nates in some, while in others noradrenaline is present in higher content. SHEPHERD and WEST[10] proposed the hypothesis that the corticoadrenal tissue and its hormones bear an importance in determining the type of the predominant amine in the adrenal gland. Since then many controversial works on the subject have been published. In spite of the particular position of the *Pygoscelis papua* in the systematic classification, the relationship between its cortical tissue and the adrenaline and noradrenaline containing cells is similar to that shown by all the birds studied up to now[6,11,12,13].

*Resumen.* Se investigó con microscopía óptica y electrónica y aplicando la técnica de glutaraldehido-plata[5,8] la distribución y características de las células que contienen adrenalina y noradrenalina en el pinguino Papúa (*Pygosceles papua*).

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## Effect of Hypophysectomy or Hysterectomy on the Luteal 20α-Hydroxysteroid Dehydrogenase in Pregnant Rats

The ovarian level of 20α-hydroxysteroid dehydrogenase (20α-HSD) seems to represent, in the rat, one of the principal regulatory mechanisms in the catabolism of progesterone[1]. This enzyme is found only in corpora lutea (CL)[2]; it appears at a definite time in the newly-formed CL, i.e. after 2–3 days in the oestrous CL (late diestrus) and 20 days after mating in the pregnancy CL, i.e. shortly before parturition[3,4].

Some experimental data make it possible to assume that the appearance of this enzyme is under hypophysal control[1,5,6]. The secretion of prolactin, especially, seems to inhibit its onset in the CL[1,7].

In 1938, ASTWOOD[8] demonstrated in the rat that the activity of the CL in maintaining pregnancy in its early period and pseudopregnancy, is under hypophysal control. According to LINDNER and SHELESNYAK[9] this activity manifests itself in a high progesterone/20α-hydroxyprogesterone ratio in the blood.

One can thus presume that in early pregnancy, as in pseudopregnancy, the absence of luteal 20α-HSD activity is maintained by the hypophysal incretion. In middle and late pregnancy, when ova are already implanted, it can be assumed that placental incretion is responsible for maintaining the CL 20α-HSD negative.

Experiments evaluating the 20α-HSD activity in pregnancy or pseudopregnancy CL of hypophysectomized or hysterectomized rats have been performed in order to test these possibilities.

*Materials and methods.* Female albino rats, 250–300 g body weight, with controlled regular oestrous cycles were used. Pseudopregnancy was obtained by mating the female rats with vasectomized males. The day of cohabitation is assumed as day 0 of pseudopregnancy. Pregnancy was induced by a 24 h cohabitation of proestrous females with males of proven fertility and confirmed by the presence of sperms in the vagina the morning after (day 1 of pregnancy).

Hypophysectomy was performed by transpharyngeal route and confirmed by histological examination of the 'sella turcica' on the day of sacrifice. Hysterectomy was performed by transabdominal route. The different experimental conditions and the number of animals are shown in the Tables.

At sacrifice, the ovaries of the animals were dissected out, quickly frozen by $CO_2$ and then processed according to the methods previously described[4] for the detection of the 3β-hydroxysteroid (3β-HSD) and 20α-HSD activities. The reaction for 3β-HSD was used to identify all the CL.

*Results.* (1) Pregnancy. The data summarized in Table I show that when the hypophysectomy is performed before the 11th day of pregnancy, all the CL display a strong enzymatic 20α-HSD activity 3 days after the operation. On the other hand, when the hypophysectomy is performed after the 13th day of pregnancy, the pregnancy

Table I. Effect of hypophysectomy on corpora lutea of pregnant rats

| Day of operation | Day of sacrifice | No. of animals | No. of animals with 20α-HSD negative CL |
|---|---|---|---|
| 1 | 4 | 4 | 0 |
| 3 | 6 | 4 | 0 |
| 7 | 10 | 5 | 0 |
| 11 | 14 | 10 | 8 |
| 13 | 16 | 8 | 8 |
| 15 | 18 | 3 | 3 |

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CL appear 20α-HSD negative as happens in the non-operated control animals. After hysterectomy the CL behave in exactly the opposite way; i.e. when hysterectomy is performed before the 11th day of pregnancy, the pregnancy CL appear as usual, 20α-HSD negative; when it is performed after the 13th day, an intense enzymatic activity can be detected in the pregnancy CL 3 days after the hysterectomy. (Table II.)

(2) Pseudopregnancy. As shown in Table III, the pseudopregnancy CL, i.e. the ones due to the last ovulation, are, as previously shown[6] 20α-HSD negative at least until the 9th day of pseudopregnancy. This enzymatic activity is present only in the involuting CL, i.e. those of previous generations. In hypophysectomized pseudopregnant rats, the pseudopregnancy CL show 20α-HSD activity 3 days after the operation.

