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*A magazine established by the co-workers of Edward H. Angle, in his memory. . . . .*

## The Hypophysis and the Teeth*

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### I. Changes in the Rat Incisor following Hypophysectomy

The hypophysis cerebri in man is an organ weighing about .65 grams. It is located in the sella turcica and thus is given special protection and support. The sella turcica has been considered as a little skull within the skull. Hanging from the brain by means of the infundibular stalk, the hypophysis is for the most part separated from the brain by a special extension of the dura mater called the diaphragma sellæ. The organ consists of the anterior, intermediate and posterior lobes. It is in the anterior lobe where our special interest lies because its cells give rise to the growth and sex hormone.

In the embryo, the pars buccalis, which includes the anterior lobe, arises from the ectoderm of the stomodeum just in front of the oral plate as a long evagination known as Rathke's pouch. Thus the ectoderm of the stomodeum, which more anteriorly gives rise to the dental lamina and the enamel organ of the teeth, also gives rise to the anterior lobe. Reverberations of the origin of the anterior lobe and the enamel epithelium from similar and adjacent tissues are found in tumors of the hypophysis some of which present a histologic picture that is similar to that of the adamantinoma. Two cases of hypophyseal tumors containing teeth have been reported by Pflüger and Schürman (1931).

*Early History*: This organ was known in Galen's time, but its purpose and function were nothing more than merely a hypothesis. Today the function of the hypophysis is sufficiently well known to warrent the use of its ex-

*This is the first of the series to be published in successive issues of the *Angle Orthodontist*: II. Changes in the Rat Molar following Hypophysectomy; III. Effects of Replacement Therapy on the Erruption and Histological Changes of the Teeth of Hypophysectomized Rats; IV. Dental Changes in a Hypopituitary Condition. A case report.



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tracts by competent medical men. Galen in the second century and even Vesalius in 1543 considered this organ as an organ of external secretion which helped the brain to get rid of its waste matter. For that reason, Vesalius named it pituitary gland—pituita meaning mucus or slime. The Galenic theory of the excretory function of the hypophysis was first contested in 1640 by Schneider. He showed that the mucous discharge from the nasal fossæ came not from the brain but from the lining membranes of the nose.

*Nineteenth Century*: Schneider thus disproved one hypothesis but offered no substitute. The function of the hypophysis remained a mystery until the end of the nineteenth century. In 1886, Marie announced an important discovery. He described a condition characterized by "a peculiar non-congenital hypertrophy of the upper, lower and cephalic extremities." Marie designated this condition as acromegaly (acro-end; megaly-enlargement). One year later in 1887, Minkowski suggested that the hypophysis may play a role in this syndrome.

Further progress in our knowledge of the function of this gland depended on the pursuit of experimental studies. In an experiment, we may exaggerate one factor or minimize or even eliminate another factor so that a resulting picture, although abnormal, is still of distinct value in clarifying the influence of a particular cause. It was therefore essential that the following methods were perfected: *first,* complete removal of the gland; *second,* the preparation of a potent extract of the anterior hypophysis with subsequent replacement therapy.

The removal of the hypophysis was attempted as early as 1886 by Horsley. But he and many others were unsuccessful since their animals died at the operation or survived only for a relatively short period.

*Experimental Period*: Ascoli and Legnani (1912) and Aschner (1912) were among the first to succeed in obtaining hypophysectomized dogs that survived the operation for a year or more. Smith (1916) and Allen (1916) independently succeeded in removing the anterior lobe of the hypophysis of frog larvae and found characteristic effects. Smith (1926) perfected a method of removing the hypophysis in the rat without an injury to the brain. Smith found that successful hypophysectomy resulted chiefly in a stoppage of general growth and a disturbance in the gonads.

The advances made in the preparation of the potent extracts of anterior hypophysis made possible successful replacement therapy in hypophysectomized rats and experimental production of hyperpituitarism. Evans (1924) gave 200-400 successive daily injections of anterior hypophyseal extract and produced gigantism and sex disturbances. In 1929 Putnam, Benedict



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and Teel produced acromegaly in dogs by the injection of anterior hypophysis extract. Evans produced gigantism and not acromegaly in his rats because in these animals the epiphyses remain open throughout life. Thus the experiments on dogs and on rats confirmed the clinical findings. The latter have shown that a hyperfunction of the hypophysis in children results in gigantism. The bones become very large and long. A hyperfunction in the adult in which the bones already stopped their growth in length results in acromegaly. The bones become heavier and thicker, especially at their ends.

Replacement therapy has been made possible by two methods, hypophysis transplants, or injections of extracts. Both types were used successfully by Smith (1930) who was able to accelerate growth and restore gonad function in recently hypophysectomized rats that were treated with anterior lobe substances.

At the present moment, the hypophysis is the subject of intense research in many of the leading scientific laboratories. One author has enumerated as many as 22 hormones that have been ascribed to the hypophysis by various investigators. The hypophysis is now in the saddle. It is regarded by some as the master endocrine organ. Whether it will continue to hold this seat remains to be seen.

It is only natural that an organ that has such a far-reaching influence on growth and that is so closely interrelated with the other endocrines, should also affect the jaws and teeth.

*Review of Clinical Literature*: A review of the clinical literature yields repeated findings of abnormalities in dentition and tooth structure in pituitary disturbances. However, there appears to be a conspicuous neglect of a study of the dental changes. In spite of the fact that one of the early and most common and reliable symptoms of acromegaly is the prominent mandibular protrusion, reports which include a careful radiographic study of the teeth are not readily found. Similarly the reports on hypopituitarism as a rule fail to give a detailed account of the teeth and the investing tissues. An analysis of the dental changes in a hypopituitary case is now being prepared by Dr. Brodie, Dr. King and the author and will be reported at another occasion.

