countered by the pre-implantation blastocyst was stressed by Drs H. M. Beier (Marburg, Germany) and J. C. Daniel (Colorado). They have shown that during this phase the intrauterine fluid in the rabbit has a high protein content, partly derived from the maternal plasma and partly from the endometrium itself. Among the specific fractions is a glycoprotein ("uteroglobin" or "blastokinin") which is present in intrauterine and blastocoelic fluid and may promote embryonic growth. No comparable fraction has so far been isolated from human uterine secretions.

The complex system of cellular interactions between the first stage of "induction" and the fully differentiated tissue may soon come into closer focus. This was the implication in the contribution from Professor H. Tiedemann (Berlin) who described the isolation of a protein fraction from chicken embryo which can induce the formation of endoderm and mesoderm in amphibians, but which is counterbalanced by an inhibitor, an acidic protein. The study suggests that transcription of RNA is involved in differentiation and that hormones may take part in the later morphogenetic stages.

PROTEINS

Primordial Muscle

from our Molecular Biology Correspondent

THE presence of contractile protein systems in such nondescript objects as amoebae and slime moulds, not to say in fibroblasts and leucocytes, is now well established. In several cases actin-like and myosin-like proteins have been dredged from the cytoplasm, and it has been conjectured that something very akin to muscular contraction may underlie the process of cytoplasmic streaming, which is the basis of the lethargic locomotion of which these organisms are capable.

The properties of the myosin from a slime mould, previously isolated by Hatano and his colleagues, have been studied recently by Hatano and Ohnuma (*Biochim. Biophys. Acta*, **205**, 110; 1970). In agreement with Adelman and Taylor (*Biochemistry*, **8**, 4976; 1969), they find that the protein has a sedimentation coefficient little different from that of rabbit muscle myosin. The viscosity, however, though high, is considerably less than that of muscle myosin, and it is inferred that the presumed rod-like part of the molecule is either shorter or more flexible. The most distinctive difference between the two proteins, as Adelman and Taylor also noted, is that when the salt concentration is reduced no filaments are formed; instead some low aggregates, up to perhaps the tetramer, can be discerned in the ultracentrifuge. The amino-acid compositions are very similar, with the notable exception that cysteine, of which there are enzymatically vital residues in rabbit myosin, is absent in the slime mould protein. The ATPase activities, according to Hatano and Ohnuma, are comparable, but Adelman and Taylor find three times higher activity in the slime mould enzyme. There is also disagreement about the effect of magnesium, which Hatano and Ohnuma say inhibits the ATPase, but which Adelman and Taylor say does not.

The broad parallel between the actomyosin of vertebrate muscle and the putative contractile system of the slime mould has been placed on a much surer footing by two new studies with the electron microscope. Nachmias, Huxley and Kessler (*J. Mol. Biol.*, **50**, 83; 1970) have shown that the actomyosin of this creature occurs as long filaments, some 50 Å thick, looking very like actin, and bearing at intervals formations of the characteristic arrowhead shape seen in mixtures of authentic F-actin and myosin. There are also thin fibres, joining the filaments at irregular intervals. When ATP was added all the attached bodies were released, leaving isolated filaments with the beaded structure of actin. Preparations of the actin-like protein had a thickness of 40–50 Å, which is less than that in muscle actin, and a 360 Å periodicity. The most striking feature of this work is the appearance of indubitable, though somewhat irregular, arrowhead structures on addition of rabbit myosin subfragment-1 (the isolated globular heads). That the slime mould actin reacts with mammalian myosin was inferred some time ago, but the present results show that the mode of interaction is the same as in muscle, and that the binding sites of the actin—both for myosin and for its own neighbours—have been conserved throughout evolution.

A parallel study, this time on an amoeba, accompanies this paper (Pollard *et al.*, *ibid.*, 91). The actin again appears as beaded filaments, some 60 Å in diameter, and in some of the pictures the twisted double helical structure can be made out, with a period of 370 Å. When the actin was mixed with rabbit heavy meromyosin (myosin with a proteolytically truncated shaft), good regular arrowheads were seen at intervals of 370 Å along the filament. A similar appearance is presented by the filaments of the intact cell on addition of heavy meromyosin, these measuring moreover about 80 Å across, just like the thin filaments of rabbit muscle. It thus seems that in spite of some obvious differences in the myosins, the mechanochemistry of these primitive cells is indeed closely related to that of muscle, and that different systems of motion evolved from a common precursor.

NITROGEN FIXATION

Proteins and Associations

from a Correspondent

ANOTHER step forward in the understanding of biological nitrogen fixation has been the recent isolation of the second protein associated with nitrogenase, the enzyme complex involved in this process. Nitrogenase consists of two protein components, no matter from what organism it is isolated. L. E. Mortenson's team at Purdue University obtained the first almost homogenous preparation of one of these—the oxygen-sensitive, non-haem iron protein from *Clostridium pasteurianum*—90 to 95 per cent pure. It had a molecular weight of 40,000 and contained two iron atoms and two labile sulphur atoms per molecule (*Biochim. Biophys. Acta*, **172**, 106; 1969). The second protein associated with nitrogenase is not particularly oxygen-sensitive; it has been known for some years to contain molybdenum as well as iron and labile sulphur, but it has been difficult to purify because of its disposition to aggregate and disaggregate. A signifi-