The most interesting protein to be isolated from a membrane is, however, that described by Neville (*Biochem. Biophys. Res. Commun.*, **34**, 60; 1969). It is extracted from liver cell plasma membranes from several animals. The protein from rat liver has been obtained in pure state, and its circular dichroism has been determined in aqueous solution. The curve is precisely that of an α -helix. Hydrodynamic data are quoted which indicate that the structure is a rod of length 700–1100 Å, and it is clearly strikingly reminiscent of the α -helical muscle proteins, such as paramyosin. This is an intriguing result which leaves much obvious scope for diverting speculation.

MEDICAL BIOCHEMISTRY

The Adaptable Heart

from our Medical Biochemistry Correspondent

THERE is much to suggest that there is no significant difference in the uptake of oxygen and oxidizable substrates in normal and failing human hearts, although there was some evidence of increased glycolysis in failing hearts. Biochemical abnormalities were thought to lie in the energy-using rather than the energy-providing reactions.

It is therefore rather surprising that Ballo and Messer (*Biochem. Biophys. Res. Commun.*, **33**, 487; 1968) have now shown that there is a change in the lactate dehydrogenase (LDH) isoenzymes in human hearts which have a decreased blood supply. Earlier last year Mager *et al.* (*Amer. J. Physiol.*, **215**, 8; 1968) had shown that adult rats exposed to conditions of low oxygen pressure had a greater proportion of M chains in their heart LDH isozymes. In muscle, anaerobic glycolysis is an important source of energy and the M (muscle) chains of LDH are much less sensitive to inhibition by pyruvate than the H chains found in the heart (the heart normally derives most of its energy from the aerobic reactions of oxidative phosphorylation). The change in the proportion of isozymes containing M chains was therefore probably an adaptive change enabling the heart to derive more energy from glycolysis in conditions of oxygen deficiency. This was further supported by their demonstration that newborn rats (whose hearts normally have isozymes containing a greater proportion of M chains than the adult rat) took much longer to produce the adult isozyme pattern when they were reared in conditions of oxygen deficiency.

Ballo and Messer investigated the isozymes of autopsy samples of human hearts and found that newborn hearts contained a greater proportion of isozymes with several M chains than normal adult hearts. Muscle taken from enlarged hearts (which also had evidence of decreased blood supply resulting from infarction or coronary artery narrowing) contained a greater percentage of M chains (35 ± 10) than normal hearts (15 ± 5) or hearts which showed only one morphological change (15 ± 5); the percentage of M chains in newborn hearts was 45 ± 10 . Even more impressive was their demonstration of a significant difference in the behaviour of heart homogenates in the presence of low and high concentrations of pyruvate. The LDH activity at high concentrations of pyruvate in normal hearts was only 30 ± 1.1 per cent of the activity at lower pyruvate concentrations; for the

hypertrophied hearts with decreased blood supply the percentage was 40.1 ± 3.7 , while for newborn hearts it was 42.8 ± 4.3 . This shows that there is a change in LDH isozymes towards the muscle pattern in two conditions in which the oxygen supply to the heart may at times be subnormal. The reduction in pyruvate inhibition suggests that the failing heart is more dependent on glycolytic energy than the normal heart. The energy-supplying reactions of the heart are changed and may make the heart more susceptible to adverse conditions.

NEUROPHYSIOLOGY

Unanaesthetized Cerebellum

from our Neurophysiology Correspondent

ECCLES and his collaborators have recently produced a fairly coherent picture of cerebellar function (Eccles, Ito and Szentágothai, *The Cerebellum as a Neuronal Machine*, Springer, New York; 1967). In their view the cerebellum makes continual short-term adjustments to the outflow from higher motor neurones, with the effect that "commanded" movements can be attained with an interposed allowance for initial conditions of limb position and velocity. In their model the cerebellum is essentially without memory, all traces of a stimulus having disappeared within about 100 ms. This immediately raises the question of the effects of anaesthesia: Clark (*J. Neurophysiol.*, **2**, 19; 1938) showed that it was possible to produce prolonged, repeatable, sequences of movements by stimulating the cerebellar cortex of unrestrained cats, and many authors since then have questioned the propriety of using anaesthetized preparations in any investigations of central nervous function.

Bloedel and Roberts (*J. Neurophysiol.*, **32**, 75; 1969) have now published recordings from the cerebella of unanaesthetized cats "decerebrated" by surgical section either at the mid-collicular or at the C-1 spinal level. Cerebellar Purkinje cells are invaded antidromically after electrical stimulation deep in the white matter; in Eccles's preparations this invasion is effectively inhibited by earlier stimulation of the cerebellar surface. The inhibition is attributed to basket cells—surrounded by a network of fibrils formed by the axis of another cell—excited by parallel fibre activation. In unanaesthetized cats Bloedel and Roberts found no such inhibition. They showed convincingly the development of inhibition after administration of pentobarbital, but no inhibition in the same preparation before anaesthesia. Furthermore, they have shown that in the unanaesthetized preparation surface stimulation has a slight facilitatory effect on antidromic invasion. This is greatest about 35 ms after the surface stimulus. The facilitation spreads laterally, as does inhibition in the anaesthetized cat. Another profound difference between the two preparations is the much higher spontaneous activity of Purkinje cells in the unanaesthetized cerebellum. This is correlated with a greater responsiveness to local stimulation which may produce trains of impulses from Purkinje cells. The authors suggest that the higher rate of spontaneous firing provides a basis for the difference between the two states. Axon collaterals from the Purkinje cells are known to exert an inhibitory effect on neighbouring basket cells, so that a tonic inhibition