reaction and are fibrotic and necrotizing; and (3) haemosiderin-like granules which have been identified as a mixture of iron oxides and hydroxides.

Titanium has been positively identified at levels in excess of 2,000 p.p.m. in the tissues around some titanium implants. Particles of cobalt-chromium and carbides from the alloy are found in macrophages near cobalt-chromium prostheses. A granulomatous reaction associated with very minute particles near cobalt-chromium total joint replacements was described. The severity of the local tissue reaction depends on the size, shape, chemical nature and particularly on the number of particles present. The otherwise unexplained pain which some patients with prostheses suffer may be related to these foreign-body tissue reactions.

Research is being pursued into the fabrication of materials into which bone will grow and lock the implant into the skeleton. Porous ceramics, titanium, polythene and various forms of pyrolytic carbon are being investigated. Special techniques which have been developed for the histological study of these hard materials were described by Dr J. J. Klawitter (Clemson University).

Dr S. F. Hulbert (Clemson University) and his colleagues have established that the minimum size of interconnecting pores for the ingrowth of bone into calcium aluminate ceramic pellets is 40–100 μm and the material appears to be well tolerated by the tissues. Dr G. D. Winter said that 50 μm was the critical pore size for the induction of heterotopic bone in certain synthetic sponges in the skin of the pig.

Dr L. L. Hench (University of Florida) demonstrated that a cementoid layer forms between surface active glass and glass–ceramic implants and healing bone bonding the two together. The glass surface is purposefully formulated to release sodium, calcium, phosphate and silicon ions. Collagen fibres become incorporated within the 600–1,000 Å cementoid layer and mineralization occurs. In rats, after 28 weeks, the bone to implant bond is stronger in torsion than the bone itself.

A recent report of the clinical use of induced electrical fields to heal a congenital pseudarthrosis of the tibia has stimulated renewed interest in electrical phenomena in tissues. With commendable enthusiasm Dr R. O. Becker (Veterans Administration Hospital, Syracuse) sees the electrical stimulation of hard tissue growth as an alternative to prosthetic devices and he reported success with rabbits in obtaining new growth of articular cartilage over defects on the femoral condyle by implanting bimetallic electrogenic devices.

Next year's symposium will be about the selection of materials for reconstructive surgery.

FEBS

New Foods

from a Correspondent

At the special meeting of the Federation of European Biochemistry Societies (FEBS) in Dublin between April 15 and 19 (see also this week's issue of *Nature New Biology*, **243**, 130; 1973), one of the most interesting contributions was the description by Drs J. F. Connolly (The Agricultural Institute, Dublin), M. Noonan and Professor M. G. Harrington (University College, Dublin) of a physiological mechanism for producing a polyunsaturated lamb chop.

In the body fat of all ruminants (for example, cows and sheep) there is a relatively high concentration of saturated fatty acids which result in part from the hydrogenation of unsaturated fatty acids by microorganisms in the rumen. By bypassing the rumen it might be possible to avoid hydrogenation and produce special products suitable for patients being treated for coronary heart disease — containing polyunsaturated fatty acids. Indeed in 1961 Ogilvie *et al.* (*Nature*, **190**, 725) avoided the rumen by administering fatty acids directly into the abomasum (or small intestine), and in 1970 a similar result was obtained in Australia by Cook *et al* (*Nature*, **228**, 178) who fed cows with specially coated seeds as dietary supplements that were rich in polyunsaturates. It was thus possible to produce milk with a high level of such fats and it has been shown that diets containing these products can lower the blood cholesterol.

Dr Connolly and his colleagues exploited a physiological mechanism (the oesophagal groove reflex feeding system (see Ørskov and Benzie, *Brit. J. Nutr.*, **23**, 415; and Lawlor *et al.*, *loc. cit.*, **26**, 439; 1971) by which the suckling ruminant automatically passes food beyond the rumen) to feed lambs substitute diets rich in polyunsaturated fatty acids. A special milk substitute high in linoleic acid was used. The lambs were killed at 36 kg and analyses showed that the body fats of the animals fed the special diet contained ten times as much polyunsaturated fatty acid as the control lambs. Muscle lipids showed a similar trend. It is not without interest that cutlets prepared from these "polyunsaturated lambs" were indistinguishable from those of lambs fed in the orthodox way. The availability of such lambs is commercially feasible so that it should be possible now to formulate special diets aimed at lowering the levels of blood lipids in man. At present only a very limited range of natural appetizing foods are available to patients on cholesterol-reducing diets. Dr Connolly and his colleagues have now begun experiments to produce a veal type calf using a similar feeding system.

Turning from fats to proteins, Professor A. Spicer (The Lord Rank Research Centre, High Wycombe) may well have raised the price of beef in Dublin with his well founded prediction "no beef by 2000". The trouble was that cattle are

New Variant for the Haemoglobin Collection

An interesting new abnormal haemoglobin, with a functional defect, is described by Bromberg *et al.* in *Nature New Biology* next Wednesday (June 6). It has been termed haemoglobin Little Rock (LR), and is unique among the variants so far studied in that it has an anomalously high oxygen affinity without any accompanying diminution in the haem–haem interaction, or any change in the Bohr effect.

A fingerprint analysis establishes that the substitution is glutamine for histidine at position 143 in the β-chains. This is known from X-ray work to be part of the binding site for the cofactor, 2,3-diphosphoglycerate. In the haemolysate the oxygen affinity of haemoglobin LR is greater by a factor of three than that of normal haemoglobin in the adult human.

This difference is not eliminated when the cofactor is stripped off, although the effect of diphosphoglycerate in displacing the oxygen binding curve is appreciably lower than in the normal protein. Evidently, therefore, the affinity for the cofactor is decreased as a result of the substitution by a factor estimated as about 2.5. This effect cannot, however, explain the difference in oxygen affinity.

In an accompanying note, Perutz reports on the consequences of the substitution in terms of the molecular model of haemoglobin. The normal his-143 is not engaged in any interaction with other side chains in either the oxy or the deoxy form, though it does make contact with the cofactor when this is present. A glutamine in the same position in the oxy form is so placed as to make a hydrogen bond with asn-139 in the other β-chain. On deoxygenation, the relative displacement of the β-chains would lead to rupture of these bonds. Thus the oxy-structure in haemoglobin LR is stabilized by the extra hydrogen bonds, and in addition the interaction with the diphosphoglycerate in the deoxy form is weakened because a salt bridge is missing in either β-chain.

Perutz predicts on the basis of these inferences that the dissociation of tetramer to dimer should be inhibited in the liganded forms of haemoglobin LR, and that in the absence of cofactor the increased oxygen affinity should be associated chiefly with a change in the association constant, K_4, for attachment of the last oxygen to the tetramer.