1393 COMPARISON OF POSTNATAL HORMONAL CONTROL OF GLUCOSE IN OFFSPRINGS OF DIABETIC MOTHERS (IDM) AND IN HEALTHY INFANTS.

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Venous concentrations of glucose and the carbohydrate regulatory hormones were measured at birth, 1, 4, and 12 hrs of life in 9 vaginally delivered control babies and in 17 IDM (12 delivered by caesarian section [C/S]). Pre and perinatal maternal diabetic control was generally good. 14 IDM received standard glucose infusions after 1 hr. Biochemical data (median values; significance †):

	Birth		+1 hr		+4 hr		+12 hr	
	IDM	NL	IDM	NL	IDM	NL	IDM	NL
Glucose (mg/dl)	104	109	39	42	79†	64	89†	53
Insulin (uU/ml)	28†	6	19†	3	49†	3	19†	3
Glucagon (pg/ml)	125	70	190	80	110	90	140	145
Epi (pg/ml)	80	45	200	200	45	40	40	50
NE (pg/ml)	750	400	800†	500	300	400	450	500
Cortisol (ug/dl)	12	20	25	28	9	9	6	8
GH (ng/ml)	15	10	25†	15	25†	12	25†	23

Glucose levels at 4 and 12 hrs were higher in the IDM because of glucose infusions. Free insulin levels in the IDM were higher at all intervals. In the IDM delivered by C/S, cortisol at birth (8.5) was lower than in either IDM delivered vaginally (20) or controls (20). Growth hormone (GH) was higher in the IDM at 1, 4 and 12 hours; the higher values at 4 and 12 hrs might be due to glucose infusion. Norepinephrine (NE) was elevated only at 1 hour in the IDM. Cortisol, epinephrine (Epi) and glucagon values in the 2 groups were similar at all intervals. Conclusion: Our IDM population had no deficits in their counter-regulatory hormone responses during early postnatal life. They did however have significant hyperinsulinemia.

●1394 PREVENTING ALVEOLAR OVERDISTENTION IN MECONIUM ASPIRATION (MA).

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Initial determinations of functional residual capacity (FRC) in human infants with MA show that commonly used ventilator settings can lead to gross alveolar overdistention independently of PEEP. Using an animal model of MA we investigated the effects of varying exhalation time (inspiratory to expiratory ratio, I:E) on FRC, minute ventilation (V_E), PaO_2 and $PaCO_2$. Cats (n=11) were insuflated with 3.5 ml/kg human meconium (20% sol'n). After stabilization (1 h) they were mechanically ventilated (Baby Bird®) at 40 BPM on 70% O_2 with a mean airway pressure, 8.8±0.3 cm H_2O (mean±SE) and PEEP 3.9±0.4 cm H_2O. These settings were maintained constant while I:E was varied in random order from 1:1 to 1:2, 1:3 and 1:4 (or exhalation times 0.75, 1.00, 1.125 and 1.20 sec). An I:E of 1:1 produced gross alveolar overdistention in all of the animals. Changing the I:E from 1:1 to 1:4 resulted in a large decrease in FRC toward normal values (44±7 to 34±6 ml/kg, p<0.01; a 29% decrease). Tidal volume increased from 7±1 ml/kg to 13±1 ml (p<0.001) due to increases in lung compliance and peak inspiratory pressure. This resulted in an increase in V_E from 206 to 532 ml/min and a large decrease in $PaCO_2$ from 51±7 to 31±2 mm Hg. PaO_2 was not significantly altered by changes in I:E. Best gas exchange with minimal FRC change occurred at an I:E of 1:3 ($PaCO_2$ 30±3 mm Hg and PaO_2 99±13 mmHg). Our study suggests that I:E with exhalation times less than 1.0 sec should not be used in severe MA. Ratios should be selected in accordance with the degree of illness and its effects on the time required for complete exhalation.

●1395 HORMONES AND SURFACTANT SYNTHESIS IN EXPLANTS OF HUMAN FETAL LUNG.

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To further study the effects of glucocorticoids and thyroid hormones in fetal lung, we cultured human lung (16-22wk) for 4-8d as explants in serum-free Waymouth's medium with 95% air/5% CO_2. Effects of dexamethasone (Dex, 10 nM) and T_3 (2 nM) on phosphatidylcholine (PC) synthesis varied with precursor (Table).

^{3}H-Precursor	n		Incorporation into PC (% stimulation) T_3	Dex	T_3 + Dex
Choline	18	mean	44 ± 9	121 ± 13	189 ± 15
Acetate	4	± SE	15 ± 7	830 ± 235	840 ± 230
Glycerol	3		0	77 ± 10	62 ± 18

The additive hormonal effect occurred over a range of choline concentrations, did not alter the distribution of label among acid-soluble precursors, and correlated with tissue saturated PC content. Dex, but not T_3, altered the distribution of precursor among phospholipids; compared to controls, glycerol incorporated more into PG (13.5 vs 4.9%) and less into PI (13.1 vs 18.9%), and acetate incorporated more into PC (81.5 vs 73.1%) and less into sphingomyelin (2.1 vs 6.3%). By electron microscopy, epithelial cells of treated explants showed less glycogen, many more lamellar bodies, and proliferation of microvilli. We conclude that low concentrations of glucocorticoids and thyroid hormone stimulate surfactant production in fetal lung in the absence of serum or other hormones. The two hormones appear to act at different biochemical sites to produce a synergistic response.

