263 INCREASED AMINO ACID CATABOLISM IN THE FETAL LAMB DURING MATERNAL FASTING. James A. Lemons, Richard L. Schreiner, Helen Moorehead, Rick Bohnke, and Debra Reyman (Spon. by J. Bergstein). Indiana University School of Medicine, Indiana University Hospitals, Department of Pediatrics, Indianapolis, Indiana.

The effect of maternal fasting upon fetal nitrogen uptake in the form of free amino acids ($\dot{Q}_N$), fetal oxygen consumption ($\dot{Q}_{O_2}$), glucose utilization ($\dot{Q}_G$), urea excretion ($\dot{Q}_U$) and umbilical blood flow (UBF) was assessed in the chronic fetal lamb preparation. Five animals (mean gestational age 118 days) were studied in the fed state 7 days after surgery and again 12 days postoperatively after 5 days of maternal fasting. $\dot{Q}_G$ decreased from 6.88 ± 1.04 to 2.69 ± .30 mg/kg/min during the fasted state while $\dot{Q}_{O_2}$ remained unchanged (7.38 ± .53 vs. 7.41 ± .70 ml/kg/min). The glucose:oxygen quotient thus decreased from .69 to .28 during fasting. $\dot{Q}_U$ increased from 448 to 691 mg/kg/day, although nitrogen uptake from the placenta did not change during fasting (802 vs. 768 mg/kg/day). These findings indicate that the fetal metabolic rate remains unchanged during the fasted state while exogenous glucose utilization decreases to <50% of fed state values. An augmented utilization of amino acids is reflected by the increased urea excretion rate, but without a detectable increase in nitrogen uptake from the placenta. Therefore, the ovine fetus becomes increasingly reliant on amino acid substrate during fasting and may be required to catabolize its own protein stores, or to direct exogenous amino acids from growth to catabolism to maintain adequate energy substrate.

264 HINDLIMB METABOLISM IN A CHRONIC FETAL SHEEP PREPARATION: FETAL AUTOREGULATION OF ALANINE UPTAKE. Lynne L. Levitsky, Laurence Burd, John B. Paton, Anna Tomasi, David E. Fisher. Pritzker School of Medicine, Univ. of Chicago, Michael Reese Hosp., Depts. of Pediatrics and Obstetrics and Gynecology, Chicago.

Fetal energy requirements can be met partially by protein catabolism during maternal substrate deprivation in sheep. The mechanism of this phenomenon is poorly understood. Hindlimb metabolism was studied in 7 chronically catheterized sheep pregnancies in the fed state. Catheters were placed in the fetal aorta and femoral vein in order to measure arteriovenous differences for substrate across the hindlimb. The hindlimb took up 2.9>5.8<8.7 μM/min of glucose (95% conf. limits) and put out 4.3>10.8<17.3 μM/min of lactate (95% conf. limits). Neither acetoacetate nor β-hydroxybutyrate were taken up but arterial levels of these substrates correlated with maternal arterial levels. Fructose was neither taken up nor released by the fetal hindlimb. Uptake of alanine was correlated with fetal arterial levels of alanine [y=0.190x -0.015 (mM/L)] and glucose (both p<.001) but was not correlated with levels of arterial ketone bodies. At low levels of arterial alanine and glucose, alanine was released by the hindlimb. The ovine fetus can autoregulate its alanine supply. This may provide a mechanism for the shift in fetal fuel sources during maternal fasting in the sheep.

● **265** FETAL CATECHOLAMINE (CAT) RESPONSE TO HYPOXEMIA Alan B. Lewis, William N. Evans and William Sischo. Univ. of Southern Calif. School of Medicine, Childrens Hospital of Los Angeles, Dept. of Pediatrics, Los Angeles

The cardiovascular responses of the fetus to hypoxemia are characterized by hypertension and bradycardia and are mediated by increases in sympathetic and parasympathetic tone. The sympathetic activity is likely to be a combination of increased adrenergic neuronal tone and circulating Cat. This study was undertaken to quantitate plasma norepinephrine (NE) and epinephrine (E) levels at rest and following hypoxemia in 10 chronically catheterized fetal lambs in utero. Hypoxemia was produced by gradual inflation of an umbilical cord cuff-constrictor while fetal heart rate and blood pressure were monitored continuously. Cat were measured by radioenzymatic assay using 50 μL of plasma.

Condition	Po2(torr)	HR	BP (mmHg)	NE(pg/ml)	E(pg/ml)
Control	23±.5	161±4	68±1/45±1	256±31	24±5
Hypoxemia	12±.6*	100±4*	86±3/58±2*	1888±384*	1159±433*
Recovery	23±1.1	177±6**	77±2/51±1*	531±63*	113±33*

*p < .01 **p < .05 Mean ±SE

Control E levels rose significantly during the last .25 gestation from 16±6 to 37±7 pg/ml (p< .05). NE and E increased exponentially in response to hypoxemia and the magnitude of the response was independent of gestational age. In conclusion, the late gestation fetal lamb is capable of manifesting a profound Cat response to hypoxemia. The increase in plasma NE and E appears to play a major role in the fetal cardiovascular compensation to stress.

