Paediatric Research Society

18th Meeting, St. Mary's Hospital, Manchester, 26 and 27 March 1971

The respiratory jacket: a method for measuring static compliance in conscious children. A. D. Milner (*introduced by David Hull*) (*Institute of Child Health, London*). The methods currently available for measurements of static lung compliance in adults are difficult and have not been attempted with children.

Values for dynamic compliance in health and disease have been published but, unfortunately for the clinician, are least reliable in the presence of increased airways resistance.

A method for measuring static compliance in conscious children was described. The thoracic volume changes produced by connecting a child, by a mouth-piece, to a reverse plethysmograph, which acts as a pressure reservoir (Volume 1500 l.), are measured from the pressure changes produced in a respiratory jacket. The measurements are made after a period of voluntary overbreathing.

Early fed prematures: relation between fluid balance and weight change during first 4 days of life. Alan I. Murdock (*introduced by J. W. Scopes*) (*Nuffield Neonatal Research Unit, Hammersmith Hospital, London*). Fluid balance was determined on 9 healthy premature infants by measuring intake, urine output, stool H₂O output, and evaporative water loss. The babies were nursed in incubators and received milk (63 Kcal/100 ml) at daily rates of 60, 90, 120, and 150 ml/kg birthweight for the first 4 days of life. Their birthweights ranged from 1140 to 2690 g (mean 1894 g). The mean daily intake over the 4-day period was 105 ml/kg day (range 99 to 120 ml/kg day).

A consistent pattern of daily fluid balance occurred regardless of birthweight. The results indicated a negative fluid balance on the 2nd day that was repaired by the end of the fourth day. The mean loss in birthweight at age 96 hours was -18 g/kg. The difference between weight loss and fluid balance represented solid excretion in the stools primarily. The change in weight (g/kg per day) correlated strongly with fluid balance (ml/kg per day), ($r = 0.979$, $p > 0.001$). Thus when a baby gains (or loses weight), the gain (or loss) of fluid and solid substance can be reliably estimated from the change in weight, using the equation: Fluid balance = $5.9 \pm$ change in weight.

Study of altered behaviour patterns in children with coeliac disease. D. N. Challacombe and M. J. MacCulloch (*introduced by R. H. R. White*) (*Institute of Child Health, University of Birmingham*). This paper

describes a preliminary study of mood and movement patterns in children with coeliac disease, and the changes in these patterns in response to a gluten-free diet.

The depressed mood of children with this disorder has been frequently noted in the literature, but less well documented is the reduction of muscle tone, leading to restricted voluntary movements. These physical signs are often rapidly alleviated by a gluten-free diet.

By studying the behaviour of our patients and controls using ethological techniques we are beginning to define the changes in facial expression and bodily movement. At the same time by using an electronic floor area activated by movement we have also been able to quantitate some of our observations.

Plasma citrate levels during exchange transfusion. F. Harris and J. A. Black (*Department Child Health, University of Sheffield*). The unpredictable clinical deterioration occurring in newborn infants undergoing exchange transfusions has prompted another look at plasma citrate levels during the procedure. 17 infants requiring 20 exchange transfusions had serial estimations of plasma citrate during the procedure. Very high levels of plasma citrate were found and these levels correlated best with the age of the infant at the time of the transfusion. Because of the small number of infants no meaningful correlation between plasma citrate levels and clinical deterioration could be determined.

Permanent deficit of neurones in cerebral and cerebellar cortex following early mild under-nutrition. John Dobbing and J. W. Hopewell (*introduced by J. A. Davis*) (*Department of Child Health, University of Manchester, and Radiobiology Laboratory, The Churchill Hospital, Oxford*). In a search for lasting effects of early undernutrition on the developing brain, extensive use has been made of varying the litter size of rats at birth to produce growth retardation in the first three postnatal weeks. Many of the irrecoverable effects on brain as well as bodily growth are now well known. The former have been attributed to vulnerability of the developing brain in relation to its 'growth spurt', which coincides with the suckling period in the rat.

The present paper is a preliminary report of histological evidence of specific neuronal deficits in certain areas of cerebral and cerebellar cortex in rehabilitated adult animals previously growth retarded. Quantitative histology and area measurements by planimetry have

shown a shortage of postnatally dividing microneurons in the cerebellar granular layer and other neurones in the deeper layers of the cerebral cortex. The deficit is particularly surprising in view of the comparatively mild growth retardation imposed during the brain's vulnerable period of development. The comparable period of human brain growth extends from about 30 weeks of gestation into the second year of postnatal life. Behavioural correlates in the experimental animal were also discussed.

