1481 THE FUNCTIONAL RESIDUAL CAPACITY (FRC) OF INFANTS WITH RESPIRATORY DISTRESS SYNDROME (RDS) RECEIVING POSITIVE END-EXPIRATORY PRESSURES (PEEP). Peter Richardson and Jeffrey Carlstrom, (Spon. by H. Hill) Dept. of Peds., University of Utah Medical Center, Salt Lake City, UT.

RDS is characterized by an inadequate surfactant system which, in the untreated course, leads to progressive atelectasis and decreased FRC. PEEP is used to counter atelectasis and reduce intrapulmonary shunting. FRC is controlled by PEEP yet PEEP is selected primarily on the basis of blood gases and not FRC. We were concerned that these empirical methods of selecting PEEP for RDS infants frequently result in FRC levels well above or below normal. Therefore, we measured the FRC of 14 prematurely born infants in their second day of life. The infants' mean (± SD) gestational age was 31.5 ± 2.2 wk; birth wt 1.6 ± 0.5 kg; Apgar score (1 min) 4.4 ± 2.2. All infants had clinically diagnosed RDS and were ventilated with the following mean settings: peak inspiratory pressure 23.3 (range 14-34) cm H_2O; PEEP 4.4 (3-8) cm H_2O; rate 42 (20-60) BPM. Computerized N_2 washout methods, similar to those used in this study, show the FRC of healthy infants this postnatal age to be 17 ± 2 ml/kg body wt (Hansen et al, Ped 1970). In our study on RDS infants the FRC ranged from 3 to 33 ml/kg with a mean of 14.5 ml/kg. Only 3 infants (21%) had volumes within one SD of normal. In 5 infants, FRC was greater than one SD above normal and in 6 infants, FRC was greater than one SD below normal. Six infants (43%) had FRC values outside of 2 SD of normal. These results suggest that conventional methods of selecting PEEP do not result in the maintenance of normal FRC levels in infants with RDS.

†1482 NORMALIZING FUNCTIONAL RESIDUAL CAPACITY (FRC) IN RDS. P. Richardson, C. Bose, F. Gonzalez, G. King, N. Shaw, and J. Carlstrom, (Spon. by H. Hill), Dept. of Peds., Univ. of Utah Med. Center, Salt Lake City, UT

PEEP is used in infants with RDS to counter atelectasis and maintain FRC. FRC is controlled by PEEP yet blood gases, not FRC, are the bases for selecting ventilator settings. To test the hypothesis that maintenance of normal FRC leads to improved pulmonary function and reduced mortality, six paired twin lambs delivered prematurely (125-132 days, term is 147) were ventilated, initially, with peak inspiratory pressures (PIP) of 32 cm H_2O, 6 cm H_2O PEEP, 0.33 sec inspiratory time and 60 BPM while on 100% O_2 and then monitored for 24 hr. In the control group ventilator settings were adjusted using criteria based on arterial blood gas analyses. In the study group, FRC was maintained within normal limits (25±2SE ml/kg) by adjusting PEEP. The study group FRC on the initial PEEP of 6 cm H_2O ranged from 9 to 55 ml/kg. PEEP required adjustment in 5 of these 6 lambs. Mean PIP, PEEP and mean airway pressures ($\bar{P}aw$) during the 1st 8 hr of life were 29.6, 5.5 and 7.1 cm H_2O (study group) and 40.4, 2.8 and 6.8 cm H_2O (control). Of the 12 lambs studied, 6 died before 24 hr; 4 control and 2 from the study group. Even though $\bar{P}aw$ of the two groups were not different for the 8 hr period, PaO_2/FiO_2 of the study group was significantly greater than the control group (156±20 vs 112±16 mmHg). Also, the driving pressure (PIP-PEEP) was less in the study group, yet, $PaCO_2$ was significantly less in the study group than the control group (28±2 vs 39±3 mmHg). These preliminary data suggest that the normalization of FRC improves pulmonary function and may reduce mortality of lambs with RDS.

†1483 EFFECT OF A SINGLE BREATH OF 100% OXYGEN ON RESPIRATION IN NEONATES DURING SLEEP. Tazeem Aizad, Jaya Bodani, Don Cates, Leanne Horvath and Henrique Rigatto. Dept. of Pediatrics, Univ. of Manitoba, Winnipeg, Canada.

To determine the effect of a single breath of 100% O_2 on ventilation, 10 term (BW 3360±110g (SE); GA 39±.4 wk, postnatal age 3±.6 days) and 10 preterm neonates (BW 2020±60 g, GA 34±2 wk, PNA 9±2 days) were studied during active and quiet sleep states. The single breath method was used to measure peripheral chemoreceptor response. To enhance response and standardize the control period for all infants, FiO_2 was adjusted to 16±0.6% for a control O_2 saturation of 83±1%. After 1 minute of control in each sleep state, each infant was given a single breath of O_2 followed by 21% O_2. $\dot{V}_E$, V_T, f, P_AO_2, P_ACO_2, O_2 saturation (ear oximeter) and $TcPO_2$ were measured. $\dot{V}_E$ always decreased with inhalation of O_2 ($p<0.01$). In quiet sleep, the decrease in $\dot{V}_E$ was less in term (14%) than in preterm (40%) infants ($p<.001$). Decrease in $\dot{V}_E$ was due primarily to a drop in V_T in term infants as opposed to a fall in f and V_T in preterm infants ($p<0.05$). Apnea, as part of the response, was more prevalent in preterm than in term infants. In active sleep the decrease in $\dot{V}_E$ was similar both among term (19%) and preterm (21%) infants ($p>0.5$). These results suggest greater peripheral chemoreceptor response in preterm than in term infants, reflected by a more pronounced decrease in $\dot{V}_E$ with O_2. The results are compatible with a more powerful peripheral chemoreceptor contribution to breathing in preterm than in term infants.

