

decreasing birth weight; and there is a known correlation between head circumference and cellular growth of the brain in early life. Over one hundred surviving infants of birth weights 1500 g and less cared for at Hammersmith Hospital between 1961-1968 inclusive have been studied. Approximately one third had birth weights below the 10th percentile for their gestational age. At later follow-up, significantly more of these small for date children were found to have head circumferences below the 10th percentile than those whose birth weight was appropriate for gestation. In the years 1965-1968, fewer children of the latter group had head circumferences below the 10th percentile than in the years 1961-1964. The incidence of neurological abnormality among them was lower, and it is concluded that their brain growth may have been more satisfactory.

34. Long lasting effects of intrauterine undernutrition. A comparative study of twins of dissimilar birth weight. L. HÖHNAUFER. *Univ. Kinderklinik, Innsbruck, Austria.*

Among 26,138 consecutive births (1952-1965) 30 twin pairs were found which matched the criterias: (1) difference in birth weight 300 g or more, (2) identical sex, (3) gestational age 36 weeks or more, (4) no gross abnormalities. Voluntary breast milk intake at day 5 was 73.5 ± 14.7 in the stunted twin vs 62.3 ± 14.1 in the larger one (mean \pm sd, $P = 0.01$). Twenty of them could be reexamined (9 identical, 11 dizygous) at a mean age $8\frac{1}{2}$ yrs (range: $4\frac{1}{2}$ to $17\frac{1}{2}$). Physical "catch up" (height and weight) had occurred in 10 pairs at a mean age of $3\frac{1}{2}$ years. The following differences were found:

Stunted twin	Inferior	Equal	Superior	N	P^1
Head circumference	17	0	3	20	0.01
Arm circumference	15	0	5	20	0.05
IQ (Krauer)	16	(1)	1	17	0.001
School achievement	9	(1)	0	9	0.05
First free walking	11	(8)	1	12	0.01

¹Sign test for comparison of pairs.

Intellectual performance at home as judged by the mother was equal in 10 but inferior in 10 stunted twins ($P = 0.01$). In all 7 pairs aged 11 years or more a disadvantage of the formerly smaller one was evident.

Growth retardation at birth was significantly correlated with suboptimal performances later in life. Since genetic and environmental differences between test and control subjects are practically excluded, the handicaps are ascribed to the prenatal undernutrition. The nutritional deficit is emphasized by the neonatal drinking behavior.

35. Respiratory reflexes in the newly born. G. BODEGÅRD and G. H. SCHWIELER. *St. Görans Hosp. and Karolinska Inst., Stockholm, Sweden.*

The Hering-Breuer inflation reflex (H.B.i.r.) and the thoracic respiratory reflex (th.r.r.) have been studied in 17 babies of different postmenstrual ages ($30\frac{1}{2}$ to 13 weeks). Pronounced development of the strength of the reflexes have been found indicating the existence of differences in the mechanoreceptor regulation of the breathing between infants of this maturity level and adults.

The H.B.i.r. was studied by tidal volume inflation obtained by occluding the airways at the height of an inspiration. The strength of the reflex was assessed by relating the relative increase of the length of the breathing cycle to the transpulmonary

pressure at the moment of occlusion (thus the pressure which simultaneously stimulates the pulmonary stretch receptors). The reflex was found to be very weak at a postmenstrual age of 32 weeks. It increased to a maximum strength at a postmenstrual age of 36 to 38 weeks. Later on there was a decline of the strength of the reflex.

The th.r.r. was studied as the reflex respiratory response to an added respiratory load and recorded as the change in amplitude of the intracranial (=intrapleural) pressure swings caused by airway occlusion. It has earlier been shown in adults that an increase of the respiratory load leads to an increased power generation of the respiratory muscles reflected as an increasing amplitude of the intrapleural pressure swings. In the babies studied the response to an increased respiratory load was found to increase gradually with increasing postmenstrual age indicating increasing maturation of the thoracic respiratory reflex system.

In some babies estimations both of the strength of the H.B.i.r. and the th.r.r. were made at repeated occasions and the same principal development of the reflexes was seen in the single baby as was seen from cross-sectional data in all the infants studied.

Furthermore there was found a dip in the development of the th.r.r. at the time when the H.B.i.r. reaches its maximum which might indicate some kind of competition between the two reflex systems. Such a competitive interaction could also explain why the H.B.i.r. decreases in strength after 38 weeks of age when the th.r.r. continues to increase in strength.

36. Respiratory patterns in newborn infants related to postconceptive age (fetal age + neonatal age). U. SELSTAM and T. OLSSON. *Univ. of Göteborg, and Chalmers Univ. of Technol., Göteborg, Sweden.*

The aim of this paper is to present a method of analyzing respiratory patterns in newborn infants and to present variations of respiration related to postconceptive age, i.e., fetal age + neonatal age. The equipment consists of a tetrapolar impedance plethysmograph with an alarm unit, a Mingograph 81 (Elena-Schönauder), and a computer (PDP 12). The respiratory movements are detected from variations in the transthoracic impedance signal. The time intervals between adjacent detections of respiration are recorded in the memory of the computer, programmed for a time interval histogram analysis. Different parameters in the program are clinically estimated. The infants are studied during sleep, shortly after feeding. Other factors influencing respiration, for example, surrounding temperature, light, and background sound, are kept as constant as possible. Data are treated statistically.

With increasing age there is a decrease in the mean frequency of respiration and a decrease in the frequency of periodic breathing and apneic episodes. The top of the histogram, i.e., the most frequent frequency of respiration, increases. When the periodic breathing, which usually is very regular, ceases, there is a period of rather irregular breathing, again followed by increasing regularity of respiration.

37. Alveolar and capillary permeability in the lung of the fetal lamb. I. C. S. NORMAND, R. E. OLVER, E. O. R. REYNOLDS, and L. B. STRANG.

Radioisotope-labeled, metabolically inactive molecules of varying radii (2-13 Å) were used as probes to investigate the permeability properties of the internal cellular lining of the lung in exteriorized fetal lambs (mean gestational age of the two groups: 127 and 140 days). By placing the isotopes in the blood or lung liquid compartments and serially collecting samples of blood,