INTRACELLULAR ELECTROLYTE RESPONSE TO CHANGED OSMOLALITY: AN ELECTRON MICROPROBE (EP) INVESTIGATION. B.L. Nichols, L. Mizrahi, H. Soriano, D.C. Chang, C.F. Hazlewood, and S. L. Kimzey. Section of Nutrition and Gastroenterology, Dept. of Pediatrics, Baylor Col. of Med., and the Cellular Analytical Laboratory, L.B. Johnson Space Center, Houston, Tx., 77025

It has been the practice to postulate the existence of idiogenic and inactivated cell osmoles to account for cellular response to altered serum osmolality. These changes have been investigated by a direct determination of intracellular sodium and potassium with EP. Analyses were performed on 8μ frozen sections of rat gastrocnemious prepared by freeze drying. The instrument was calibrated with gelatin standards. Changes in plasma osmolality were produced by IV infusion of 5% glucose and 72% sucrose solutions in anesthetized rats. Serum osmolality was measured by freezing point depression.

The prior view that organic osmoles account for the discrepant cellular response to hypertonic dehydration is difficult to accept because the idiogenic osmoles approach 25% of total cellular osmoles. An alternate hypothesis has been developed that some of the ions and water in the cell are inhibited from participating in chemical potentials. A model of the cell can be derived from the relationship of extracellular osmoles and intracellular Na + K by simple mathematical expressions. These indicate that 53% of cell water and 44% of cell cation do not respond to changes in extracellular osmolality. Work supported by: David Underwood Trust, NGR 44-003-053 and Fellowship from PAHO.

CONSTANT GLUCOSE (G) INFUSION (CGI) AND SERUM INSULIN (I) CHANGES IN SEQUENTIALLY STUDIED PRETERM INFANTS. Dale L. Phelps and William Oh. UCLA Sch. of Med., Harbor General Hospital, Dept. of Pediatrics, Torrance, Calif.

CGI as a stimulus in evaluating pancreatic β-cell responsiveness is considered superior to the bolus intravenous G tolerance test. This method was used to study the serum I changes in 14 preterm infants at various stages of maturity and at different postnatal ages. G infusion rate was 9 mg/min/kg for 2 hrs. on day 1, and 6 mg/min/kg on days 7,14,21,28 and 35. Baseline G and I, half-hourly G, and hourly I levels were measured. CGI resulted in the following: on day 1, a steady state of G 30 mg% above baseline was achieved at 30 through 120 min. of the infusion. ΔI's (change in I from baseline) at 60 and 120 min. were 6.3 ± 2.6 μU/ml, $p < .05$ (M ± SEM), and 8.2 ± 2.2 μU/ml, $p < .01$, above a baseline of 7.3 ± 0.8 μU/ml. On days 7 and 14, G rose at 30 and 60 min. but fell at 90 and 120 min. I at 120 min. was significantly less (0.7 ± 0.7 μU/ml, $p < .001$) than the corresponding day 1 value. After 21 days, no significant increase in G was seen during the CGI. The ΔI's at 60 and 120 min. were significantly less than on day 1 (-1.2 ± 1.4, $p < .02$ and -3.2 ± 1.2 μU/ml, $p < .02$). The G and I changes seen in relation to postnatal age were independent of gestational age.

These data indicate that G utilization by preterm infants is proportional to postnatal age and that the serum I changes during CGI are proportional to the G levels.

BODY COMPOSITION AT MENARCHE (M) IN SELECTED DISORDERS OF GROWTH. David C. Osler, John D. Crawford, Harvard Med. Sch., Massachusetts Gen. Hosp., Children's Service, Boston.

To further evaluate the Frisch-Revelle hypothesis that M is triggered by the achievement of a critical body weight or composition (fat:water:solids), heights and weights were assembled and body compositions derived for groups of girls with selected disorders of growth. 34 with unusually tall stature had M at weights in excess of the "critical" figure of 47.8 kg, but had the typical menarchal body composition. 18 girls under 10 years of age with central idiopathic precocity had M far below the critical weight; their body composition differed from that of age and height controls but was similar to that of normal girls at M. 18 with gonadal dysgenesis were studied at the age of M in a normal population, and 15 of these at the age when normal girls would be beginning their growth spurts. Body composition changed as in normal girls between these times. 11 first decade girls with hypothyroidism but no clinical evidence of puberty had pre-pubertal body compositions; 7 with precocious M had as much fat/kg as normal menarchal girls. 14 girls under 10 years with simple obesity had pre-pubertal phenotypes but even more fat/kg than normals at M. Thus, except in gonadal dysgenesis and simple obesity, M was highly correlated with a characteristic body composition; girls with Turner's syndrome indicate its achievement is not entirely estrogen dependent while those with obesity suggest its attainment does not directly "trigger" M.