Some reports speak of characteristic signs in form of the small or large size of particular teeth. The author cannot accept the size or shape of certain teeth as diagnostic indicators of a pituitary disturbance. The central incisors appear larger when compared to the smaller absolute size of the face and head. This does not prove that the absolute size of the incisors is



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significantly different from the average. Besides, the anatomical crown of a given tooth is of the same size regardless of its state of eruption. If a tooth is only partially erupted, that portion of it that is exposed to the oral cavity naturally is small. The neglect to distinguish between the anatomical and clinical crown can thus readily lead to confusion and misinterpretation. Furthermore, the outer form and size of the crown is determined by the enamel organ and is not subject to change after the latter has atrophied and disappeared except in reduction by external influences such as caries or surgery. The mesio-distal width of the crowns of the molars of rats that were hypophysectomized for as long as fifteen months was the same as that of the litter mate controls. The reason for this is that the rats were operated upon at the age (not less than 35 days) when the crowns of the molar had reached their full form.

Recently considerable literature has developed attempting to associate so-called pyorrhea with disturbances of the anterior lobe of the hypophysis. The fact that many of the patients with pituitary disturbances do not present a clear-cut disturbance of the hypophysis alone makes it difficult to determine the exact role played by the disturbed function of this organ.

*Review of Experimental Literature*: Thus by necessity, our present knowledge of the effect of the hypophysis on the teeth is limited chiefly to the findings in experimental studies. Ascoli and Legnani (1912) reported that hypophysectomy in the dog resulted in an abnormal persistence of the deciduous teeth. Kranz (1914) studied the teeth of a hypophysectomized dog and its control which is obtained from Ascoli and found a few small differences in chemical composition and a considerable difference in size. Microscopic studies revealed no histologic changes. Aschner (1912) observed in a hypophysectomized dog the eruption of the permanent incisors and cuspids in spite of the persistence and firmness of the deciduous teeth so that there arose a double row of teeth. Erausquin (1917) studied the teeth in dogs that were hypophysectomized by Houssay. He found retarded eruption, shorter roots and wide pulp chambers and apical foramina. These changes were most prominent in the canine. The histologic picture was normal. Burnett (1923) confirmed Erausquin's findings. Downs (1930) reported a delayed eruption and a crowding and "flaring" of the teeth in hypophysectomized dogs. His histologic findings were negative. The above investigators thus found hypophysectomy in dogs resulted in retarded eruption and a smaller size of the teeth. It is surprising, however, that histologic changes were not found.



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## Effect of Hypophysectomy on the Incisor of the Rat

In 1931 and 1932, the author and van Dyke reported on the effect of hypophysectomy on the rate of eruption and the gross and microscopic anatomy of the teeth of the rat (Schour and van Dyke, 1932, a, b, c.).

The rat was found to be especially favorable for this study because it has incisors which erupt relatively rapidly and which show persistent growth and also molars which resemble those of man in their gross and microscopic anatomy and in their limited growth.

Their work was based on twenty-three successfully hypophysectomized rats. The age of the animals when operated upon ranged from thirty-four to sixty-four days and the interval between the operation and the death of the animal ranged from sixty-three to 459 days. The operations were performed by the parapharyngeal approach following the technique of Prof. Phillip E. Smith. An operation was considered successful when there was no increase in spontaneous oestrous cycles for weeks or months. Smith (1930) showed that such functional impairment was correlated with a complete removal of the gland. The factor of safety of the hypophysis appears to be large. The removal of only a large portion of the hypophysis will produce no effects. Clinically it has been found that the destruction of part of the hypophysis in a number of diseases shows no hypopituitary symptoms (Simonds, 1922).

They also made a study of 16 litter mate controls most of which were unsuccessfully hypophysectomized. The latter, as well as the unoperated litter mate controls, showed no indication of hypophyseal deficiency. This fact was offered as evidence that the changes noted in the teeth of the successfully operated group were not due to operative injuries.

Their work may be divided into three phases.

1. Findings in the living animals based on:
   a. The appearance of the exposed portions of the incisors.
   b. The rate of eruption of the incisors.
   c. The rate of eruption of the incisors during replacement therapy.
   d. The radiographic study of the incisors and molars.
2. Gross findings based on:
   a. Gross dissection.
   b. Radiographs or dissected jaws.
   c. Planimeter readings.
3. Histologic findings based on serial decalcified sections and on ground sections of the incisors and the molars:
   a. In hypophysectomized animals without replacement therapy.
   b. In hypophysectomized animals with replacement therapy.



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This report will be confined to the findings in the incisors. The changes in the molars and the effects of replacement therapy will be described in subsequent papers.

### Findings in the Living Animal

The exposed portion of the incisors appeared to be smaller than that of the incisors of the control animals. The pigment was lighter than normal. In some of the oldest animals, waves on the enamel were readily seen with the naked eye.

The rate of eruption was retarded within a week following the operation. This retardation was progressive. In the oldest animals, the eruption ceased entirely (Fig. 1). That this disturbance in eruption was a result of the hypophysectomy could be readily proved by replacement therapy. Upon the injection of an extract of the anterior lobe of the hypophysis the eruption was accelerated if treatment was begun early enough (Schour and van Dyke, 1932.).

