In the forebrain the concentration of total gangliosides expressed as *N*-acetylneuraminic acid rose sharply during the latter part of gestation to a peak value at birth. A subsequent fall to 9 weeks of age was followed by a rise to an almost mature value at 20 weeks. In the cerebellum the highest concentration was at 7 weeks of age, with a subsequent fall from 9 weeks to a near mature value at 20 weeks. In the brain stem a slight rise in concentration during the latter part of gestation was followed by a fall to, again, a near mature value at 20 weeks.

When expressed as amounts per brain part, the amount of *N*-acetylneuraminic acid in the forebrain rose during the foetal stages, remained almost constant during the first 9 weeks of postnatal life and subsequently rose to a near adult value by 20 weeks. The amount of *N*-acetylneuraminic acid per cerebellum rose rapidly to reach an almost adult value at 9 weeks after birth. In the brain stem the greatest rise was before birth and the adult amount was present by 7 weeks.

In each part of the brain the percentage distribution of the four major gangliosides had the mature pattern at birth.

The developmental pattern of the gangliosides in the brain of the pig will be compared with that in the rat (Dickerson & Merat, 1971) and with that of other constituents in the pig (Dickerson & Dobbing, 1966). The relationship of the developmental changes to the effects of malnutrition will be discussed.

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Compartmental Analysis of the Distribution of Cholesterol in the Isolated Perfused Rat Liver

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The rate of cholesterol turnover has been described as conforming to a two-compartmental system consisting of one pool that turns over rapidly and a second pool with a low turnover rate (Goodman & Noble, 1968). The pool with the higher turnover rate is associated with the blood, liver and intestine. We have performed experiments with the isolated perfused rat liver preparation to examine transfer rates of cholesterol between whole blood, liver and bile.

Livers from rats of the Wistar strain were perfused by a method essentially as described by

Percy-Robb & Boyd (1970). The liver cholesterol was labelled by adding a single pulse of DL-[¹⁴C₂]-mevalonate to the perfusate and the time-course of the rates of appearance of radioactive cholesterol in erythrocytes, plasma, liver and bile were determined. Model simulation was performed on an EAL PACE TR48 analogue computer and estimates of the transfer rates were determined by 'eye-fit' of the experimental results to the simulated curves displayed on a trace oscilloscope.

On a theoretical basis there are at least six compartments in this system, namely plasma esterified and unesterified cholesterol, liver esterified and unesterified cholesterol, and cholesterol in erythrocytes and bile. The system is, however, probably more complex, since individual pools of cholesterol may exist in different lipoprotein classes (Roheim, Haft, Gidez, White & Eder, 1963). We have fragmented the model to determine transfer rates in a closed plasma and erythrocyte system and applied these rates to the larger model. The larger transfer rates (min⁻¹) were associated with the exchange between plasma unesterified and plasma esterified cholesterol, and between plasma unesterified and erythrocyte cholesterol, these being an order of magnitude greater than the lowest rates of exchange between liver unesterified and plasma unesterified cholesterol and between liver unesterified and liver ester cholesterol. The unidirectional flow of cholesterol into the bile has a very low transfer rate when cholesterol is considered alone, but is much larger if one considers the transfer in the form of bile acids (Kay & Entenman, 1961; Percy-Robb & Boyd, 1970).

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Optical-Rotatory-Dispersion Studies of Steroid Molecules in Liposomes and Erythrocyte Membranes

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The natural cholesterol of animal cellular membranes can be replaced to a considerable extent with other steroids by allowing an exchange to occur between the membrane and liposomes containing

the steroid (Bruckdorfer, Graham & Green, 1968). To obtain information on the binding of sterol molecules in natural membranes and lipid bilayers, this process has been used to introduce steroids containing a probe group in different parts of the molecule into liposomes and erythrocyte membranes. The $\alpha\beta$ -unsaturated oxo group can be introduced into the steroid skeleton at various points with relatively small effects on their general shape and conformation. The $n-\pi^*$ transition of this chromophore has a Cotton effect at about 350 nm that is solvent-sensitive and can be used to assess the nature of the environment in which it is located.

