1642 THE EFFECT OF A THERMAL STRESS ON RESPIRATION IN PREMATURE INFANTS DURING SLEEP. Robert A. Darnall and Ronald L. Ariagno, (Spon. by J. Kattwinkel), Depts. of Pediatrics, Univ. of Virginia Medical Center, Charlottesville, and Stanford University School of Medicine, Stanford.

Cool temperatures have been associated with a reduction in the frequency of apnea. In premature infants, most respiratory pauses (RP) occur during periodic breathing (PB). A decreased frequency of RP during cooling may therefore be related to 1) a decrease of RP during PB, non-PB, or both and/or 2) a decrease in the relative amount of PB. To sort out these relationships, we evaluated the frequency of RP and the amount of PB in 5 premature infants subjected to a mild thermal stress during sleep. The infants were studied under radiant warmers for 6-8 hours while measurements of respiration and body temperature were made. Cooling was accomplished by allowing skin temperature to fall slowly for short periods 4-10 times during the study periods. Breathing pattern (PB or non-PB) and state were assessed, and an index (RI) reflecting the % of time apneic, was calculated for each 60 sec epoch. PB occurred in all subjects and accounted for 11-60% of the total sleep time. Most pauses occurred during PB compared to non-PB (mean RI=30+7% and 6+2%, respectively). During cooling the mean RI decreased (18.6+5.7% and 12+5.5% for warm and cool periods, respectively), but there was no change in the mean RI during cooling for episodes of either PB or non-PB when evaluated separately. However, the relative amount of PB decreased during cooling (43+15% to 22+14%, $p<.05$). We conclude that the decrease in the mean RI during cooling was due to a decrease in the relative amount of periodic breathing.

1643 SPECTRAL ANALYSIS IN THE STUDY OF APNEA OF NEWBORN AND YOUNG INFANTS. Alan E. Davis, Danielle Grondin, Jacob V. Aranda, McGill Univ-Montreal Children's Hosp Depts of Pediatrics, Pharmacology and Therapeutics, Montreal, Quebec, Canada.

Spectral analysis based on the Fourier transform, has been used extensively in the analysis of EEG and other periodic waveforms. We evaluated the usefulness of this technique in 7 infants, ages 7 days to 3 months, being investigated for apnea. Two to three hour recordings were made during sleep of left and right hemispheric electroencephalogram, electrooculogram, electromyogram, electrocardiogram, impedance pneumograph and nasal air flow. For each signal, Fourier transforms of 4 sec epochs were calculated to give amplitude and frequency estimates of each epoch. These estimates were then plotted longitudinally against time to display amplitude and frequency of each signal over the entire recording period. The results clearly showed sleep cycles, EEG asymmetries, obstructive and central apneas and cardiorespiratory responses to apnea which corrobated other clinical data on the babies. The extensively developed techniques of spectral analysis, including coherence, gain and phase measurements indicate applicability to the study of apnea and could provide quantitative descriptions of the complex interactions between cortical, respiratory, muscoluskeletel and cardiac response and the mechanism (s) and event (s) underlying the genesis of apnea.

1644 THE DEVELOPMENT OF INSULIN RECEPTORS IN THE FETAL RABBIT LUNG. S. Devaskar, S. Ganguli, U. Devaskar and M. Sperling, Dept. of Peds. Univ. of Cincinnati.

Recent studies demonstrated higher insulin (I) binding to various fetal tissues when compared to the adult. We investigated the status of I receptors in developing fetal lung in rabbit. Plasma membranes were prepared from the lungs of fetuses at various gestations: 22-24D (n=5), 26-27D (n=5), 28-29D (n=8) and 30D (n=5); lungs from non-pregnant adult animals >2 years of age (n=3) and a younger group <4 months (n=6) were used as controls. I dose-response binding curves were done with I^{125} insulin and native I at various doses (10^{-10} to 10^{-7}M), and analysed by Scatchard plots. There was no change in total affinity of the I receptor sites at different gestational ages. However, the number of I receptors x 10^{16} per mg protein increased with gestational age from 2.1 ± 0.8 at 22-24D to a peak of 12 ± 4.8 at 29D, decreasing to 1.67 ± 0.66 prior to birth. The number of I receptors were markedly lower in the adult lung; 0.58 ± 0.23 in the younger group and 0.2 ± 0.08 in the older group; affinity was also significantly lower. This pattern differed from PGE_1 (1×10^{-4}M) stimulated c-AMP generation which increased steadily from 26D to 30D gestation (30% to 300%) in these lung membranes. Conclusions: 1) The I receptor number and affinity are higher in fetal lung than in adult; 2) The decrease in I receptor number just prior to parturition does not parallel the progressive increase in adenylate cyclase sensitivity to PGE_1 and 3) Since c-AMP promotes lung maturation and I retards it, the fall in I receptors and increase in c-AMP responsiveness are appropriate maturational events.

