sively thereafter. However, between 3 to 12 months of life mean values mostly remain higher (66 to 87 ng/100 ml) than in male infants of the same age and also higher than in girls aged 1 to 2 years (40 ng/100 ml), period at which 17-OH-P levels are similar in both sexes.

"Is 17-OH-P a good index of gonadal activity?" Although 17-hydroxy-progesterone is a hormone of dual origin, the testicular or ovarian participaton to the plasma pool of 17-OH-P is important at periods of gonadal activity in maturity. Plasma 17-OH-P levels also increase in children with precocious puberty and reach adult male values in prepubertal boys after human chorionic gonadotropin stimulation. As we expected, the pattern observed for 17-OH-P in male infants correlates with that of testosterone.

In contrast we did not expect to observe such a pattern in female infants. From the above data we would conclude that a certain ovarian activity is present in infancy and moreover opposite to male infants lasts (episodically or as surges?) until late infancy.

In addition the pattern of 17-OH-P levels found in female infants resembles closely that described by Bidlingmaier *et al.* for oestradiol [4] and supports the findings and conclusions of these authors.

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L. **Prenatal and neonatal steroid influences,** J. H. LEATHEM, S. W. C. CHAN, A. W. JORDAN and B. N. GARNER, Bureau of Biological Research, Rutgers University, New Brunswick, New Jersey 08903, U.S.A.

Placental growth is of biological significance in that placental tissue promotes prenatal life and pregnancy maintenance whereas placental suppression can be adverse. Uniquely, however, DNA synthesis stops on day 18 of the 21 day rat gestation period but cell hypertrophy continues. Nevertheless, placental weight is known to vary inversely in the rat relative to the number of fetuses but normal placental growth is not modified by exogenous estrone, progesterone or provera but may be retarded by prednisolone. However, the interrelationship among maternal, fetal and placental endocrine systems has had only modest consideration relative to placental growth. Thus it was of interest to observe a marked placental overgrowth in the rat, if ovariectomized on day 10 and injected with estrogen and progesterone to sustain pregnancy. This overgrowth resulted in an increase in DNA that did not stop on day 18 and also in Ribosomal RNA. Furthermore, the excess growth occurred in the absence of the adrenal and pituitary. An ovarian control over placental growth was indicated and in an inhibitory manner as "giant placentae" do not develop when ovaries are intact. Efforts to elucidate the potential placental growth antagonist has centered on estradiol. Wide variations in serum progesterone did not relate to the degree of hypertrophy while reductions in serum estradiol promoted, whereas elevated estradiol levels suppressed excessive placental growth. Unilateral ovariectomy favors placental overgrowth and the response is enhanced by administration of anti-estradiol serum. The estrogen–progesterone ratio is also important to the growth induced. Then too, aminoglutethimide (10 mg/100 gm) modifies steroid synthesis so that placental overgrowth could be induced with estrone and progesterone in the presence of the ovaries.

The independent development of the placenta after fetectomy is well known but fetectomy before day 16 in the rat sharply retards placental growth. However, the sustaining of placental weight results in growth of the endocrine elements. Fetectomy on day 14 restricted placental growth to 100–150 mg and the organ was unresponsive to exogenous steroids. However, in the absence of the ovary, placental weight increased to 700 mg in response to estrone and progesterone with little evidence of an influence of steroid ratio. Curiously, 20α-dihydro-progesterone provided an enhanced growth response. The significant placental growth invoked by steroids was associated with a marked increase in total protein and DNA but RNA and Ribosomal RNA failed to increase in the absence of the fetus.

The steroid synthetic competence of the rat placenta has been reinvestigated to compare the normal and giant placenta. Incubation of basal zone placental tissue with [7α-H^3]-pregnenolone as the substrate resulted in significant progesterone synthesis (30·3%) and with 17-hydroxyprogesterone, androstenedione and testosterone being identified. Incubation of whole placentae produced only a 4% conversion to progesterone and the 5α-reduced products predominated. Addition of 200 iu HCG *in vitro* to basal zone tissue significantly enhanced the production of progesterone, 17-hydroxyprogesterone, androstenedione and 5α-pregnan-3,20-one. The basal zone of "giant" placentae was significantly greater than normal in mass. However, incubation of this tissue with pregnenolone yielded significantly less progesterone (17%) and more androstenedione than normal tissue. Furthermore unlike normal placental tissue no stimulation of steroid formation was obtained in response to hCG when giant placenta basal zone was used. These data then suggest that it may be premature to conclude that placental hypertrophy is merely accelerated growth consequential to the removal of any growth inhibitor due to ovariectomy.

