This work was supported by U.S. Public Health Service grant No. *H*-5168.

TITUS H. J. HUISMAN
Departments of Biochemistry and Pathology,
VIRGIL P. SYDENSTRICKER
V.A. Hospital and Department of Medicine,
Medical College of Georgia, Augusta,
Georgia.

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A Rat Serum Protein related to Reproduction, Tissue Synthesis and Lactation

DARCY[1,2] has demonstrated by immunoelectrophoresis the presence of a protein in the sera of fœtal, neonatal, pregnant, tumour-bearing and regenerating rats not found in the sera of healthy, non-pregnant adults of either sex. More recently, Beaton *et al.*[3,4] and Heim[5] have shown, in the sera of pregnant and neonatal rats, the existence of a distinct protein component in the electrophoretic pattern obtained by starch-gel electrophoresis which is absent from the patterns of sera from healthy, non-pregnant, adult rats. Beaton *et al.*[4] also demonstrated this component in certain pathological conditions and Heim[5] found it in sera from fœtal and lactating rats. The presence or absence of the new component, hereinafter termed reproduction-associated protein, has now been determined over most of the life-cycle of the rat and under certain experimental conditions. A hypothesis of identity of the reproduction-associated protein with the protein discovered by Darcy[1] is suggested.

The sera were obtained as previously described[6] from Sprague–Dawley rats. Ages of fœtuses were counted from the day on which sperm first appeared in daily vaginal smears. After collection, the samples of blood were stored at 4–6° C. for 4–6 hr. The sera were then obtained by centrifuging in the cold. Electrophoresis was conducted by the vertical starch-gel technique of Smithies[7] with four modifications: (1) all separations were done at 10° C.; (2) a voltage gradient of approximately 8 V./cm. was used; (3) the block was stained for 15 min.; (4) a mixture of paraffin and mineral oil was used in place of petroleum jelly to prevent evaporation.

The reproduction-associated protein band (Fig. 1) was found in the sera from certain rats, as given in Table 1. It has a mobility, in starch gel, slightly slower than $S\alpha_2$-globulin of the adult, according to the nomenclature of Smithies[8]. It should not be confused with an indistinct, broadly staining area in approximately the same region of the pattern which may appear after excessively strong centrifugation of the clotted sample. In many fœtal sera, it stains more intensely than the adult-type $S\alpha_2$-globulin. The time of first appearance of reproduction-associated protein during ontogeny could not be determined because it is already present in the sera of the youngest embryos from which enough blood could be obtained, that is, those of 15 days gestation.

Table 1. OCCURRENCE OF REPRODUCTION-ASSOCIATED PROTEIN IN RATS UNDER VARIOUS CONDITIONS

A. Reproduction-associated protein present: Fœtal, fifteenth day of gestation onward (see text). Neonatal, birth through about twenty-fifth day. Pregnant female, eighth day of gestation onward. Nursing female, parturition through about twentieth day. Partially hepatectomized adults, 3 and 4 days post-operative. Adults bearing large Walker 256 carcinosarcomas.

B. Reproduction-associated protein absent. Adults, healthy and non-pregnant, either sex. Adult females injected with œstrone, progesterone or chorionic gonadotropin, alone, together or in sequence. Laparotomized adults, sham operated as controls for partially hepatectomized rats, 3 and 4 days post-operative.

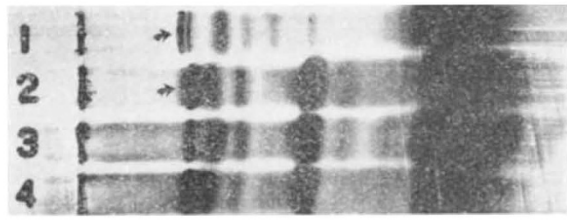

Fig. 1. Starch electrophoresis patterns of rat sera. (1) Pooled sera from neonatal rats within 10 hr. after birth; (2) serum from dam of above neonatal rats, taken within 10 hr. after giving birth; (3) serum from nonpregnant, adult, female rat; (4) serum from sire of above neo-natal rats. Arrows indicate the reproduction-associated protein. Starting wells at left; migration toward right

The immunoelectrophoretically demonstrable serum protein component of Darcy is reported present in sera from pregnant, neonatal or juvenile[1] and fœtal rats[2] as well as in sera from rats subjected to partial hepatectomy or partial renalectomy and, weakly, in those with partial dermatectomy or laparotomy[1]. It is also present in rats with large neoplasms[9]. The component of Beaton *et al.*[4] is also found in pregnant rats after the 8th day of gestation, in neonatal or juvenile animals and in animals bearing large neoplasms. Further, its appearance could not be brought about by the injection of œstrogen, progesterone or growth hormone. The pattern of appearance in the previous studies is thus generally confirmed and extended hereby. The mobility of Darcy's component in the slow α- or fast β-globulin region during agar electrophoresis[1], as compared with the more cathodal position of the pertinent protein in the work of Beaton *et al.*[4] and the present work, is explained by the observation that the component migrates in the α_2-globulin region during paper electrophoresis[10]. The difference in position is thus probably due the molecular size selectivity of the starch gel. It is therefore postulated that the components observed by Darcy[1,2], Beaton *et al.*[3,4] and me represent the same material, and that it is a serum protein which appears whenever large-scale synthesis of tissue or milk occurs in the rat.

The work was supported in part by grant *G*-10104 from the National Science Foundation and grant *ICRG* No. 16 from the American Cancer Society.

WERNER G. HEIM
Department of Biology,
Wayne State University,
Detroit 2, Michigan.

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