From mouse to man? R. D. Barnes (*Division of Infant Development, Clinical Research Centre, Northwick Park, Harrow*). The techniques of ovum transplantation and ovum fusion are described since these have been successfully used to investigate various diseases in mice. Ovum transplantation allows the transfer of one fertilized egg to an animal of another strain and is a very useful technique to investigate the role of transplacental infection in any disease. Secondly, ovum fusion derived chimaeras provide an excellent experimental model to investigate the interrelation between two cell populations in the same animal. Furthermore, in this respect ovum fusion allows us to investigate the hypothesis that certain diseases in mice, including autoimmune haemolytic anaemia and leukaemia, occur due to the time-related failure of what might be considered a normal recognition and inhibition control process, and evidence for this is presented.

Finally, the modification and further sophistication of *in utero* grafting techniques might, in the event of proving useful in curing certain defined diseases in mice, suggest that these techniques could subsequently apply to man. However, this must await full investigation in animals, and furthermore, the development of suitable techniques for antenatal diagnosis of affected children.

Coagulopathy in the hypoxic newborn baby. M. A. Chadd (*introduced by O. P. Gray*) (*Department of Child Health, Welsh National School of Medicine*). It is well established that coagulation defects and haemorrhage may result in death in the perinatal period.

Classical haemorrhagic disease as first described in the 1800s by Townsend is now of almost academic interest with the decline in breast feeding and the increased use of vitamin K in neonatal nurseries.

The concept of secondary haemorrhagic disease first proposed by Aballi and de Lamerens 10 years ago is recognized as becoming of increasing importance. It is frequently found in association with hypoxia and is unresponsive to vitamin K.

This study of 75 hypoxic newborn and 75 control infants was undertaken in an attempt to elucidate the nature and incidence of coagulation defects in the newborn and the role of hypoxia in producing such defects.

Brain oedema induced by asphyxia in newborn rats. S. W. D'Souza (*introduced by J. A. Davis*) (*Department of Child Health, University of Manchester*). Using 5-day-old rats an attempt has been made to

induce brain oedema experimentally with asphyxia as the precipitating insult.

Changes in brain water, sodium, and potassium content can be induced by slow prolonged asphyxia at body temperature and to a lesser extent in the cold, but not by acute anoxia. These changes are more marked in the brainstem than in the hemispheres.

Plasma growth hormone response to intravenous glucagon administration. L. Stimmler and G. Snodgrass (*Guy's Hospital, London*). Glucagon administration has been shown to stimulate growth hormone secretion. In a previous study sampling times were delayed, whereas it is known that glucagon produces a very rapid rise in plasma insulin.

Glucagon 15 µg/kg body weight was administered intravenously to a group of 24 children being investigated for abnormally short stature. Blood samples were obtained immediately before and at frequent intervals after glucagon administration. 20 of these children showed a marked rise in growth hormone levels. In 14 of these patients a significant rise had already occurred at 2 minutes after glucagon administration. The time of peak growth hormone response occurred before 20 minutes in 17 of these patients. Insulin and glucose levels were also estimated. The interrelation between these parameters and the growth hormone response was discussed.

Insulin release from human fetal pancreas in vitro. R. D. G. Milner and M. A. Ashworth (*Department of Child Health, University of Manchester*). Pieces of pancreas removed from dead human fetuses delivered by hysterotomy were incubated *in vitro* as described previously for rabbit pancreas. The gestational age of the fetuses studied was between 14 and 24 weeks and their body weights ranged from 50 to 625 g. Insulin released into the incubation medium was measured under basal conditions and in the presence of various substances known to stimulate insulin secretion in adult man and other species. Glucose (3.0 mg/ml) did not stimulate insulin release. Stimuli which are thought to act by raising intracellular levels of cyclic AMP: glucagon (5 µg/ml), theophylline (1 mM), and dibutyl cyclic AMP (1 mM) stimulated insulin release in the presence of 0.6 or 3.0 mg/ml glucose or in its absence. Ionic stimuli which act late in the stimulus-secretion pathway were also uniformly effective: barium (2.54 mM), ouabain (10⁻⁵ M) and potassium (60 mM). Leucine (5 mM) and arginine (5 mM) were effective in some experiments only. Tolbutamide (400 µg/ml) was ineffective in two experiments.

It was concluded that cells capable of secreting insulin are present in human fetal pancreas from the 14th week of fetal life onwards.

Applications of praecordial accelerometry. D. Pickering (*introduced by B. D. Bower*) (*Department of Paediatrics, Radcliffe Infirmary, Oxford*). A praecordial accelerometer is described which has been