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Is Human Placenta Permeable to Gonadotropic and Estrogenic Hormones?*

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The amount of gonadotropin and estrogen passing from the maternal to the fetal organism may be gauged by comparing the levels of these substances in the blood of the maternal organism and in the vein of the umbilical cord. The concentrations of hormones in the blood of the mother and the umbilical cord may, therefore, serve as a criterion of the permeability of the placenta to these hormones. The estrogen,[1, 2, 3] as well as the gonadotropin[1, 2] concentration in the blood of the umbilical cord has repeatedly been studied but without simultaneous hormone determinations in the maternal blood. In the following experiments, the estrogen and gonadotropin concentration of the umbilical vein, on the one hand, and that of the retro-placental serum, on the other, were quantitatively studied.

Experimental. Immediately after cutting the umbilical cord the arteries were clamped and the fetal blood flowing from the umbilical vein (about 20 cc) collected in a test tube. The retro-placental (maternal) blood was obtained during the expulsion of the placenta. After coagulation, the serum of both specimens was centrifuged.

Determination of Gonadotropin. The sera were 3 times vigorously shaken with ether. The small amounts of ether which remain in the serum were removed by allowing the sera to stand in the open air for an hour. These sera contained no free estrogen, as shown by control determinations in castrated female mice, and each were tested on 8 infantile female albino rats for their gonadotropin content. The quantity of serum to be tested was given to the animals in 6 subcutaneous injections over a period of 48 hours. From the 60th to the 120th hour after the experiment was begun, vaginal smears were taken; after this time, the animals were sacrificed and uteri and ovaries inspected. We considered 1 RU as that quantity of hormone which, with the above technic, produced full vaginal

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1 Zondek, B., *Hormone des Ovariums und des Hypophysenvorderlappens*, Springer, Berlin, 1st ed., 1931, p. 200; Springer, Vienna, 2d ed., 1935, p. 356; Zondek, B., *cf.* No. 1; Bruehl, R., *cf.* No. 1.

2 Bruehl, R., *Klin. Wchschr.*, 1929, **8**, 1766.

3 Loewe, S., and Voss, H. E., *Klin. Wchschr.*, 1926, **5**, 1083.

TABLE I.
Comparison of the Gonadotropin Content of Retro-placental Blood and Blood of the Umbilical Vein.

Case No.	Retro-placental serum, RU	Serum from the umbilical vein, RU	Proportion, %
1	20,000	300	1.5
2	20,000	500	2.5
3	15,000	500	3.3
4	15,000	500	3.3
5	20,000	300	1.5
6	15,000	1500	10.5
7	20,000	2000	10.5
8	10,000	1250	12.5
9	20,000	300	1.5
10	5,000	500	10.5
Avg	17,000	745	4.38

cornification. In our rats 1 RU is equivalent to 1/3 to 1/6 IU.

Our results are seen in Table I.

As shown in Table I, the serum of the umbilical vein invariably contained less gonadotropic hormone than the serum of the retro-placental blood. The maximum ratio (Case No. 8) was 12.5%, the minimum ratio (Cases Nos. 1 and 9) 1.5%; on an average the ratio was 4.38%.

Determination of Estrone. The freshly drawn sera were tested for content of free estrogen on 8 castrated female mice each. The dose to be tested was given to the animals in 6 subcutaneous injections over a period of 48 hours. From the 48th to the 96th hour vaginal smears were taken, and 1 MU was considered that quantity of estrogen which, with this technic, produced full vaginal cornification (Allen-Doisy test). In our mice 1 MU is equivalent to 2 IU. The results are given in Table II.

TABLE II.
Comparison of Estrogen Content of Retro-placental Blood and Blood from the Umbilical Vein.

Case No.	Retro-placental serum, MU	Serum from the umbilical vein, MU	Proportion, %
1	1500	400	27
2	1200	800	66
3	800	800	100
4	1500	1500	100
5	1200	400	33
6	1250	1000	80
7	1000	400	40
8	1500	1500	100
Avg	1243	850	68

As is seen from Table II, in 3 cases (Nos. 3, 4, and 8) the concentration of estrogen in the umbilical vein was the same as in the retro-placental blood of the mother. In the other cases the concentration of estrone in the umbilical vein was lower; the minimum ratio was 27%; the maximum ratio 80%; and the average 68%.

Results. The above experiments show that the concentration of gonadotropin in the blood serum of the umbilical vein is far lower than that of the corresponding retro-placental blood serum. Thus it appears that the placenta allows the passage of gonadotropic hormone only to a very limited extent. Goodman and Wislocki[4] obtained similar results in their experiments on animals. They injected gonadotropin in pregnant rabbits or cats, but were unable to recover the injected substance from the amniotic fluid.

Determination of the estrogen content of the retro-placental and umbilical serum showed the concentration to be more or less equal in either case. The differences were at least not as pronounced as those in gonadotropin content. The placenta is, therefore, to a great extent permeable to estrogenic hormone.

Summary. The free estrogen and gonadotropin content of the serum from the umbilical vein and the corresponding maternal retro-placental serum were studied. The maximum concentration of gonadotropin in the serum of the umbilical vein was 12.5%; the minimum 1.5%; and the average 4.38% of that in the retro-placental blood.

The concentration of estrogen in the umbilical vein was either equal or only slightly different from that of the retro-placental blood. It averaged 68% of that in the retro-placental blood.

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Ornithosis (Psittacosis) in Pigeons and Its Relation to Human Pneumonitis.

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In a previous paper,[1] it was reported that a psittacosis-like virus had been isolated from the lung of a patient who had been exposed

4 Goodman, L., and Wislocki, G. B., *Am. J. Physiol.*, 1933, **106**, 323.

1 Meyer, K. F., *Schweiz. med. Wchnschr.*, 1941, **71**, 1377.