142 Metabolic Responses to Physiologic Stimuli in the Newborn. KENNETH R. KOSKINEN, LYNNE L. LEVITSKY, ERIC FINE and MARVIN CORNBLATH, Univ. of Maryland, Dept. of Ped., Baltimore, MD.

In order to evaluate the physiological adaptations to feeding in low birth weight for gestation infants and the infants or gestational diabetic mothers (IGDM), blood glucose (G), plasma insulin (PI) and free fatty acid (FFA) responses to the ingestion of formula by 42 normal newborns were studied in the first three days of life. These measurements were made at fasting, and 30 and 60 min after feeding. Blood glucose values rose significantly over fasting at 30 min on all 3 days, and the values at 30 min on day 3 were significantly higher than those on day 1. The only significant change in the FFA values was a lower fasting value on day 3 than on day 2. Fasting PI values on day 1 were significantly higher than those on day 3. The decrease in PI values and relatively stable FFA values after formula feeding are in contrast to changes that occur with the administration of a large quantity of glucose either orally or intravenously. This difference in metabolic homeostasis was apparent not only in the normal infant but in the IGDM and low birth weight for gestation infants as well.

143 Cardio-respiratory Changes Associated with Gavage Feedings. E. G. HASSELMEYER and E. H. HON, Yale Univ. Sch. of Nursing and Med., New Haven, Conn. (introduced by C. D. Cook).

An exploratory study of the effects of gavage feedings upon neonatal ECG, heart and respiratory rates was carried out in 8 healthy, asymptomatic, low birth weight infants (b. wt. 885–1,605 g; gestation ages 28–36 weeks). Enrollment ages ranged from 3 to 27 days. Data were collected by attaching four silver electrodes to the chest wall and connecting them to a prototype system providing meter display and strip chart recordings of heart and respiratory rates and oscilloscopic display of ECG; data were also recorded on magnetic tape. 48 feedings were studied; 6 per infant. A no. 5 feeding tube marked at one inch intervals was passed through the nostril or mouth; feedings were given by the push method. ECG, heart and respiratory rates were recorded for a minimum of 20 min before and after gavage. In 21 feedings, heart rate drops greater than 30 were observed when the catheter was passed; in 18 of these, the tube had been inserted only 4 to 6 inches. Feeding volumes (10–45 ml) were given within 30 to 138 sec; heart rate drops from 30 to 110 were observed 13 times with push feedings. One case of bradycardia with heart rate drop greater than 90, of 36 sec duration, occurred p.c. when infant was prone in high Fowler's; this was accompanied by p. wave changes to point of momentary elimination. Apnea of longer than 20 sec, but without heart rate and ECG changes, was observed in two babies in association with bowel movements. The interesting clinical observations noted in these patients suggest that the cardio-respiratory responses of small infants can be altered markedly by widely accepted clinical procedures.

144 Colonization of Newborn Infants with R-factor Carrying Gram-negative Organisms. ROSE MARIE J. APOSTOLICO, KATHLEEN L. DAVIS, DONALD V. EITZMAN and HERMAN BAER, Depts. of Ped. and Micro-Biol. Univ. of Florida Coll. of Med., Gainesville, FA.

Recently, increasing numbers of gram-negative organisms with multiple drug resistance have been cultured from infants. The majority of these cultures were obtained from areas in which a high percentage of infants were being treated with antibiotics, primarily penicillin and kanamycin. A prospective study was done to determine incidence, age of appearance, and predisposing factors to R-factor cayrrying *Enterobacteriaceae* in the nursery. Cultures were obtained from groin, umbilicus, axilla, nose, throat, eyes, and stool at 12-h intervals for the first three days of life and then daily. Ninty percent of the infants in the intensive care nursery were found to have R-factor carrying bacteria during their stay in the nursery. The mean age of acquiring these organisms was 3.8 days with a range of 1–10 days. The incidence was essentially the same for infants regardless of whether they had been treated with penicillin and kanamycin or no antibiotics. Infants in the regular nursery, many of whom stayed 6 days, had a less than 10% incidence of R-factor carrying gram-negative organisms. These organisms were found only sporadically on the fomites and in fecal and vaginal cultures of the mothers, but could be recovered from personnel working in the intensive care nursery. Most of these personnel also worked in the regular nursery and handled babies who had a low incidence of R-factor carrying organisms. It is presumed that the high incidence of R-factor carrying *Enterobacteriaceae* found in the intensive care nursery is related to the use of antibiotics such as kanamycin in this area. Multiple drug resistance should be looked for in clinical situations such as this and treatment adjusted accordingly.