1645 NONINVASIVE EVALUATION OF UPPER AIRWAY OBSTRUCTION (UAO) IN CHILDREN. D. Dodd, R. Beckerman, R. Hopkins, W. Waring, (Spon. by J. Lewy), Department of Pediatrics, Pulmonary Section, Tulane University School of Medicine, New Orleans, La.

Information obtained from serial inspiratory-expiratory (I/E) flow volume (FV) curves on four children with signs and symptoms or UAO was compared to that obtained by physical examination, bronchoscopy, and airway fluoroscopy in an attempt to evaluate the usefulness of FV curves in young children. FV patterns associated with lesions of the upper airway have been described as fixed (F) UAO, variable intrathoracic (VI) UAO, and variable extrathoracic (VE) UAO.

Case	Age (Yrs)	History	Physical Findings	Flow-Volume Pattern	Site of Obstruction
1	5	S/P pneumonectomy for crush injury	expiratory stridor	VI	Tracheomalacia (TM) above carina
2	4	S/P tracheostomy	inspiratory stridor	F	Subglottic Stenosis
3	14	S/P tracheostomy	inspiratory stridor	F	Subglottic Stenosis
4	9	S/P TE fistula	brassy cough	VI	Probable TM

In three of the four cases (Cases 1,2,3) the FV pattern suggested a lesion of the upper airway confirmed by more conventional techniques. In Case 1, fluoroscopy alone confirmed the diagnosis suggested by the FV pattern. I/E FV patterns when combined with airway fluoroscopy, may characterize anatomic lesions of the upper airway frequently missed by less dynamic techniques.

1646 NEONATAL RESPIRATORY MUSCLE BLOOD FLOW: EFFECTS OF REBREATHING AND SEDATION. Edward F. Donovan, (Spon. by James M. Sutherland), Univ. of Cincinnati College of Med., Dept. of Pediatrics, Cincinnati

Respiratory muscle blood flow is necessary for the delivery of adequate energy substrate to maintain required respiratory muscle work rates. Diaphragmatic blood flow (Qdi) and cardiac output (Qc) were measured in 8 newborn dogs age 4-15 days using the radionuclide-labelled microsphere method. Measurements were made during quiet breathing (QB) and CO_2 rebreathing (CR) (steady state FiO_2=.31±.09, $FiCO_2$=.029± .008, mean±SEM) with and without pentobarbital sedation (5-7mg/kg).

	Unsedated			Sedated		
	pCO2 (Torr)	Qdi (ml/min/g)	Qc (ml/min/kg)	pCO2 (Torr)	Qdi (ml/min/g)	Qc (ml/min/kg)
QB	39.8	.54	276	37.9	.22	338.2
CR	41.8	1.08	316	43.1	.25	240.4
P	NS	<.05	<.05	NS	NS	NS

In the unsedated newborn dog, rebreathing results in increased respiratory frequency (38±7 v 53±11bpm), alveolar ventilation (V_A), Qdi, and Qc. Although V_A increased during sedated rebreathing, Qdi and Qc were unchanged. Thus the cardiovascular response to increased ventilation produced by CO2 rebreathing is adversely affected by pentobarbital sedation, suggesting that sedation may impair respiratory muscle endurance.

● **1647** FREQUENCY DEPENDENT IMPEDANCE OF THE RESPIRATORY SYSTEM IN PARALYZED, INTUBATED INFANTS Henry L. Dorkin, Ivan D. Frantz, Ann R. Stark, Joseph W. Werthammer, and Denise J. Strieder. Pulmonary and Neonatology Divisions, Children's Hospital Medical Center and Department of Pediatrics, Harvard Medical School, Boston MA.

Theory predicts that the mechanical efficiency of high frequency ventilation should depend on the impedance of the respiratory system (Z_{rs}). We therefore measured Z_{rs} in 9 paralyzed, intubated infants with respiratory distress syndrome to determine magnitude of Z_{rs} as a function of frequency and also the resonant frequency of the respiratory system. Infant gestational ages ranged from 31 to 36 weeks and weights from 1.6 to 2.3 kg. All were from 1 to 7 days old. Forced oscillation measurements were made between 4 and 40 Hz with the speaker plethysmograph method of Jackson and Vinegar (J Appl Physiol: 47, 1979). The studies were conducted during brief interruption of conventional ventilation while monitoring the infant's $P_{tc}O_2$ and pulse rate. Resonant frequencies ranged from 11 to 23 Hz and at resonance Z_{rs} was 33 to 71 cm H_2O/L/sec. Both below and above resonant frequency, Z_{rs} increased, rising by 20% at 6 Hz below (range 4-8 Hz) and 8 Hz above (range 5-13 Hz) resonance. One infant exhibited little frequency dependence of Z_{rs}. For these patients, we conclude that a region of frequencies surrounding resonance exists where Z_{rs} changes little and therefore the mechanical efficiency of high frequency ventilation should change little.