Following parturition, a critical period of sensitivity to steroids occurs in some rodents from birth to day 10. Indeed, a single injection of androgen on day 5 can permanently sterilize a female mouse or rat. Similar results were noted with estradiol but less consideration was given to this effect in view of the attractive studies relative to the impact of early androgen on the development of a genetic female. Nevertheless, the potential importance of estrogen effects was emphasized by the recent evidence that testosterone is converted to estradiol by the brain. Furthermore, the dosages used for sterilization may not be pharmacologic as previously suggested in that receptors are few in the neonate brain.

Estradiol dipropionate (10 μg) administered to Swiss–Webster mice at either 5 or 20 days of age caused vaginal opening within 3 to 6 days. Beginning at 30 days of age, vaginal smears of mice injected at age 5 days revealed irregular cycles for 30 days and periods of prolonged diestrus thereafter. The steroid did not alter the pattern of estrous cycles when injected at 20 days of age.

Morphologically the ovaries of mice injected with 5 μg of estradiol diproprionate fail to form corpora lutea. When treatment was delayed until 10 days of age, no corpora lutea developed in 60 day old mice until the dosage was reduced to 1 μg. Another measure of ovarian development was the distribution of 5-ene-3β-hydroxysteroid dehydrogenase. In the mouse ovary,

significant increases occur in the theca and interstitium between days 10 and 25 of age whereas the granulosa exhibits an enxyme decline after day 15. Dehydroepiandrosterone (DHA), pregnenolone, 17-hydroxypregnenolone and 16-dehydropregnenolone served as substrates. Administration of 5 μg of estradiol benzoate at 5 days of age delayed the development of the enzyme to day 20 in the interstitium and to day 30 in the theca regardless of the substrate but at age 40 days substrate differences were noted. When estradiol was injected on day 10, enzyme development in the interstitium was actually enhanced through day 40.

Prior studies have indicated that 10 μg of estradiol diproprionate administered to the neonate will invoke infertility if injected at 5 days of age and that this dosage is partially effective at 10 days of age when studied in mice 100 days old. Administering 5 or 10 μg of estradiol benzoate at 5 days of age resulted in 29 of 30 mice being infertile, although cohabitated with males for 90 days. Littermate controls proved fertile in 23 or 24 cases with litters being delivered in 24–31 days after admission of the male. When comparable steroid treatment was given at 10 days of age, 50% of the mice in each group proved infertile. Furthermore, litter size was subnormal and cohabitation time with the male was extended from 24 days (control) to 41 days (5 μg) to 57 days (10 μg) with each time period being significantly different. Finally, the influence of aging and neonatal steroid effects were examined 16 to 17 months after 5 μg of estradiol benzoate was administered on day 5 (7 expt., 9 controls) or day 10 (6 expt., 8 controls). After 100–150 days in breeding n4 pregnancies resulted in neonatal steroid treated rats whereas 3 controls produced small litters. The impact of neonatal steroid treatment on aging is unknown but does deserve consideration.

51. Physiologically available cortisol in the human fetus and mother, B. E. PEARSON MURPHY and A. C. CAMPBELL, Reproductive Physiology Unit, Montreal General Hospital, and Department of Experimental Medicine, McGill University, Canada