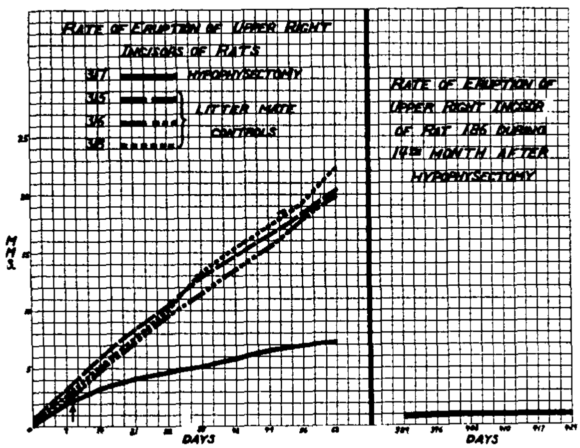


Fig. 1. Graph showing the effect of hypophysectomy on the rate of eruption. Note that while one week previous to the removal of the gland, the rate of eruption was the same for animals 315-318, the curve for rat 317 flattened immediately after the operation. The eruption of the incisors in rat 186 stopped entirely after it lived without the hypophysis for a number of months.

*Radiographs*: The upper incisors of six sets of hypophysectomized animals and their litter mate controls were x-rayed weekly while under observation. Dental x-ray films were used that required an exposure of only three-fourths of one second, so that the animals did not need to be anesthetized. An effort was made to use a constant angle of exposure.



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In two of the hypophysectomized animals, the radiographs showed an area of enamel hypoplasia which was seen to move anteriorly and progress as eruption proceeded. This finding indicated that the enamel hypoplasia originated in the basal zone. (Figs. 2 and 3.)


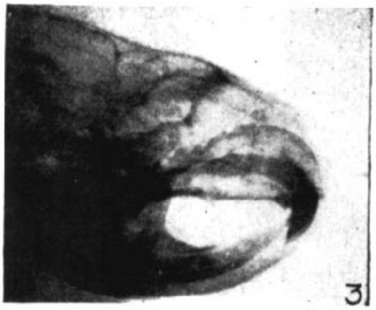


Fig. 2. Radiograph of rat 255 which is litter mate control to hypophysectomized rat 258. X2. The radiograph was taken from the living animal. Note the smooth contour of the incisors. Compare with figure 3.

Fig. 3. Radiograph of rat 258 which was taken from the living animal 398 days after hypophysectomy. X2. Note the irregular contour of the upper incisors. Compare with Figure 2.

## Gross Findings

The incisors showed a distortion in form, especially in the basal zone. The teeth and jaws were small (two thirds normal size). The planimeter readings of the radiographs showed that the incisors of the hypophysectomized animals of long standing were about two thirds the area of their litter mate controls, and yet the amount of hard dental tissues was about the same in the experimental and control animals. There was no discrepancy between these facts because the hard tissues, at least in parts, persisted at the expense of the pulp which was being gradually obliterated.

Photographs of dissected portions of the jaws corroborate the planimeter findings in regard to comparisons in size (Fig. 4).

The radiographs of the dissected jaws of the experimental animals showed incisors that were characterized by a prominently reduced pulp chamber, an irregular labial contour (Fig. 6) and a prominent distortion of the



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basal zone. The latter showed multiple foldings and an accumulation of radiopaque substance. The radiograph of the incisor of a hypophysectomized rat that lived a given period after the operation gave a constant characteristic picture (Fig. 6). Compare with Figure 5 which is taken from a control rat.

Fig. 4. Photograph showing the comparison in size of the left mandible of control rat 202 (above) and of its hypophysectomized litter mate 199 (below). X 1.8.

## Histologic Findings

The histologic changes both in the incisors and in the molars were progressive. The actual conditions in a given case naturally depended on the time elapsing between the operation and the death of the animal and are progressive.

In contrast to the picture of a normal rat incisor (Fig. 7), the following changes were found in the incisors of the experimental animals (Fig. 8).

1. The enamel epithelium was entirely lacking or underwent various degenerative changes (Fig. 9). Compare with Figure 10.

2. The enamel showed occasional areas of severe hypoplasia (Fig. 11).

3. The dentin in the greater portion of the tooth filled the pulp almost entirely so that the tooth contained practically as much dentin as did the normal control, although the bulk of the tooth was one third smaller than the normal (Figs. 6 and 8). The structure in this zone was normal except



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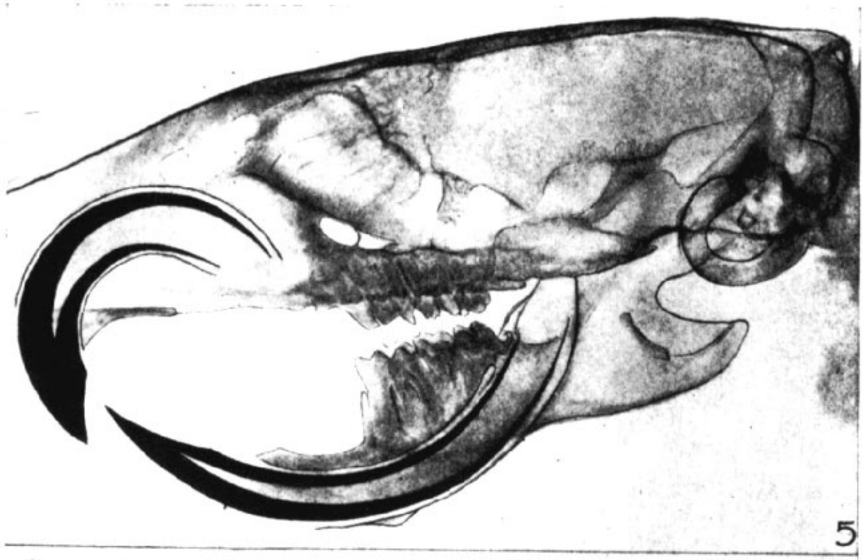