*Discussion.* The above-mentioned results show that the hypophysal incretion inhibits in pseudopregnancy and in early pregnancy (i.e. in the period of pre-implantation, implantation and placenta formation) the onset of the 20α-HSD activity in CL. As a consequence of the absence of this enzyme, present only in the involuting CL, the concentration of the progesterone (P) in the blood increases and the concentration of the 20α-hydroxy-progesterone (20α-OH-P) decreases[1,9].

When hypophysal incretion is lacking and 20α-HSD appears in all the CL the particular equilibrium between P and 20α-OH-P, which is necessary to allow pregnancy or pseudopregnancy, is altered and both the situations are interrupted. When the placenta is already formed, the control of the 20α-HSD activity in the CL goes from the pituitary to the placenta itself. In late pregnancy, in fact, hypophysectomy does not cause the onset of the 20α-HSD activity in the CL, which is instead brought about by hysterectomy, as shown by the present data, or by placental dislocation[1]. In the second half of pregnancy the placenta is the organ responsible for the proper P/20α-OH-P ratio, by maintaining 20α-HSD negative the pregnancy CL.

It should be noted that the placental incretion, while inhibiting the onset of the 20α-HSD activity when it is lacking, is not able to abolish it when present. In fact in pregnant ergocornine-treated rats in which pregnancy is maintained by progesterone administration, the presence of placenta and foetuses does not abolish the 20α-HSD activity induced in all the CL by ergocornine[7,10].

Table II. Effect of hysterectomy on corpora lutea of pregnant rats

| Day of operation | Day of sacrifice | No. of animals | No. of animals with 20α-HSD negative CL |
|---|---|---|---|
| 1 | 4 | 5 | 5 |
| 1 | 6 | 3 | 3 |
| 1 | 8 | 4 | 4 |
| 8 | 11 | 5 | 5 |
| 11 | 14 | 5 | 4 |
| 13 | 16 | 5 | 2 |
| 15 | 18 | 6 | 0 |

Table III. Effect of hypophysectomy on corpora lutea of pseudopregnant rats

| Day of operation | Day of sacrifice | No. of animals | No. of animals with 20α-HSD negative CL |
|---|---|---|---|
| – | 5 | 4 | 4 |
| – | 7 | 4 | 4 |
| – | 9 | 5 | 5 |
| 2 | 6 | 6 | 0 |
| 4 | 7 | 5 | 0 |

*Riassunto.* Sono stati studiati con metodi enzimoistochimici alcuni meccanismi che controllano la comparsa della 20α-idrossi-steroide-deidrogenasi (20α-HSD) in ratte gravide o pseudogravide dopo ipofisectomia o isterectomia. I risultati dimostrano che nel primo periodo della gravidanza e in pseudogravidanza, l'ipofisi è necessaria per mantenere i corpi lutei privi di attività 20α-HSD.

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## The Formation of Androgens in Human Foetal Liver in vitro

The source of testosterone in the human organism is not only the tissue of steroidogenic endocrine glands, but also the periphery, as can be deduced from the differences in the secretion and production rates of testosterone[1]. An important role in the formation of testosterone in the periphery is played by the liver, and an appreciable proportion – about 40% – of the hepatic production of testosterone comes from 3β-hydroxy-5-androsten-17-one[2–5].

The reports of a virilizing hepatoma in a young boy[6] and of the presence of several of the enzymes involved in steroidogenesis in foetal liver[7], imply that the liver is an endocrine tissue. Slaunwhite et al.[7] found small amounts of oestradiol and oestriol isolated from the incubation of human foetal liver with 3β-hydroxy-5-androsten-17-one, which demonstrate that foetal liver possesses an aromatizing enzyme system and indirectly signifies the presence of a 3β-hydroxy-$\Delta^5$-steroid dehydrogenase system. Goldman et al.[8] demonstrated histochemically the activity of 3β-hydroxy-$\Delta^5$-steroid dehydrogenase in hepatic cells; the activity increased roughly in proportion to foetal age. This paper reports a study showing directly the in vitro conversion of 3β-hydroxy-5-androsten-17-one to 5-androstene-3β,17β-diol, 4-androstene-3,17-dione and testosterone in human foetal liver.

Human foetal liver tissue was obtained from 9 foetuses of both sexes removed by legal interruptions of pregnancy from healthy women. 50 mg of homogenized liver was incubated in 3 ml of Krebs-Ringer phosphate buffer, pH 7.4, containing 20 m*M* glucose/l, each with 1.05 μCi [4-$^{14}$C]-3β-hydroxy-5-androsten-17-one (specific activity 27.5 mCi/m*M*, in 0.1 ml ethanol). $NAD^+$ (1.5 mg) and NADH (1.5 mg) were added and the mixture was incubated at 37 °C in air atmosphere for 90 min. After the incubation, 10 μg each of testosterone, 4-androstene-3,17-