

Difference in Biological Behavior Between Primate and Beef or Whale Pituitary Growth Hormones.* (24517)

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Isolation and characterization of pituitary growth hormones (somatotropins) derived from several mammalian species have been reported, and these hormones have been shown to manifest physical and chemical differences (1-4). It was deemed of interest to investigate the growth-promoting activity, as evidenced by body-weight gain of hypophysectomized rats, of the somatotropins from pituitary glands of these various species.

Methods. Female rats of the Long-Evans strain were used. The animals were hypophysectomized at 28 days of age and injections were begun 14 days after operation. Animals which had gained more than 5 g in the post-operative period were discarded. All rats were maintained on stock diet *ad libitum*.† The somatotropins were isolated by the published procedures from beef(5), human(6), monkey (6) and whale(3) pituitary glands. The hormone was dissolved in cold distilled water at pH 9.0, with a hormone concentration of 50 μ g/ml. Fresh solutions were prepared every 5 or 7 days. The rats were injected once daily with 0.5 ml of the test solution by the intraperitoneal route. Body weights were determined to the nearest gram at intervals of from 2 to 4 days. Growth-promoting activity of each somatotropin preparation was also assayed by the tibia test(7) in hypophysectomized rats.

Results. Somatotropins isolated from human, monkey, whale, and beef pituitary glands were found to possess almost identical growth-promoting potency according to the tibia test (Table I). Results on the basis of body weight gain in hypophysectomized rats are summarized in Figs. 1 and 2. It is of in-

terest to compare, in Fig. 1, the results obtained at 10 days with those obtained during the following 10 days. Within the first 10 days, all somatotropins tested elicited a weight gain in the experimental animals of from 11-17 g. The groups receiving whale and bovine somatotropins tended to manifest a greater gain than did the groups receiving human and monkey hormones; however, these differences were not statistically significant. By 20 days, very evident differences appeared. At this time, body weight of the groups receiving primate somatotropins had ceased to increase, whereas continuing weight increases were manifested by the groups given bovine and whale hormones. These differences between primate groups and whale-bovine groups are highly significant statistically. It is therefore evident that somatotropins of various species are not comparable on the basis of the body-weight test when the experimental period is longer than 10 days.

Also of interest was the observation that injections of both bovine and whale somatotropins, when continued at the same daily dose level (25 μ g/day), were capable of inducing body-weight increases over a long experimental period. Whale and bovine groups were still gaining weight after 90 days of hormonal administration (Table II). Thus, a further distinction between the primate hormones and those of the other species may be made, in that whale or bovine somatotropin is

TABLE I. Bioassay by Tibia Test of Growth Hormone Isolated from Human, Monkey, Whale and Beef Pituitary Glands.

Species	No. of rats*	Tibia width, μ
Bovine	9	217 $\pm$ 5†
Whale	5	220 $\pm$ 4
Monkey	12	225 $\pm$ 5
Human	8	213 $\pm$ 2

* Total dose of 20 γ inj. over a period of 4 days; tibia width of control animals receiving saline averaged 155 μ .

† Mean $\pm$ stand. error.

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† Stock diet consists of 67.5% ground whole wheat, 15% casein, 7.5% skim milk powder, 0.75% NaCl, 1.5% CaCO₃, 6.75% hydrogenated vegetable oil, 1% fish oil concentrate and 1 μ g of KI/g of the diet.

TABLE II. Body Weight of Hypophysectomized Female Rats Injected with Bovine and Whale Somatotropins for 90 Days.

Group*	No. of rats	Body wt (g)				Body wt gain in 90 days (g)
		Onset	40th day	60th day	Autopsy	
Control	10	74 ± 3†	85 ± 4	88 ± 3	92 ± 4	18
Bovine hormone	9	82 ± 3	129 ± 7	147 ± 8	167 ± 12	85
Whale "	10	83 ± 2	141 ± 5	162 ± 7	187 ± 8	104

* Daily dose, .025 mg; controls received no inj.

† Mean ± stand. error.

capable of effecting continuous body-weight gain whereas human or monkey hormones exhibit a plateauing of effect after 10 days of hormonal injections. These differences are further demonstrated in Fig. 2. In the group

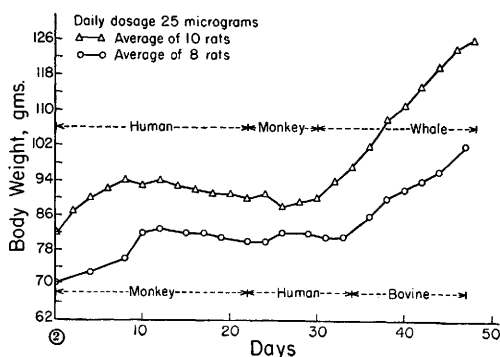
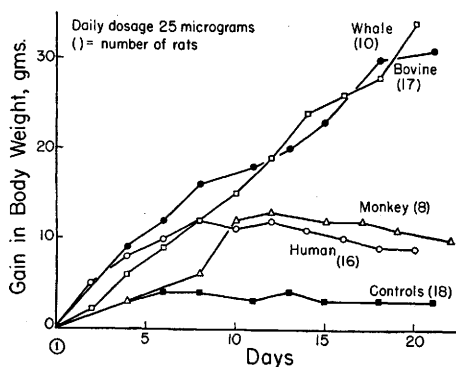


FIG. 1. Curves representing avg body-wt gain in hypophysectomized female rats for 20-22 days. Animals were hypophysectomized at 28 days of age and inj. begun 14 days later with whale, bovine, monkey and human growth hormones.

FIG. 2. Curves representing avg body-wt gain in hypophysectomized female rats for 47-48 days. Animals were hypophysectomized at 28 days of age and inj. begun 14 days later with human, monkey, bovine or whale growth hormone.

which initially received human somatotropin, an attempt was made to reinitiate body weight gain by switching to the monkey hormone; this was without effect. Whale somatotropin, however, was capable of reinitiating body-weight gain at a rate comparable to that observed in animals that had been given whale growth hormone from the beginning (Fig. 1). Indeed, the same type of result was obtained in rats whose weight had reached a plateau with monkey somatotropin; here, although human growth hormone was without effect, bovine hormone proved very effective.

Summary. Growth hormones isolated from beef, whale, monkey and human pituitaries have been investigated with respect to their ability to elicit body-weight gain in hypophysectomized female rats. Whale and beef hormones elicited a continuous increase of body-weight for 90 days, whereas primate somatotropins exerted this effect only for 10 days. After 10 days of injections with monkey or human hormones, animals became resistant to the effect of primate somatotropins, although no corresponding decrease in response to whale or bovine hormones was evident.

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