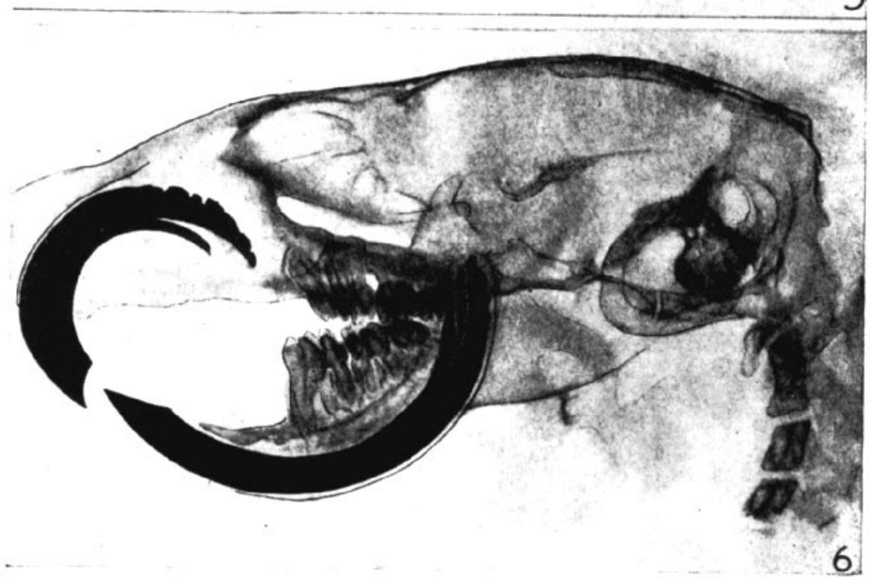

Fig. 5. Radiograph of head of control rat 202. X3. The calcified portions of the upper and lower incisor are traced in black.

Fig. 6. Radiograph of head of hypophysectomized rat 144. X 3. This animal lived 257 days after the operation. The calcified portions of the incisors are traced in black. Note the distortion of the labial surface in the posterior region and the prominent obliteration of the pulp.



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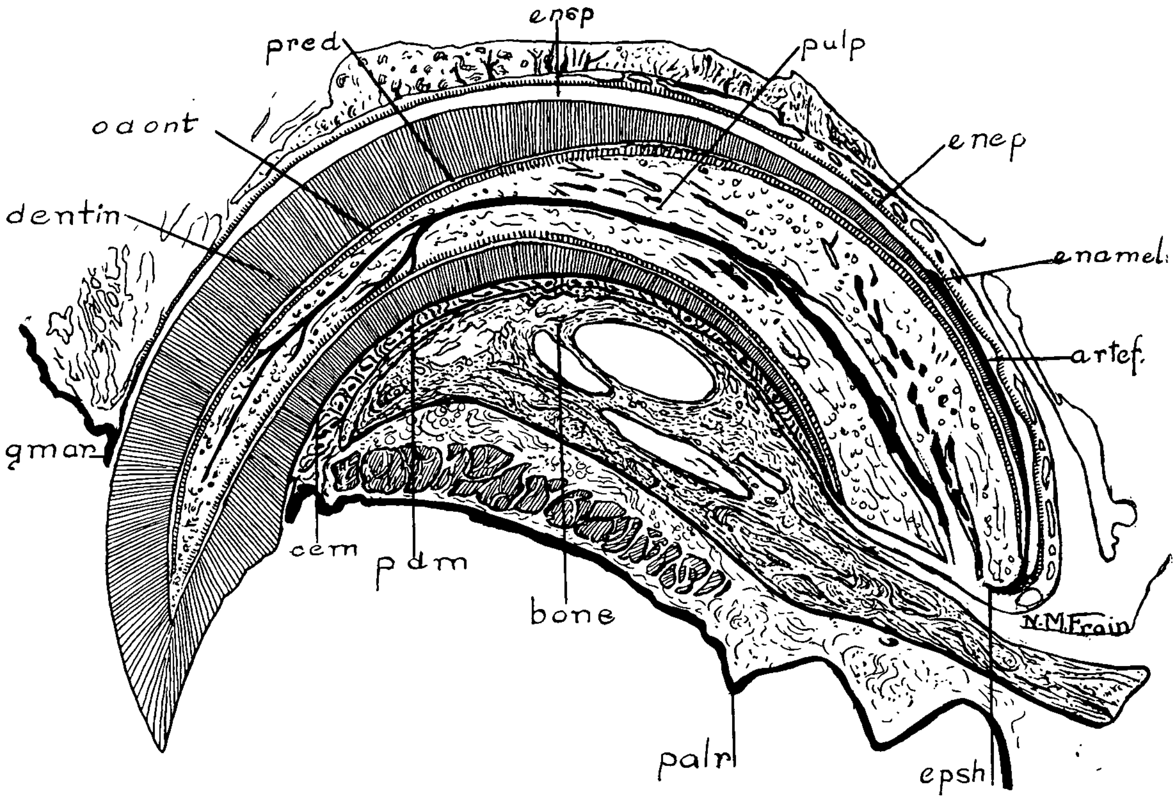


Fig. 7. Upper incisor of a normal rat. Semi-diagrammatic reproduction of photomicrograph. Sagittal section: *artef,* Artifact due to separation of ganoblasts from enamel that is not yet completely formed; *cem, cementum; ensp,* space formerly occupied by enamel lost in decalcification; *epsh,* epithelial sheath of Hertwig; *gmar,* gingival margin; *odont,* odontoblasts; *palr,* palatal rugae; *pdm,* periodontal membrane; *pred,* predentin. X 12. Compare with Figure 8.

