of thiamine. It was not possible at this stage to say whether the thiamine was covalently linked with the collagen, but it seemed to be fairly firmly bound.