●1484 IN VIVO LIPID PEROXIDATION IN NEWBORN RABBITS: EFFECT OF OXYGEN AND VITAMIN E. Jon R. Wispé, Matthew E. Knight, and Robert J. Roberts. University of Iowa College of Medicine, University of Iowa Hospitals and Clinics, Departments of Pediatrics and Pharmacology, Iowa City, IA.

Expired ethane and pentane are sensitive in vivo monitors of lipid peroxidation. The present study examined the effect of vitamin E (E) on lipid peroxidation in newborn rabbit pups exposed to normoxia (A) or hyperoxia (O_2). All pups were given parenteral fluid (electrolytes and glucose) and were treated with either E (100 mg/kg α-tocopherol IV) or placebo. O_2 exposure did not alter expired pentane levels in either the E- or placebo-treated pups (3.3 pmoles/100 g/min in O_2 vs 4.1 pmoles/100 g/min in A). Expired pentane levels were significantly reduced in E-treated A or O_2-exposed pups compared to placebo-treated A or O_2-exposed pups (1.6 pmoles/100 g/min in E vs 6.6 pmoles/100 g/min in placebo). Lung E levels were 162 ± 42 µg α-tocopherol/g in E-treated vs 4.2 ± 6 µg/g in controls (mean ± SD). Expired ethane levels were not different among the four treatment groups. Animals given only parenteral fluid had a 13% 3-day mortality in O_2 vs 0% in A. Elevated expired pentane levels (300 pmoles/kg/min) in an infant on parenteral lipid emulsion were not altered by E therapy (100 mg/kg α-tocopherol daily p.o. x 3). These data show that a single 100 mg/kg IV dose of E significantly increased lung E levels and reduced expired pentane in newborn rabbits given only parenteral fluids. O_2 did not effect expired ethane or pentane levels but did result in lung injury and mortality. Oxygen toxicity may arise from mechanisms other than those associated with lipid peroxidation. (Supported by NIH GM12675 and PMA Fellowship.)

†1485 THE PRENATAL DEVELOPMENT OF NEONATAL MOTOR RHYTHMS. S. Robertson (Spon. by J. Kennell), Dept. Peds, Case Western Reserve University, Cleveland, Ohio 44106

Spontaneous fetal movement (FM) is essential for normal development of muscles and joints, and the associated neural activity may play a role in the selection of synapses in central motor circuits. A common property of embryonic and FM in many species is cyclic occurrence, with a period of ~1-10 minutes. Similar motility patterns have recently been described in the human neonate and fetus near term. To determine whether cyclic motility in the human appears only near birth, or emerges earlier as in other species, 22 normal fetuses were studied biweekly until birth (at 37-42 wk, all AGA), beginning at 21-34 wk gestation. FM was detected by 2 pressure transducers on the mother's abdomen. Each analog FM record was digitized in 5 sec intervals during 12-41 min (29±7, mean±SD) of fetal activity free of major artifacts. Spectral analysis revealed significant ($p<.001$) cyclic patterns in 84/87 FM records, including 4/5 fetuses studied at 21-24 wk. The length of the motility cycles was 0.5-7.7 min (3.3±1.7), and did not change with gestation. The proportion of FM variance accounted for by motility cycles between 1.0 and 5.5 min increased modestly but significantly ($p<.001$) from 25 wk (.33±.07) to 33 wk (.41±.05). The existence of consistent and strong cyclic motility throughout the second half of gestation suggests it is more than a transient adaptation to the perinatal period. Cyclic activation appears to be a basic property of developing motor circuits in many species, including the human, and its consistent absence may therefore signal compromised CNS function in the fetus.

†1486 WHOLE BLOOD VISCOSITY DETERMINED BY PLASMA PROTEIN, HEMATOCRIT, AND MEAN CORPUSCULAR VOLUME: O. Linderkamp, D.W. Roloff. Dept.of Pediatries, Univ. of Munich, 8000 Munich, West Germany (spon. by W.F. Howatt)

Therapeutic decisions in the management of neonatal hyperviscosity are often made on the basis of hematocrit (Hct) values only. However, in tubes with the diameter of arterioles, whole blood viscosity (WBV) increases also with plasma viscosity (PV), red blood cell (RBC) aggregation and impaired RBC deformability. In order to determine the correlation between total plasma protein (TPP) as a measure of PV, and Hct at various mean corpuscular volumes (MCV) on a WBV of 4.2cP previously found to be clinically significant, we adjusted the placental blood of 20 premature and 10 term infants, and the venous blood of 10 adults to a Hct between 50 and 70% and measured TPP and WBV (100µm-capillary viscometer). From these data a nomogram for WBV = 4.2cP was constructed. Thus, a plot for TPP and Hct below the appropriate MCV line indicates a WBV with a lower risk for symptomatic hyperviscosity. The regression equation expresses the critical Hct for this WBV as it is influenced by TPP and MCV. It will be noted that certain therapeutic measures e.g., transfusions with plasma, albumin, or RBC with their attendant change in TPP and MCV may alter whole blood viscosity unfavorably.