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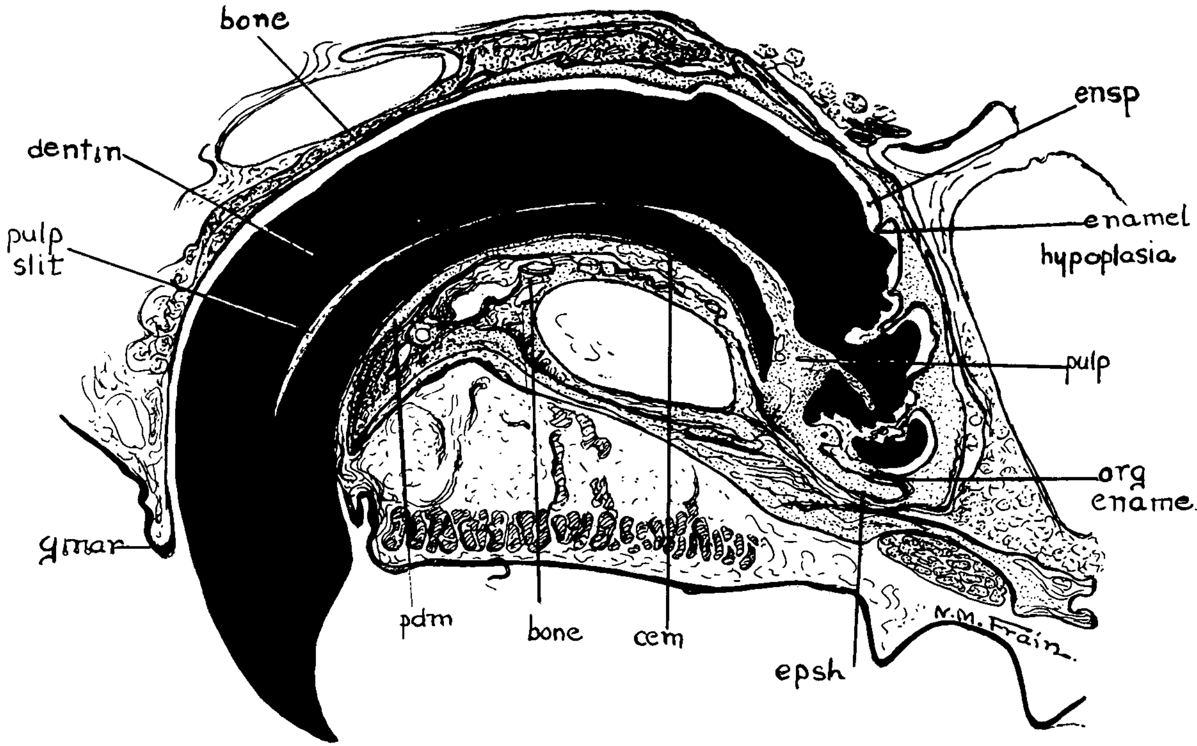


Fig. 8. Upper incisor of rat 151 which lived 380 days after hypophysectomy. X 11. Semi-diagrammatic reproduction of photomicrograph. Legends are the same as in Figure 7.



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for some pulpal inclusions. At the basal zone, the dentin formed the principal bulk of the multiple foldings, and varied structurally from normally calcified to very poorly calcified dentin and irregular uncalcified matrix.

4. The pulp was almost completely obliterated and dentified in the anterior zone. The pulpal slit that remained in this zone contained many calcified globules. In the basal zone the pulp took on a more or less typical appearance, but its blood supply was reduced in comparison with the rich blood supply of the control material.

5. The cementum was thicker than normal. It sometimes reached five times the normal thickness. Its outline was in some cases disturbed in the basal zone.

6. The periodontal membrane was, as a rule, normal in structure but its blood supply was below normal. It was uneven in width, and contained an increased number of epithelial rests.

7. The labial alveolar periosteum had a reduced blood supply and was irregular in width. Occasionally it contained islands of bone that were near the enamel or in contact with the enamel.

8. Hertwig's sheath displayed greater vitality than any other dental tissue. It was often displaced. An accumulation of eosin-staining fluid between the sheath and the pulp was sometimes observed.

## Discussion

*Rate of Eruption*: The rate of eruption is retarded within a week following hypophysectomy and may thus be used as an early and reliable indicator of the success or failure of the operation. In the case of those animals for which the rate of eruption of the incisors was measured within a week following hypophysectomy, one of the investigators (I. S.) who made the measurements without knowing the history of the animals was able to determine on the basis of one week's measurement which animals were successfully operated upon. His determination was later corroborated in each case by the other investigator (H. B. v D.) who had the records of the weight curve and oestrous cycles.

*Dentin*: When looking at a histologic section of the incisor of the hypophysectomized rat one might on first glance suppose that one deals with a pathologic increase in dentin formation since the space normally occupied by the pulp is for the most part dentified and in addition dentin is found to be accumulated in irregular folds at the basal end (Fig. 8).

However further consideration shows that there is actually no abnormal



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increase in the amount of dentin formed. In the incisor of the normal rat, dentin grows by apposition at the pulpal surface in the form of layers which move anteriorly along the long axis of the tooth and are constantly replaced by similar layers (Erdheim 1911). The balance between the rate of apposition and the rate of the forward movement of these layers is such that in the mature rat the total amount of dentin substance remains the same.

