ANZAAS

Pepping Up the Cow

from a Correspondent

AT one of the more significant intersection symposia at the ANZAAS Congress, which was held in Perth from August 13 to 17 (see also *Nature*, **244**, 534; 1973), the role of polyunsaturated fats in animal production and human nutrition was discussed. Local research in this field was given strong impetus by the development in 1967 by Dr K. Ferguson (CSIRO Division of Animal Physiology) of a method for protecting the essential amino acid methionine with formaldehyde in order to bypass the rumen of the sheep, thereby increasing the wool yield. This idea was later extended by Dr T. Scott of the same laboratory to protecting polyunsaturated fats in order to increase animal production generally.

At the ANZAAS Congress Dr Scott reported how this idea has now been developed to the point where the research and development activity for commercial application has become the largest such effort between government science and industry in Australian history. After world-wide competition, CSIRO granted licences on a world basis to a new combine, Dalgety–Agrilines Ltd, for a record fee in return for exclusive royalties. The process has been patented in many countries, and the Australians claim that there is no competition for its unique features.

The process depends on the microencapsulation of globules of lipids, 1 μm in diameter, from sunflower or safflower oil seeds, with monomolecular layers of protein. In sheep and cattle, the protein envelope remains stable in the rumen where the *p*H is approximately 6, but dissolves in the abomasum (the third stomach) where the *p*H is 2. In the abomasum, as the protein envelope comes off, the fat is absorbed by the duodenal mucosa and is carried away by the blood stream and lymphatic system to be metabolized normally. By this device, the rumen is bypassed; the hydrogenation process which usually converts the polyunsaturated portion of the fats in pasture grass in the animal's normal food into the saturated form is thus avoided (roughly 5% of pasture grass is fat, of which about 75% is polyunsaturated).

This process makes available to the animal up to 40% of the energy obtainable from the fats, which is otherwise obtained by the bacteria in the rumen: experiments have demonstrated increases in yields of milk, butterfat content in milk and growth rates of both cattle and sheep. Moreover, by using polyunsaturated fats, as in sunflower seeds, the milk and meat products from the animal show increases in the ratio of polyunsaturated to saturated fats. In meat, for example, there is a relative increase in linoleic acid, the polyunsaturated fat believed to have an important effect on serum cholesterol levels in the human blood. At ANZAAS, figures were quoted which showed that, after supplementing the normal food of cattle with 3 kg of protected lipid per day, for 40 days, the proportion of polyunsaturated fats in tissue fat increased from about 4% to 30%. With dairy cattle a similar effect on milk is noticeable within 3 days. Dr J. Wilson, the Technical Manager for the Australian branch of the international company which has a 3-year programme for testing and developing the process in Australia, New Zealand, the United Kingdom, the United States and Canada, told the congress that many scientific problems remain to be solved. The milk products, for example, are too easily oxidized, and optimum conditions have to be found for dairy processes such as pasteurization, curing and culturing.

The process of microencapsulation is simple and cheap to establish. A plant producing about 1 tonne per hour will cost about $A120,000. The whole oil seed is first crushed with water and 5% casein or other protein source in alkaline solution, and the mixture is homogenized in a colloid mill causing dispersion of the fat globules in the aqueous phase. The third stage involves treatment with a small amount of formaldehyde which causes the protein matrix surrounding each fat globule to shrink and harden. Finally, the material is flash dried.

Conflicting evidence was presented to the congress about the medical effects of polyunsaturated foods. Dr P. Nestel (Clinical Science Department, Australian National University) reported evidence that lowering of serum cholesterol reduces the risks of arteriosclerotic heart disease. Headlines in the popular press were, however, generated by a pathologist at the same university, Dr C. West, who questioned the safety of polyunsaturated foods; he claimed that tests in the United States had shown that a person on such a diet suffers increased risk of gallstones and cancer. This claim was contested by Drs Wilson and Nestel who said that it was not new, was not based on sound evidence, and referred to the benzpyrenes and polycyclic hydrocarbons found in vegetable oils and not to polyunsaturated fats such as the ones described here.

New Copper Process

Another promising industrial process was reported to the congress by Dr A. J. Parker (Australian National University) who has recently been appointed Foundation Professor of Chemistry at the new Murdoch University in Western Australia from 1974. In his Liversidge Lecture (in memory of a pioneer Australian chemist), Dr Parker described how

Polymerases Galore

NATURE, both in reality and its journalistic reflexions, of late, it seems, abounds in DNA polymerases. The role of DNA polymerase I is the topic of a communication by Goebel and Schrempf in *Nature New Biology* next Wednesday (September 12); in the issue for August 22 Masker and Hanawalt (*Nature New Biology*, **244**, 242; 1973) discussed the excision repair function of DNA polymerase II and Youngs and Smith (*ibid.*, 240) a similar function of DNA polymerase III.

Goebel and Schrempf exploited a mutant of *Escherichia coli* which contains a temperature sensitive DNA polymerase I. Their technique was to examine the sensitivity of supercoiled DNA of colicinogenic factor E implanted in the mutant to RNA-degrading conditions (ribonuclease and alkali) after pulse-labelling and chasing with tritiated thymidine for varying lengths of time at a permissive temperature (30° C) and at a temperature (43° C) that inactivates the DNA polymerase I both *in vivo* and *in vitro*. The supercoiled DNA of the mutant, pulse-labelled at either temperature, is partially sensitive (converted to the "relaxed" or open circular form) to RNA-degrading conditions. After chase, however, a smaller proportion of the DNA purified from the sample incubated at the lower temperature is affected by such treatment. Supercoiled DNA in the parent strain grown at either 30° or 43° C is almost completely resistant to RNA-degrading conditions. Only the small fraction of RNA-containing nascent supercoiled DNA from the parent strain is sensitive, as detected by pulse-labelling the RNA.

Goebel and Schrempf suggest that DNA polymerase I is responsible for excision of RNA involved briefly in the origin of DNA replication and subsequently replaced by DNA (see *Nature*, **244**, 483; 1973). Their interpretation is consistent with the known exonucleolytic activities of DNA polymerase I. Once the RNA is excised DNA polymerase I also apparently repairs the gap, now in its synthetic functional mode. Unpublished data obtained by the same authors are cited to suggest that polymerase I may synthesize the whole of Col E_1 DNA, unassisted by either DNA polymerase II or III. This role is normally attributed to DNA polymerase III.