266 DEVELOPMENTAL CHANGES IN BASOLATERAL MEMBRANE (BLM) OF RABBIT PROXIMAL CONVOLUTED TUBULE (PCT). Michael A. Linshaw and Larry W. Welling. Univ. of Ks. Med. Ctr., Depts. of Peds. and Path., Kansas City, Kansas

The maturational increase in proximal tubular sodium reabsorption is associated with several developmental changes: 1) decrease in hydraulic conductance 2) decrease in leakiness of tight junction 3) increase in surface area of BLM. The BLM provides a barrier to fluid reabsorption but its role is poorly characterized because reabsorption studies relate primarily to fluid movement across the entire transepithelial surface. To evaluate developmental changes in the rate of fluid movement across the BLM, 53 single early PCT with collapsed lumens were isolated from the outer cortex of rabbit kidneys and both ends tightly crimped in pipets. BLM surface area and rate of change of cell volume assessed by cell diameter in 10^{-4}M ouabain were measured in the same tubule segment. Rates of swelling were used to compare trans BLM fluid movement during development.

AGE	TUBULE SWELLING RATE		BLM SURFACE AREA	
DAYS	nl/min/mm tubule length		$\mu^2 \times 10^5$	
2-5	0.009±0.002	N,5	9.58±0.6	N,7
14-17	0.012±0.001	N,10	10.97±1.25	N,8
Adult	0.045±0.006	N,15	29.49	N,8

Tubules from 2-17 days were of similar maturity as judged by swelling rate and BLM surface area, but swelling rate and surface area increased by adulthood. We conclude that increases in trans BLM fluid movement relate primarily to surface area and not necessarily to intrinsic changes in membrane permeability.

● **267** THE RELATIONSHIP BETWEEN CEREBRAL BLOOD FLOW AND MITOCHONDRIAL ACTIVITY OF FETAL LAMB BRAIN IN STATES OF REDUCED OXYGEN CAPACITY. Robert M. Liston, Linda Sacks, Endla Anday, Crosby Roper, Thomas Heffernan, Steven Gabbe and Maria Delivoria-Papadopoulos. University of Pennsylvania School of Medicine, Philadelphia, PA.

Previous studies have shown that the increased respiratory rate (RR) of newborn and adult brain mitochondria seen in states of reduced arterial O_2 tension is an adaptive response. The present study investigates the response of fetal lamb brain mitochondria to decreased O_2 content produced by increasing carboxyhemoglobin concentration [COHb]. Ten chronically catheterized fetal lambs were subjected to increased [COHb] for 2 hrs at a constant blood volume. Blood gases, [Hb], [COHb] and cerebral blood flow, determined by the microsphere technique, were measured before and after establishment of 0 - 25% [COHb]. State 4 (substrate, no ADP) and state 3 (substrate, +ADP) RR of brain mitochondria, expressed as nm O_2/nm cytochrome oxidase ($a+a_3$) were determined with glutamate-malate substrate. As left ventricular O_2 content was reduced from 8 to 3.5 ml/dl, state 3 activity fell from 216 to 119 nm O_2/min (r=.714), a response opposite to that reported in adult animals exposed to increased [COHb]. In spite of this decreasing O_2 content, O_2 delivery increased (r=.965) as a result of a large increase in cerebral blood flow (from 60 to 418 ml/min/100g). This rise in O_2 delivery was associated with a reduction in state 3 activity (r=.654). Our data show that fetal brain mitochondria adapt to increased oxygen availability, a response similar to that seen in newborn lambs as PaO_2 rises.

268 THE RELATIONSHIP OF SMOKING AND PRENATAL DIETARY INTAKE TO INFANT BIRTH WEIGHT. A. Harold Lubin, Ruth O. Shrock, Janet S. Kasler, The Ohio State University College of Medicine, Children's Hospital, Columbus, Ohio.

29% of pregnant women (309) enrolled in a longitudinal study determining effects of maternal nutrition and environmental factors on the infants' subsequent growth and development were identified as smokers. They were compared with an equal number of women randomly selected from the same investigation who were non-smokers. Prenatal caloric intake and maternal weight gain were examined as well as the resultant infant birth weight and gestational age. Trends were identified in the following areas: 1) Smoking mothers produced lower birth weight infants (P<.005); 2) Smoking mothers' prenatal intake was as much if not more than non-smoking mothers (P<.10); 3) Smoking mothers evidenced as much if not more weight gain than non-smoking mothers (P<.10); 4) Smoking mothers produced infants of a similar gestational age; 5) Despite adequate prenatal caloric intake, weight gain and gestational age, smokers produced lower birth weight infants.

Additional variables influencing birth weight were identified and controlled with the above trends remaining. These variables included race, parity, maternal size, socioeconomic status and sex of the child. Results indicate that despite eating as much or more than non-smoking females, smoking women continue to produce low birth weight infants.