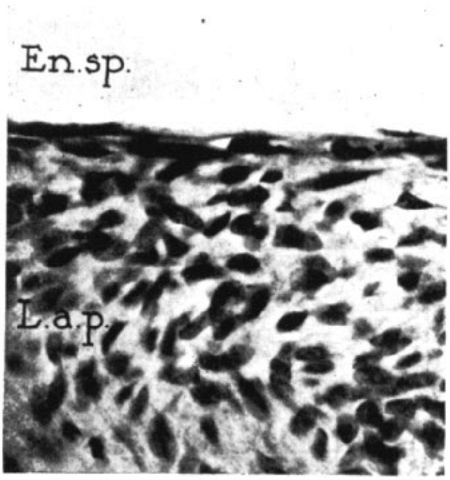


Fig. 9. Photomicrograph of section of labial surface of mid-region of upper incisor of hypophysectomized rat 199. This animal lived 273 days after the operation. X 410. Note the absence of enamel epithelium. En. sp., space formerly occupied by enamel lost in decalcification; L. a. p., labial alveolar periosteum. Compare with corresponding field of control rat 202 in Figure 10.

In the incisor of the hypophysectomized rat this balance is disturbed because of the more marked retardation of the rate of eruption. The result is that more dentin is being formed than is worn down so that the dentin substance does not remain constant but increases in amount. The new dentin layers that are being constantly and successively apposed cannot immediately occupy the position of the already formed and more slowly erupting dentin layers and thus in parts accumulate at the expense of the pulp. Because of the more limited space at the posterior end of the tooth, the dentin is here folded irregularly (Fig. 8).

*Calcification of Dentin*: The dentin takes a very deep hematoxylin stain and thus indicates a state of overcalcification. It is difficult to estab-



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lish the reason for this condition. It is possible that as the formation of organic dentin matrix is being slowed down, the amount of inorganic salts available for deposition is not correspondingly diminished so that relatively more inorganic salts are laid down with the result that the dentin shows a higher degree of calcification. Whether this state of overcalcification is in any way associated with an alteration in the functional activity of the para-

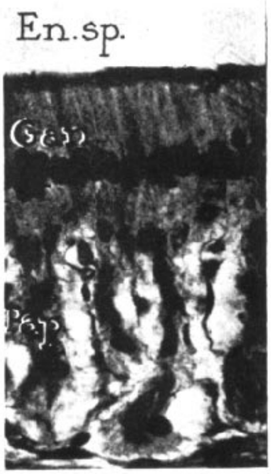


Fig. 10. Photomicrograph of labial surface of mid-region of upper incisor of control rat 202. X 410. En. sp., space formerly occupied by enamel lost in decalcification; Gan, ganoblasts; Pap, epithelial papillae.

thyroids or with a change in the utilizability of the vitamins is not known. While the bulk of the dentin is as a whole overcalcified, the calcification at the posterior end is not excessive. Here the dentin usually shows large interglobular spaces and in some cases the most recently formed dentin shows many fine isolated calcium globules.

*Cementum and periodontal membrane*: The histologic picture of a thickened cementum and a narrowed periodontal membrane coincides with that of a non-functioning tooth (Kellner, 1931). Thus we have in the hypophysectomized rat fundamentally a tooth in which the hard dental tissues accumulate increasingly while the soft dental tissues undergo a gradual obliteration.

*Disturbance of eruption and function*: The histologic picture serves to confirm and amplify the gross, x-ray, and eruption findings. In the ad-



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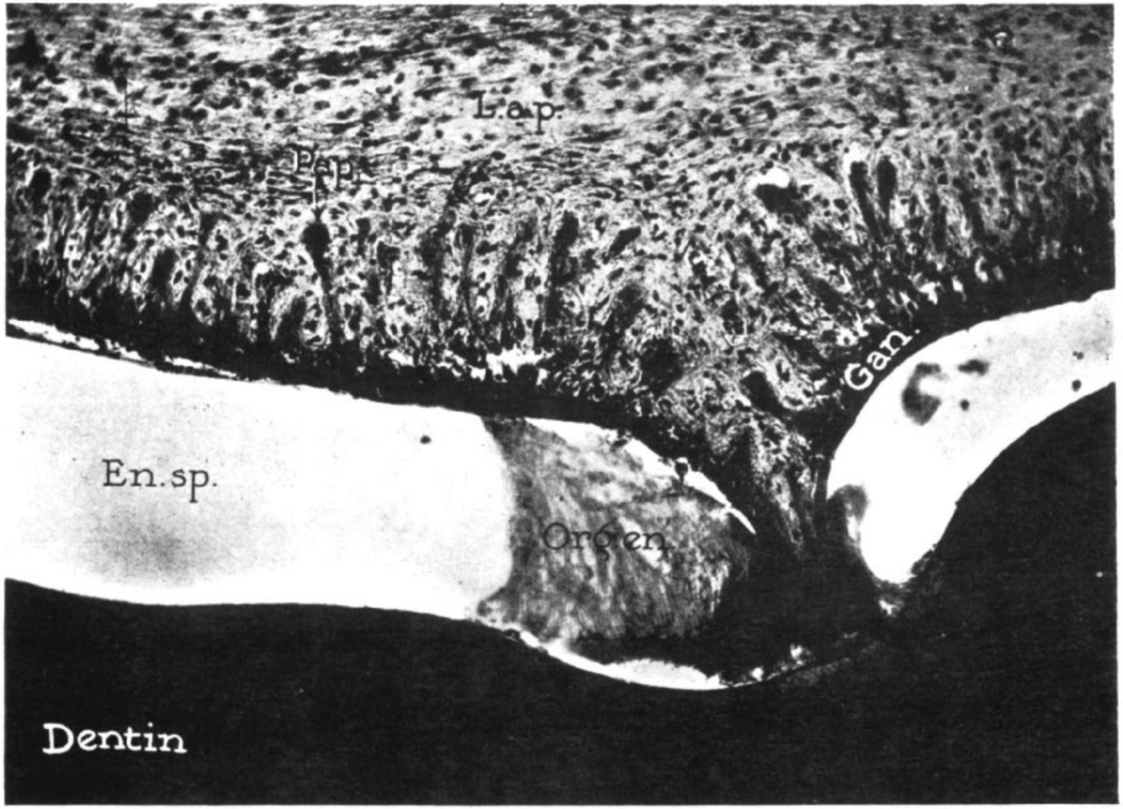