HETEROZYGOTE DETECTION IN SULFATIDOSIS. M. Philippart, E. Lassila, K. Zeilstra and H. Roberson. Mental Retardation Unit, Neuropsychiatric Inst., Los Angeles.

Reports on the reliability of carrier detection in sulfatidosis have been conflicting. Since many cases of the so-called juvenile and adult variety are still frequently overlooked, the gene frequency cannot yet be properly estimated. We have determined arylsulfatase A activity in cultured skin fibroblasts from 4 groups of subjects. Only young confluent cultures were studied after no more than 3 passages. Group 1 (N=15) included parents of proven cases. Group 2 (N=17) included the non-consanguineous spouses (N=18) in families of proven cases. Group 3 included siblings (N=9) of the proven cases, and with activities less than 2 S.D. below the normal mean defined in group 2. Group 4 (N=20): cases of mental retardation and various lysosomal diseases including mucopolysaccharidoses. Four of the possible carriers in group 3 had activities in the range of the obligatory heterozygotes (Group 1). The other 5 had intermediate values between group 1 and group 2. Several lines in group 4 had activities in the obligatory heterozygote range. This indicates that carrier detection is not infallible. In the course of this study, we found that arysulfatase B was generally lower than normal in groups 1 and 3. This might be taken as a further indication of the suspected relationship between the arysulfatases. (Supported in part by PHS Grant HD-04612.)

MATERNAL MALNUTRITION AND PLACENTAL TRANSFER OF NUTRIENTS IN THE RAT. Rosso,P.,(Intr.by M.Winick)., Col.of Phys.and Surg.,Columbia Univ.,Dept.of Ped., Inst.of Human Nutrition,New York,N.Y.

It is now well established that maternal malnutrition will retard fetal growth.It has been assumed that the primary mechanism producing this growth retardation is through a reduction in nutrient supply.Since maternal malnutrition affects cellular growth of placenta itself,it is possible that placental function as manifested by its ability to transfer nutrients is also impaired.Placental transfer of glucose and α-amino isobutyric acid(AIB)was measured after maternal protein restriction.Glucose transfer into the fetus on days 20 and 21 of gestation was reduced by about 60 per cent.AIB transfer was reduced by 37 per cent on day 20 and 47 per cent on day 21.By contrast maternal plasma glucose levels,the rate of glucose disappearance from the plasma and of glucose incorporation into maternal tissues was not altered by maternal protein restriction.These data demonstrate that placental function as manifested by the ability to transfer both glucose and amino acids is impaired by maternal protein restriction.It is possible that the fetal growth retardation is secondary to this placental "dysfunction."

PLACENTAL TRANSFER OF NUTRIENTS DURING NORMAL AND PROLONGED GESTATION. Rosso,P.and Azzi,R.,(Intr.by M.Winick).,Col.of Phys.and Surg.,Columbia Univ., Dept.of Ped.,Inst.of Human Nutrition,New York,N.Y.

The rate of placental transfer of glucose and α-amino isobutyric acid(AIB)was studied at 14,17,18, 19,20 and 21 days of gestation in normal rats and at day 22 and 23(prolonged gestation)in rats with uterine ligation.Transfer of both substances increases linearly from day 14 to day 19, levels off between days 19 and 20 and drops to 75 per cent of day 20 levels at day 21.There is a 90 per cent increase in AIB transfer between days 14 and 20 compared with a 28 per cent increase in glucose transfer during the same period.Thus,although the developmental pattern was similar the capacity of the placenta to transfer amino acids develops later than glucose.Prolonged gestation markedly reduces the capacity to transfer AIB but has little effect on the placenta ability to take up this substance. This was demonstrated in experiments showing little if any change in uptake of AIB at days 22 and 23 compared to day 21.By contrast,AIB transfer was 30 per cent less than day 21 and 55 per cent less than day 20.Thus,there are marked developmental differences in the maturation of the transfer systems for glucose and amino acids.Prolonged gestation reduces transfer of both substances.