●1396 REGIONAL CEREBRAL BLOOD FLOW (CBF) RESPONSE TO APNEA IN NEWBORN (NB) PIGLETS.

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Previous studies have shown that sustained steady-state hypoxemia results in increased CBF with greatest increases to brainstem and subcortical structures. The present study investigates acute regional CBF response to single and repeated short (130 - 180 sec) apneas in 5 NB piglets. After catheterization and tracheostomy, piglets were paralyzed and mechanically ventilated (PO_2=60-70, pH=7.35-7.45, PCO_2=30-35) with 30% N_2O. Following baseline measurements of blood gases, pH, Hct, BP, HR, and CBF by microspheres, apnea to the point of bradycardia (HR < 80) was induced by disconnecting the ventilator, and repeated for a total of 7 apneas. CBF was measured during the first apnea (PO_2=16 ± 13 torr, pH = 7.34 ± .06, PCO_2 = 42 ± 5), recovery from first apnea (Rec 1), and ½ hr after the 7th apnea (Rec 2). During apnea, rapid regional CBF redistribution occurs, with decreased flow to the cerebrum 56 ± 4 ml/min/100g to 43 ± 7, -23%, caudate 76 ± 14 to 73 ± 22, -10%, and choroid plexus 148 ± 25 to 86 ± 22, -43%, although total brain flow increased 66 ± 8 to 84 ± 15, +28%. Flow increased significantly (70 - 200%) to brainstem structures (midbrain 64 ± 6 to 108 ± 17, pons 90 ± 26 to 183 ± 64, medulla 59 ± 4 to 174 ± 28) with moderate increases (28 - 40%) to subcortical structures (thalamus 64 ± 7 to 88 ± 11, hippocampus 38 ± 4 to 51 ± 11, cerebellum 52 ± 3 to 67 ± 8). During Rec 1 and Rec 2, CBF remained elevated from baseline, 58% and 37%, respectively; the regional flow returned, however, to a more uniform distribution pattern. The nonhomogeneous regional CBF during apnea suggests differences in regional metabolism, response time, or vascular sensitivity to hypoxemia in the newborn brain.

†1397 HEMODYNAMIC RESPONSE TO SINGLE AND REPEATED EPISODES OF APNEA IN NEWBORN (NB) PIGLETS.

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This study investigates the ability of hemodynamic mechanisms to respond to multiple episodes of apnea in 5 NB piglets. Following catheterization and tracheostomy, piglets were paralyzed and mechanically ventilated (PO_2 = 60-70 torr, pH = 735-7.45, PCO_2 = 30-35). After baseline measurements of blood gases, pH, Hct. BP, HR, and organ blood flow by microspheres, apnea to the point of bracycardia (HR < 80) was induced by disconnecting the ventilator; 30-40 sec later, mechanical ventilation was resumed until HR and BP returned to baseline. A total of 7 apneas were induced over 1½ hrs. Microspheres were injected during the first apnea (PO_2 = 16±13, pH = 7.34±.06, PCO_2 = 42±5), recovery from first apnea (Rec 1), and ½ hr after the 7th apnea (Rec 2). Tissue blood flows (ml/min/100g, mean ±S.E. and % change):

	Baseline	Apnea	Rec 1	Rec 2
heart	196±10	431±54(+121%)	254±42(+31%)	292±48(+27%)
brain	66±8	84±15(+28%)	106±26(+58%)	91±14(+37%)
kidneys	183±10	11±2 (-94%)	195±25(+5%)	209±37(+13%)
skel-muscle	16±4	0 (-99%)	13±2 (+8%)	10±2 (-10%)

The rapidity of hemodynamic response to apnea, redistribution of blood flow occurring 130-180 sec after cessation of ventilation, 30-40 sec after onset of bradycardia indicates oxygen sensitivity of newborn vasculature. Kidney and skeletal muscle flows return to near baseline during Rec 1 and Rec 2, while heart and brain flows remain elevated; lack of significant difference between Rec 1 and Rec 2 despite 6 intervening apneas suggests no cumulative effect in the newborn piglet of brief, repeated hypoxemic insults.

†1398 EFFECT OF ENDOTOXIN ON SOMATIC GROWTH IN NEWBORN RATS.

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While the mortality of endotoxin shock (ETX) is well described, the effects on growth among survivors are not documented. Therefore, 13-day-old rat pups were injected with 1 mg/kg S. enteritidis ETX i.p.. Litter mate controls received i.p. saline. Hemodynamic study of a subset each group confirmed ETX shock at this dose. During study, pups were kept with mothers, and serial measurements were obtained.

Results: 16 of 39 rats receiving ETX died within 24 hrs. Remaining ETX rats gained weight, but at a slower rate than controls. By 7 days there was a 6 gm difference, and at 14 days, 13 gm ($p<.05$). Body length in ETX group was 93% of Control ($p<.05$).

	bodyweight (gm)			body length (cm)	
day	0	7	14	7	14
Cont	35.9±.8	59.9±2.0	93.5±2.3	12.7±.1	15.0±.1
ETX	37.0±.7	51.5±2.5*	80.4±3.0*	12.3±.2*	13.9±.2*

(*$p<.05$)

These data suggest that ETX has a significant effect on both body weight and length in neonatal animals. This model appears useful for study of the effects of neonatal sepsis on somatic growth.