Fig. 11. Photomicrograph of the folding of the labial alveolar periosteum and the enamel epithelium of the labial surface of the upper right incisor of rat 314 which lived 110 days after hypophysectomy. X 250. En. sp., enamel space; Gan, ganoblasts; L. a. p., labial alveolar periosteum; Org. en., organic matrix; Pap., epithelial papillae.

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vanced stages one could deduct from the foldings and bone anchorage seen in the histologic sections that eruption was seriously disturbed even if one knew nothing of the rate of eruption. In the advanced stages we have a tooth which is insignificant in its function or does not function at all. The fact that in those animals where eruption has ceased entirely the exposed portions of the incisors are not shorter than those of other hypophysectomized animals indicates that the opposing incisors did not occlude or wear off. In rat 113, caries was found at the incisal surface of an upper incisor. This could not occur on a surface that was being constantly worn down.

*Causal relationship between hypophysectomy and the distrubances in rat incisor*: One may reason that the changes observed in the incisor of the hypophysectomized animal may be due primarily to a severe, general constitutional setback. The author, however, feels justified in concluding that the changes in the dental tissues that have been reported result primarily from the hypophysectomy for the following reasons:

1. Animals that were unsuccessfully hypophysectomized and that were exposed to injuries that were quite similar to those incidental to successful hypophysectomy showed a normal dental picture.

2. Replacement therapy accelerated the rate of eruption after it had been retarded following hypophysectomy.

3. The changes differ from those observed in deficient diets (Orban, 1927), rickets (Erdheim, 1914), parathyroidectomy (Erdheim, 1906, Toyofuku, 1911, Kranz, 1914) and thyro-parathyroidectomy (Hammet, 1922, Jung and Skillen, 1929).

*Possible basis for changes following hypophysectomy*: To trace the sequence of changes that occur more or less regularly and constantly following the removal of the hypophysis has not been difficult. On the other hand, the explanation of the process is very difficult and awaits further histologic and experimental investigation. We are dealing, on one hand, with an endocrine organ and, on the other hand, with the tooth, which is the richest calcium containing organ in the body. The fact that all the endocrine organs may be closely interrelated suggests immediately the possibility that in removing the hypophysis we are disturbing the parathyroids which are known to play an important role in calcium metabolism and the removal of which is known definitely to disturb tooth development. However, the incisor of the hypophysectomized rat presents a picture that as a whole is different from and in respect to calcification opposite to that of the parathyroidectomized rat. The incisor of the parathyroidectomized rat shows a



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pathological opacity. Its rate of eruption is retarded (Gottlieb, 1920; Orban, 1927), but apparently not as much as in hypophysectomy. The folding of enamel and dentin is comparatively mild. The chief change is in the dentin which shows a wide dentinoid border and which therefore weakens the tooth so that fractures are common (Erdheim, 1906; Toyofuku, 1911). Following hypophysectomy, the dentin shows usually a normal dentinoid border, and, in so far as it constitutes a greater portion of the tooth mass than normally, it strengthens the tooth beyond the normal. The parathyroids are therefore not playing a primary role in this problem, although they may very likely play a secondary role. In the present state of our knowledge we cannot entirely exclude the possibility that vitamins may also be involved, in spite of the fact that the animals received an adequate diet. Certain vitamins may not be utilizable.

*Disturbance in growth*: The dental changes following hypophysectomy are primarily disturbances in growth. Todd (1926) has pointed out that growth consists of two phases, an increase in dimensions and a change of proportion. The growth disturbances produced experimentally by the removal of the hypophysis confirm Todd's definition. The teeth or parts of them are smaller and the rate of eruption is reduced, but in addition there are disturbances in proportion. The latter include abnormal proportion between the rate of eruption and the rate of formation of the dental tissues and an impaired adjustment between the alveolar bone and the tooth.

That this disproportion is partly responsible for the prominent folding and accumulation of calcified tissue at the basal zone and the dentification of the pulp is indicated by other experiments. The author was able to retain the incisor of normal rats at various points anterior to the basal zone so that the eruption of the tooth was checked while its growth continued, by three types of experiments:— *a*, fracture of tooth with subsequent ankylosis at the site of fracture; *b*, infection of investing tissues with subsequent intense local inflammation resulting in ankylosis of tooth at site of infection; *c*, retardation of eruption by traumatic occlusion, induced by crowning the upper incisors. The above experiments resulted in an accumulation of calcified tissues at the basal zone and a dentification of the pulp that were similar to but less intense than those seen in the incisors of the hypophysectomized rats (Schour, 1934).