145 Effect of Cooling on Effective Pulmonary Capillary Flow in Newborn Infants. JUNE P. BRADY, HENRIQUE RIGATTO and FE M. DUMPIT, Dept. of Ped., Univ. of California, San Francisco and San Francisco Gen. Hosp.

To determine whether cooling affects pulmonary perfusion in the newborn infant we measured effective pulmonary capillary flow ($\dot{Q}pc$) at two different environmental temperatures. Seven healthy term infants 15 to 61 h of age were studied initially in a 'cool' environment (ambient temperature 29.6 °C) and then in a 'warm' one (32.7 °C). $\dot{Q}pc$ was measured using the infant plethysmograph and a 15-sec period of rebreathing nitrous oxide and oxygen, as previously described [Circulation Suppl. *21:* 50, 1969]. The mean value of two determinations at each temperature was compared. The infant's rectal, abdominal skin, and foot temperatures, and the plathysmograph and room temperatures were monitored. Heart rate was measured from an electrocardiogram.

The mean foot-rectal temperature gradient was 5.1 °C in the 'cool' environment and 2.6 °C in the 'warm' one. Abdominal-rectal gradients were 0.8 °C and 0.1 °C respectively. In each instance $\dot{Q}pc$ was lower in the 'cool' environment (mean 141 ml/kg/min-'cool'; 192 ml/kg/min-'warm'; $p < 0.05$). Heart rate was lower (121/min 'cool'; 128/min 'warm') but this was not statistically significant. This reduction in effective pulmonary capillary flow could be due to increased shunting (the method does not measure shunted blood), to marked inequalities of ventilation and perfusion, or to a decrease in total pulmonary blood flow. Our results provide further evidence of the possible adverse effects of cooling the newly born infant.

146 Thermal Patterns on the Backs of Cold Stressed Babies. PAUL H. PERLSTEIN, NEIL K. EDWARDS,

CHRISTIAN COURPOTIN and JAMES M. SUTHERLAND, Univ. of Cincinnati Coll. of Med.

A Barnes M-101 Infrared Radiometer was used to map the skin temperature changes occurring on the backs of nine selected unswaddled newborn babies in a room air conditioned at 26.3 °C (range 24.4–28.1 °C). Polaroid photographs of the serial thermal variations observed during cooling were analyzed with a densitometer to provide quantitative support for grossly evident differences in rates of cooling over the surfaces examined. In particular, not only the interscapular but also the posterior flank skin regions cooled significantly less ($p < 0.05$) than skin over the coccyx, deltoid, midback, and lateral flank regions. Brown fat collections have been identified in the interscapular fat pads of newborns, and thermography may prove a valuable aid in monitoring the activity of this tissue. On the other hand only small amounts of multilocular fat have been identified in subcutaneous flank tissue. Since in this early experience with thermography the flank tissue has been found to mirror the interscapular tendency to cool relatively little in cold stressed babies, continued caution must be exercized in interpreting the significance of the 'warm nape of the newborn' as it relates to brown fat activity. Further experience with radiometry may prove useful in clarifying this and other enigmatic problems relating to the complex flux of heat in newborn babies.

147 *Inhibited Lipolysis by Hypoxia: Its Potential Role in Neonatal Thermogenesis.* DAVID BAUM, COURTNEY, L. ANTHONY, Jr. and CAROL STOWERS, Univ. of Washington Sch. of Med., Seattle, Wash.

Because of impaired thermogenesis, cold stress is poorly tolerated by hypoxic neonates. Since free fatty acids (FFA) are a major fuel for heat production, deficient FFA mobilization could contribute to reduced heat production at low oxygen tensions. In order to determine the effect of hypoxia upon cold-stimulated lipolysis and its potential role in thermogenesis, plasma glycerol and FFA levels, and deep rectal temperature were studied in cooled puppies made hypoxic.

