The Influence of Pineal Feeding Upon Growth and Development of Guinea-Pigs.

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It is believed that the pineal body is a endocrine organ, and one that exercises an important biological function up to the time of puberty. Since the ductless glands were found, various methods have been employed to study their functional significance. The commonly used methods are experimental removal and transplantation of the glands, injection of their extract, and oral administration of the glandular substances.

In order to study the effect of the loss of the pineal body, pinealectomy has been accomplished by several workers. In 1913 SARTESCHI[1] ('13) first reported the remarkable results after pinealectomy, later FOÃ[2] ('12, '14), ZOIA[3] ('14), and HORRAX[4] ('16) found that the pinealectomized young male animals grow more rapidly than the controls, show premature development of secondary sex character, and earlier development of the sex organs. Recentry IZAWA[5] ('22, '23) confirmed these results and also found that young pullets subjected to the pinealectomy showed an increase in weight of the body and in the size of the sex organs. Oral administration of the pineal substance has certain objections to study the effect of hyperactivity. DANA-BERKLEY[6] observed that the animals to which the pineal substances

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1) SARTESCHI: Pathologica, 1913.
2) FOA: Arch. ital. de. Biol. 1912, 1914.
3) ZOIA: Centralbl. f. all. Path. 1914.
4) HORRAX: Arch. int. Med. 1916.
5) IZAWA: Okayama Igakkai Zasshi. 1922, 1923.
6) DANA-BERKLEY: Med. Rec. (N. Y.) 1913.

were administered, gained a relatively greater amount of body weight than the controls. BERKLEY[1] administered the pineal substance to 50 defective children and noted mental and physical improvement in case of simple retarded mental development and mongolism; but no results were obtained in case of frank idiocy or gross physical defects. In 1914 Mc. CORD[2] fed powdered pineal extract to young guinea-pigs, chickens, and puppies. A noticeable overgrowth in body weight, increased mentality in the case of dogs, sexual precocity in some case of guinea-pigs were noted. In more his recent papers[3] he confirmed his earlier results. The growth-rate of guinea-pigs was accelerated by injections of extract of pineal body. The young guinea-pigs, so injected, showed 26 percent gain in weight over the controls during the six weeks of observation. PRIORE[4] ('15) also injected the pineal extract into young rabbits, and found that the injected animals grew slightly more than the controls, but his results were probably within normal limits of variation. BOEHM[5] ('16) has also studied the effect of prolonged oral administration of pineal substance to guinea-pigs and rats; but his results were conflicting, in some case of the fed animals showed greater development of their genital organs than the controls, while in others the control outstripped the animals fed with the pineal substance. In 1916 HOPKINS[6] fed pineal substance to albino-rats and reported that the pineal feeding likewise produces no apparent change in the weight of their body or organs, beyond differences probably within the limits of normal variation.

The general plan of this study has been to feed very young guinea-pigs with some quantities of pineal substance and to record the weight change and sexual differences. The writer took care in this work to select both experimental and control animals from the same litter so as ensure the start as near as possible an equality in weight and age. In all, 37 guinea-pigs were employed. The experiments began when the guinea-pigs were from 7 to 10 days of age, the experimental and control animals

1) BERKLEY: Med. Rec. (N. Y.) 1914.
2) Mc. CORD: Jour. Amer. Med. Assn. 1914.
3) Mc. CORD: *Loc. Cit.* 1915.
4) PRIORE: Arch. ital. de. Biol. 1915.
5) BOHM: Cited from Horrax.
6) HOPKINS: Jour. Exper. Zoo. 1916.

being kept and fed under the same conditions. During the time of observation the animals were fed twice a day and at all times the cages were kept clean. Each animal was given a mark of identification with picric acid and a separate growth record kept for it. In general, each animal was weighed once a week.

Tablet of pineal gland, (Park, Davis & Co.), were employed as matrial for pineal feeding. Each tablet repsents 0.04 G. dessicated gland, equivalent to 0,032 G. of the fresh glandular substances. The tablets were powdered and admixed with milk sugar. The mixture was ordinary given twice daily and the daily amount of dosage for each test animal was equivalent to 200 Mg. of fresh glandular substances; and the treatment was extended over period of ten weeks. The results obtained are given in table 1.