In order to interpret the relationships between total cortisol levels in maternal serum, cord arterial and venous serum and amniotic fluid, it is necessary to consider the fraction of cortisol which is physiologically available to the tissues, i.e. that which is not bound to transcortin. This was measured at 37°C by equilibrium microdialysis of 0·1 ml sample against 0·1 ml saline containing a concentration of albumin equal to that of the sample. Total cortisol was measured by a specific non-chromatographic radiotransinassay. Physiologically available cortisol was then calculated as % unbound x total cortisol. Subjects were studied at 12 to 20 weeks gestation. (6 elective hysterectomies) and at term (8 elective Caesarean sections, 14 induced vaginal deliveries, and 18 spontaneous-onset vaginal deliveries. The two vaginal delivery groups were matched for gestational age and duration of labour. The % unbound cortisol in maternal serum ranged from 17 to 29% while that in cord serum ranged from 34 to 76%. Cord arterial and venous values were similar in all instances. Lowest percentages were found at 12 to 20 weeks and highest at spontaneous vaginal delivery. Levels of physiologically available cortisol at term were all higher than at 12 to 20 weeks gestation. Cord arterial levels were consistently higher than venous levels in all groups, but especially in the spontaneous group ($P < 0.01$). Maternal levels were higher than cord levels but the amount crossing the placenta, corrected for 85% conversion of cortisol to cortisone, as estimated previously in our laboratory (*Am. J. obstet. Gynec.* **118** (1974) 538), was lower than cord levels in all instances ($P < 0.01$). Spontaneous-onset cord arterial levels (61 ± 3 ng/ml) were higher ($P < 0.05$) than induced cord arterial levels (43 ± 5 ng/ml) or Caesarean section cord arterial levels (36 ± 8 ng/ml). Amniotic fluid levels were about half those of cord levels and correlated well with cord arterial levels but poorly with maternal venous levels. These studies provide evidence that (1) the placenta, by converting maternal cortisol to cortisone, acts as a barrier to prevent fetal pituitary-adrenal axis suppression, and (2) there is a surge of fetal cortisol which precedes the onset of spontaneous-onset labour which may be important in triggering parturition in man.

52. Urinary steroid metabolites in the human newborn, R. A. ANDERSON, G. DEFAYE, C. MADANI, E. M. CHAMBAZ, C.H.U. Grenoble (France), and C. J. W. BROOKS, Chemistry Department, University of Glasgow, Scotland

Urinary steroid separations using gas phase analysis (g.l.c. and GC–MS) have shown that the main metabolites excreted in the newborn period might have a different biological significance, according to their mode of conjugation. Steroid sulfates were of the 5-ene-3β-hydroxy type, increased after ACTH stimulation and were absent in a case of anencephaly. By contrast, the glucuronide fraction contained mainly saturated pregnane structures, were not influenced by ACTH and disappeared within the first 10 days of life.

Methods were developed to obtain satisfactory group separations of steroid metabolites using lipophilic substituted dextran gels, either by direct or reversed phase elution (Anderson *et al.: J. Chromatog.* 99 (1974) 485).

A number of polyhydroxylated 5-en-3β-hydroxy-C_{19} compounds were synthesized, either by biological or chemical routes: 3β,15α-dihydroxy-5-androsten-17-one; 5-androstene-3β,7α (and 7β), 17β-triol; 3β,16β,17β-trihydroxy-5-androsten-7-one; 5-androstene-3β,15α,16α,17β-tetrol; 5-androstene-3β,15β,16β,17β-tetrol; 3β, 18-dihydroxy-5-androsten-17-one; 5-androstene-3β,17β,19-triol.

After preliminary group fractionation, 15α-hydroxy-DHA (trace) and 5-androstene-3β,15α,16α,17β-tetrol (average 110 μg/24 h) could be identified in the sulfate fraction in the newborn period.

The same methodology could be applied to the study of steroid in amniotic fluid; in a case of sulfatase defect, values within the normal range were obtained for the major 5-ene-3β-hydroxy steroids which could be measured.

53. Pattern of plasma concentration of dehydroepiandrosterone during the neonatal period and the first year of life in human, EVELINE DE PERETTI and MAGUELONE G. FOREST, Unité de Recherches Endocriniennes et Métaboliques chez l'Enfant, INSERM-U.34 Hôpital Debrousse, 29, rue Soeur Bouvier, 69322 Lyon Cedex 1, France

A specific and sensitive radioimmunoassay (RIA) for measuring unconjugated plasma dehydroepiandrosterone (DHA) has been developed. Specific antibodies have been obtained in rabbit immunized with a DHA-17 (O-carboxymethyl) oxime – BSA complex. Plasma was extracted by diethyl ether and the dry extract purified on a celite column. At the end of the RIA, bound and free fractions were separated using a Dextran-charcoal solution. In mixed cord blood, the mean values were 593·3 ng/100 ml ± 186·5 (range 248–1493) in 21 females, and 712·7 ng/100 ml ± 190·9 in 18 males (range 179–1367). These values were within adult range (642 ± 112 ng/100 ml in male and 515 ± 107 ng/100 ml in female). During the first day of life the peripheral