Upon lowering ambient temperature from 30 to 20 °C, levels of plasma glycerol and FFA increased in 12 puppies ventilated with air ($PaO_2 < 75$ mm Hg). In contrast to persisting high plasma glycerol and FFA levels with continued cooling in the control group, plasma glycerol fell from $172 \pm 8\%$ to $85 \pm 10\%$ and FFA from $206 \pm 25\%$ to $105 \pm 13\%$ mean control values (mean $\pm$ S.E.) in six animals made hypoxic (PaO_2 25–35 mm Hg) for 45 min. Comparison of core temperatures during cooling revealed that the rate of temperature fall was accelerated by hypoxia, and that the mean peak fall was significantly greater in hypoxic than in control animals ($p < 0.005$).

These observations indicate that lipolysis stimulated by cold stress is inhibited by hypoxia, which results in the reduction of FFA as a fuel source. This loss of FFA as a fuel may explain the handicap to thermogenesis observed in the hypoxic neonate.

148 *Large Insensible Water Loss (IWL) in Low Birth Weight Infants Treated with a Plastic Heat Shield.* AVROY FANAROFF, HOWARD GRUBER, MICHAEL WALD and MARSHALL KLAUS, CWRU Sch. of Med., Dept. of Ped., Cleveland, Ohio.

Published fluid requirements appear to be grossly inadequate for some small premature infants. To explain the large water needs of these infants, detailed water balance studies were performed during the first six weeks of life on 22 infants whose birth weights ranged between 700 and 1,800 g, mean 1,232 g, and whose weights were appropriate for their gestational age. IWL determinations were made from measurements of loss in body weight over 3-h periods, with the infants nude in standard single walled isolettes, humidity 45 to 90% and the environmental air temperature in the neutral thermal range. In 9 infants with birth weights under 1,200 g, who were below 10 days of age, IWL was 2 to 4 times greater (equivalent to 80 to 120 g/kg/day) than previously reported for larger infants. To elucidate these large losses, paired measurements were made within 24 h on 11 infants before and after the insertion of a plastic heat shield converting the isolette into a double walled chamber. Mean IWL within the double walled chamber was 1.50 g/kg/h S.D. 55 compared to a mean of 2.18 g/kg/h S.D. 1.0 under standard conditions ($p < 0.001$). There is thus a 30% decrease within the double walled chamber. These results, in contrast to previous reports, indicate the ability of the small premature infant to markedly increase IWL in a relatively cool environment. These large losses can be reduced by diminishing radiant heat losses. Heat shields are useful not only for controlling the thermal needs of small immature infants but also in significantly reducing fluid requirements.

149 *Poverty and Race: Effects on Prenatal Nutrition.* RICHARD L. NAEYE and WILLIAM BLANC, Pennsylvania State Univ. Coll. of Med. and Columbia Univ. Coll. of Physicians and Surgeons, Depts. of Path., Hershey, Pa. and New York City.

Perinatal mortality rates are higher in the U.S. than in many other nations. An excess number of low birth weight infants in families of low socioeconomic status accounts for much of this high perinatal mortality. Necropsy material was examined from 1,002 consecutive autopsies on stillborn and newborn infants. 449 of the cases were excluded because of disorders that might have affected fetal growth. Income data was available on 469 of the remaining cases and they were classified by economic status using a U.S. Government poverty index. Autopsy weights and measurements were calculated in percent of published normal mean values.

Body weight for infants from poor families was 15% less than the mean value for infants from non-poor families. Mean gestational age for both groups was 29 weeks. In infants from poor families, weights of thymus, spleen, liver and adrenal glands were disproportionately smaller than weights of other organs. Brain and placental weights were almost identical in the two groups. The following additional measurements were less in the poor infants: thickness abdominal subcutaneous fat, mean volume adipose cells and skeletal muscle fibers, cytoplasmic mass of cells in various visceral organs and Wharton's jelly. If organ structure in the non-poor group is considered to be normal, infants from poor families were undernourished at birth. Racial groups showed few differences when they had similar economic status. In the poor, undernutrition became more severe with each gestation while nutrition-status improved with each gestation in the nonpoor.

150 *The Effect of Early Mother—Infant Separation on Later Maternal Performance.* JOHN H. KENNELL, DAVID GORDON and MARSHALL H. KLAUS, Case