Table 1.

	Male		Female	
	Pineal-Fed	Control	Pieeal-Fed	Control
Number of guinea-pigs	7	8	11	11
Average age (weeks)	10	10	10½	10½
Body weight, g.	298	301	257	260
Average weight of:	grams	grams	grams	grams
Brain	3.8	3.75	3.7	3.56
Thyroid	0.045	0.043	0.048	0.51
Thymus	0.25	0.24	0.26	0.28
Heart	1.00	1.05	0.92	1.02
Lungs	2.20	2.21	2.21	2.07
Liber	7.7	7.6	7.5	7.43
Spleen	0.28	0.292	0.32	0.33
Alimentary canal	26	24	22	21
Suprarenals	0.136	0.14	0.138	0.141
Kidney	2.3	2.27	2.2	2.23
Pituitary body	0.097	0.0965	0.098	0.098
Ovary	—	—	0.025	0.0303
Testes, Epidydimi	0.68	0.75	—	—

Personal observations.

At the end of the observation period of 10 weeks the animals were autopsied and the organs were carefully removed and weighed immediately As shown in table 1 the pineal-fed guinea-pigs have a slightly lower average body weight as compared with the controls, but this decrease is not evident in every case, some of the experimental animals show an increase in its absolute body weight than the controls. This differences are probably due to the normal variability.

Brain: there is on constant and apparent difference in the brains of experimental and control groups. The variations are slight and probably insignificant.

Heart: on directly comparing the average weight of pineal fed and controls, there are no differences that are significant.

Kidney: no constant or apparently significant variations appear in the kidney in the two groups.

Lungs: the lungs appear similar in weight in both experimental and control animals.

Suprarenal capsules: as shown in the table, the suprarenal capsules of the pineal fed animals do not appear to differ from the controls more than might be expected from the normal variability.

Alimentary canal (empty): the variationi in the canal of experimental animals in comparison with that of the controls are inconstant.

Liber: in the pineal fed animals the liber average is slightly larger than that of the controls.

There is no apparent weight change in thyroidea, pituitary body, and in thymus in the two groups.

Testes show apparent slight retardation in the case of the pineal fed animals. On cmparing the weight of ovaries in the experimental animals a slight decrease appears in the pineal fed animals. Possibly pineal feeding retards growth of testes and ovaries but there is considerable doubt as to whether the decrease noted is significant because of the comparatively small number under observation and the considerable normal variability.

Summary of Results.

The pineal fed and control animals of both sexes are of nearly the same bodyweight regardless of careful treatment, although only a slight decrease in body weight can be seen in the case of the experimental group. On comparing the results of this pineal feeding experiment, the writer's results coincide with those of HOPKINS[1], entirely different from those of MC. CORD[2] and of DANA-BERKLEY. The growth records of pineal fed animals, reported by DANA-BERKLEY[3] as well as by MC. CORD are not important because they failed to say in the account of their experiments whether the animals were selected from the same litters. Sexual precocity was noted by MC. CORD, but this easily explained by the fact that the somatic growth normally is accompanied by a corresponding development of the reproductive organs.

In this investigations ovaries and testes of the pineal fed animals appear very slight under weight as compared with the controls.

Very serious error might easily creep into the conclusion from an investigation which includes animals from several different litters. To draw conclusions from such investigations is always dangerous. In the writer's experiment the pineal substance was given in amounts considerably larger than those fed to guinea-pigs by MC. DORD and others. During the ten weeks observation there seemed no evidence to indicate that toxic effects or gastrointestinal disturbances were produced by high doses medication. As pointed out above, in the present investigation care was taken to select the animals from the same litter and the experimental and control animals were kept and fed under the same conditions.

Pineal feeding produces no constant or apparent effect upon the growth-rate of the body or organs of guinea-pigs, beyond differences probably within the normal limits of variation, although only slight retardation in the growth of testes and ovaries is noted in favour of the pineal fed animals.

1) *Loc. Cit.*
2) *Loc. Cti.*
3) *Loc. Cit.*