tissue culture virus and infectious material from naturally occurring cases, as well as neutralization tests with serum obtained from naturally and experimentally infected cattle, show that this virus is the etiological agent of infectious bovine rhinotracheitis. Serum neutralization tests also indicate that viruses isolated from different parts of the country are closely related antigenically.

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Increased Production and Utilization of Circulating Glucose During Growth Hormone Regimen.*† (23072)

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Hypophysectomized dogs exhibit extensive abnormalities in carbohydrate metabolism (1), many of which are reversed by growth hormone(2). Large doses of the hormone may produce diabetes in the normal dog(3). Recently, by application of a technic whereby body glucose pool was tagged with C^{14}(4), it was shown that the unanesthetized hypophysectomized dog in postabsorptive state, in comparison with the normal dog, had a smaller body glucose pool and lower rate of glucose turnover, *i.e.*, glucose inflow from liver into plasma, and glucose outflow from plasma into tissues(5).

The present study is concerned with effect of a growth hormone regimen on turnover rate of the glucose pool in the unanesthetized hypophysectomized dog, studied with the aid of C^{14} glucose.

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Materials and methods. Adult hypophysectomized male and female dogs, maintained on standard diet(2), were used. The animals were 57-850 days postoperative. Growth hormone (Lot C_5I_5; prepared and kindly supplied by Dr. Robert Bates) was administered intramuscularly in daily doses of 1 mg/kg for 4-5 days, last injection given 18 hours prior to experiment. The animals were in good physical and nutritional state before and during injection period. The experiments were performed after 17-18 hours fast and without anesthesia. A complete description of experimental material and procedure has been given previously(4). Uniformly labeled C^{14} glucose was administered intravenously by initial priming injection, followed immediately by constant continuous infusion. Total amount of glucose administered did not exceed 4 mg. Samples of blood were drawn at intervals for determination of concentration of plasma glucose and its C^{14} content. Plasma glucose content was determined on aliquots of Somogyi zinc-barium filtrates(6), by the method of Hagedorn-Jensen(7). Unlabeled carrier glucose was then added to other aliquots of the filtrate and glucose was

TABLE I. Plasma Glucose Concentration and Glucose Inflow-Outflow Rates in Normal, Hypophysectomized and Growth Hormone-Treated Hypophysectomized Dogs.

Dog status	Avg plasma glucose, mg %	Glucose inflow-outflow, g/m²/hr
Normal (10)*	107	3.80 ± .19†
Hypophysectomized (7)	89	2.59 ± .27
Hypophysectomized on growth hormone (1 mg/kg, 4-5 days)		
AL-22	95‡	4.07
AL- 3	134	3.76 } 3.89 ± .09
AL-16	109	3.85

* No. of experiments.
† Mean and stand. error of mean.
‡ Compared with 81 mg prior to growth hormone treatment.

isolated as the phenylosazone derivative. Rate of glucose turnover was calculated as described previously(4).

Results. Table I gives average plasma glucose concentration and turnover rate of body glucose in normal, hypophysectomized and growth hormone-treated hypophysectomized dogs. Composite values for normal and hypophysectomized dogs were obtained in earlier studies(5). The turnover rate is presented as grams glucose/m² body surface area/hr. Surface area was calculated according to Rhoads, Alving, Hiller and Van Slyke(8), using the weight at time of experiment. The outstanding observation in this study was the increase in rate of glucose inflow-outflow during the growth hormone regimen. Thus more glucose was released by the liver into the plasma and more glucose disappeared from the plasma into the tissues.

Growth hormone treatment in hypophysectomized dogs also raised plasma glucose concentration to normal or above. Although the rise is less apparent for dog AL-22, it should be noted that hormone treatment elevated the glucose concentration 14 mg% above the control. The effect of growth hormone on glucose pool size remains to be clarified.

Discussion. The present study demonstrates that growth hormone regimen resulted in an increased release of glucose from the liver and an increased uptake of plasma glucose by tissues. This was observed during growth hormone treatment in normal and adrenalectomized dogs as well as in hypophysectomized dogs. In hypophysectomized dogs, as shown here, growth hormone treatment restored to normal their low rate of glucose inflow-outflow(5).

The ability of growth hormone to increase glucose inflow from the liver is even more striking when considered together with the results obtained following insulin injection in untreated hypophysectomized animals(9). Thus when an intravenous injection of insulin (glucagon-free) increases glucose uptake by the tissues, the liver of the hypophysectomized dog, in contrast to the normal one, is unable to increase its glucose output, and consequently a prolonged hypoglycemia is observed. During growth hormone regimen, as shown in the present experiments, increased uptake of glucose during postabsorptive state was associated with increased glucose release from the liver. These findings stress the central position of the liver in the growth hormone action. A similar increased glucose release by the liver was obtained with hydrocortisone or cortisone(10).‡ However, whereas in steroid-treated animals the additional glucose is probably of protein origin, as evidenced by an increased excretion of urinary nitrogen, the growth hormone-induced increase in glucose release occurs at a time of diminished nitrogen excretion(11), increased fat mobilization(12) and while the liver glycogen is not effectively mobilizable by epinephrine(13).

The question may be raised whether the increased glucose utilization is associated with an increased secretion of insulin. Indeed, Randle(14) observed an increased plasma insulin activity in growth hormone-treated animals, even during the temporary diabetic state. The enhanced glucose utilization and increased plasma insulin activity during growth hormone treatment are in harmony with the findings that growth hormone-induced nitrogen retention is dependent upon adequate glucose utilization(15). The present data suggest that the disappearance of insulin hypersensitivity(2), when a hypophy-

‡ Reported in *Fed. Proc.*, 1956, 3.

sectomized dog is kept on a growth hormone regimen, involves other factors besides direct growth hormone inhibition of insulin action.

Summary. Using C^{14} glucose to label the body glucose pool, it was found that growth hormone treatment for 4-5 days in the hypophysectomized dog, resulted in increased rate of glucose release by the liver and plasma glucose uptake by the tissues. The plasma glucose concentrations were also increased. The significance of these findings is discussed.

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Effects of Prolactin on Duration of Pregnancy, Viability of Young and Lactation in Rats. (23073)

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Several investigators have demonstrated that prolactin is luteotrophic in the rat. Evans *et al.*(1) reported that prolactin was the only anterior pituitary hormone capable of stimulating luteal function in hypophysectomized rats, while Desclin(2) and Mayer and Canivenc(3) found that it prolonged luteal function in normal cycling rats. Cutuly(4) showed that prolactin maintained early pregnancy in rats mated and then hypophysectomized, either before or after implantation of the ovum. However, Mayer and Klein(5,6) reported that prolactin failed to prolong gestation in intact rats when injected beginning on the 14th or 19th day of pregnancy, and continuing until or beyond the normal day of parturition. They also found that prolactin did not prolong the life of corpora lutea of pregnant rats following removal of uterine horns, presumably because the luteotrophic influence of the placentae was removed. They concluded that pituitary prolactin does not exert a luteotrophic action in rats during the latter half of pregnancy.

The present experiments were undertaken to determine the effects of several levels of purified prolactin on duration of gestation, functional activity of corpora lutea and initiation of lactation in rats. In general, the results show that the prolactin preparation used by us prolonged pregnancy and maintained functional activity of the corpora lutea, without preventing initiation of lactation.

Methods. One hundred and twenty-four

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