Optical-rotatory-dispersion curves of 4,6-cholestadien-3-one (I), 3-hydroxy-3-cholesten-2-one (II), 3-hydroxy-5-cholesten-7-one (III) and 3-hydroxy-5,8(14)-cholestadien-15-one (IV) were recorded in a number of solvents of different polarity over the range 290–520 nm. Each was then dispersed with egg lecithin (phosphatidylcholine) in water to form liposomes. These were sonicated, centrifuged and filtered through a 450 nm membrane filter to give optically clear preparations. The dispersions contained the following molar proportions of steroid to lecithin: compound (I), 1:1; compound (II), 0.64:1; compound (III), 1:1; compound (IV), 0.57:1. Electron micrographs of negatively stained preparations showed the typical liposome structure (Bangham & Horne, 1964). Optical-rotatory-dispersion curves were recorded for each dispersion, and it was found that for compounds (I) and (II) the curves resembled those obtained in polar solvents such as ethanol; for compound (III) the curve resembled that obtained in a less-polar solvent such as triethyl phosphate, and for compound (IV) the curve resembled that obtained in non-polar solvents such as cyclohexane.

Erythrocyte 'ghosts' and liposomes were incubated together for 16 h. Compound (II) did not exchange at all with membrane cholesterol, but the others replaced 50–80% of the endogenous sterol. After sonication, centrifugation and filtration the optical-rotatory-dispersion curves were recorded. Some spectral shifts occurred because of light-scattering, but the curves were very similar to those given by the liposomes. Osmotic studies on whole erythrocytes containing the test steroids showed that they were no more fragile than the controls, so incorporation of the steroid molecules apparently caused no significant distortion of the membrane structure.

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Aggregated States of Chromatophore Membrane Protein from *Rhodospseudomonas spheroides*

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We are interested in the structure and physico-chemical properties of the membrane proteins of photosynthetic organelles. Previous studies (Lees, Mapp, Redmond & Rogers, 1970; Keylock, Kirk & Rogers, 1970) have reported results for chloroplast thylakoid proteins from *Phaseolus vulgaris* and *Euglena gracilis* respectively, and the investigations reported in the present communication concern similar studies on chromatophore membrane protein from *Rhodospseudomonas spheroides* N.C.I.B. 8253.

Pigmented organisms were grown anaerobically in the light in the medium S described by Lascelles (1956). Harvested cells were disrupted in the French pressure cell, and chromatophores were isolated by sucrose-density-gradient centrifugation (Gorchein, Neuberger & Tait, 1968). Chromatophores were ruptured by ultrasonication and washed extensively with water to remove soluble components. Subsequent acetone precipitation and repeated washing with acetone and finally ether yielded the insoluble, virtually lipid-free, preparation termed chromatophore membrane protein.

This protein, dissolved in buffers containing sodium dodecyl sulphate, migrated as a single symmetrical boundary in sedimentation-velocity studies in the analytical ultracentrifuge. However, under various conditions of protein and sodium dodecyl sulphate concentration and buffer composition the single boundary differed in sedimentation coefficient. For example, in 0.1% sodium dodecyl sulphate the sedimentation pattern was characteristic of dissociation of aggregated species to smaller subunits. Above protein concentrations of 4.0 mg/ml the extrapolated $s_{20,w}^0$ value was in the range 6–7 S, whereas below this protein concentration values extrapolated to intercept the $s_{20,w}^0$ axis at 3.3 S. Irreversible dissociation to the 3.3 S species could be achieved by treatment for a short time with 6 M-urea.

In higher (1.0%) sodium dodecyl sulphate concentrations the membrane protein migrated at approx. 1.6 S at protein concentrations greater than 4.0 mg/ml. Below this concentration sedimentation coefficients decreased with protein concentration to a value (0.8–1.0 S) characteristic of sodium dodecyl sulphate micelles.

These findings are similar to those obtained for chloroplast thylakoid proteins from *E. gracilis* (Keylock *et al.* 1970) and barley (W. J. Owen, D. N. Lees, A. Perry & L. J. Rogers, unpublished