In addition to the disturbance in proportion, the dental cells gradually lose normal capacity for functional differentiation and reach the final stages of cytomorphosis prematurely. In other words, in the hypophysectomized



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animal the teeth and their investing tissues present not merely a replica of the condition in the adult rat but a distortion as well as a reduction of the normal picture.

The striking disturbance, reduction, and occasional disappearance of what is normally a characteristic and exceedingly rich blood supply point to the possibility that the primary factor in this process is a circulatory disturbance which in turn produces the above mentioned alterations in rate of eruption, alveolar bone growth and tooth growth.

## Summary

The effect of hypophysectomy on the incisor of the white rat has been studied in twenty-three completely hypophysectomized rats (63 to 459 days after operation) and sixteen litter mate control rats in respect to gross changes (including x-ray findings and eruption rates) and microscopic alterations.

The findings were:

1. Progressive retardation and final cessation of eruption.
2. Distortion of form, especially in the basal zone.
3. Smaller size of teeth (two-thirds normal size).
4. Severe histopathologic changes.
5. Disturbances in calcification.

## Bibliography

Allen, B. M., 1916 The result of extirpation of the anterior lobe of the hypophysis and the thyroid of Rana pipicus larvae. Science, 44, 755-761.

Aschner, B., 1912 Über die Funktion der Hypophyse. Arch. f. die gesammte Physiol., 146, 1.

Ascoli, G., and Legnani, T. 1912 Die Folgen der Extirpation der Hypophyse. Münch. med. Woch., *59*, 518.

Burnett, F. L. 1923 Estudio de los maxillares y dientes en perros hipofisoprivos. Unpublished studies cited from correspondence with B. A. Houssay.

Downs, W. G., 1930 An experimental study of the growth effects of the anterior lobe of the hypophysis on the teeth and other tissues and organs. Jour. Dent. Res., *10*, 601.

Erausquin, R., 1917 La hipofisis y el aparato dentario (communication presented before the Pan American Dental Congress at Chile, October, 1917). Buenos Aires.

Erdheim, J., 1906 Tetania parathyreopriva. Mitteilungen aus den Grenzgebiten XVI p. 632-744.

Erdheim, J., 1911 Über die Dentinverkalkung im Nagezahn bei der Epithelkörperchentransplantation. Frankf. Zeitschr. f. Pathol. 1911, 7, 295.

Erdheim, J., 1914 Rachitis und Epithelkörperchen. 90. Band der Denkschriften der math. naturw. Klasse der Kais. Akad. der Wissensch. Wien 1914.

Evans, H. M., 1924 The functions of the anterior hypophysis. Harvey Lectures, *19*, 212-235.



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## Bibliography (continued)

Gottlieb, B., 1920 Schmelzhypoplasia und Rachitis. Wiener Vierteljhrschr. f. Zahnheilkunde. Heft 2, 71-96.
Hammett, F. S., 1922 Studies of the thyroid apparatus. VII. A differential effect of thyroparathyroidectomy and parathyroidectomy of the incisor teeth of the albino rat. Am. Jour. of Physiol., *62,* 197-201.
Horsley, V., 1886 Functional nervous disorders due to loss of thyroid gland and pituitary body. Lancet, *1,* 5.
Jung, F. I. and Skillen, W. G., 1929 Effects of thyroparathyroidectomy on the teeth of the rat. Proc. Soc. for exp. Biol. and Med., *26,* 589-590.
Kellner, E., 1931 Das Verhältnis der Zement und Periodontalbreiten zur funktionellen Beansprachung der Zähne Zeitschr. f. Stomat., Bd. 29, 44-62.
Kranz, P., 1914 Innere Sekretion in Beziehung zur Kieferbildung und Zahnentwicklung. Dtsche. Zahnheilk. in Vortragen, 32.
Marie, P., 1886 Sur deux cas l'acromegalie, hypertrophie singuiliere non-congenitale des extremites superieures, inferieures et cephalique. Rev. de Med., Par. 6, 297-333.
Minkowski, O., 1887 Über ein Fall von Akromegalie. Berl. klin. Woch. *24,* 371.
Orban, B., 1927 Nutrition and Teeth. Jour. Am. Dent. Ass., *14,* 1619-1630.
Pflüger, H. und Schürman, P., 1931 Die Histogenese Ekto-Mesodermaler Mischgeschwülste der Mundhöhle. I. Die Hypophysengangeschwülste und die Tumoren des Zahnbildenden Gewebes. Ss. 1-62. George Thieme. Leipzig.
Putnam, T. J., Benedict, E. B., and Teel, H. M., 1929 Studies in Acromegaly. Arch. Surg. *18,* 1708.
Schour, I., 1934 The effect of tooth injury on other teeth. Jour. of Physiol. Zool.
Schour, I. and van Dyke, H. B., 1932a Effect of replacement therapy on eruption of the incisor of the hypophysectomized rat. Proc. Soc. for Exp. Biol. and Med., *29,* 378-382.
Schour, I. and van Dyke, H. B., 1932b Changes in the teeth following hypophysectomy. I. Changes in the incisor of the white rat. Am. Jour. of Anat., *50,* 397.
Schour, I. and van Dyke, H. B., 1932c Effect of hypophysectomy on the molar of the rat. Proc. Soc. Exp. Biol. and Med., *29,* 688-689.
Simonds, J. P., 1922 The pathological anatomy and histology of the hypophysis. Barker, Endocrinology and Metabolism, *1,* 767. Appleton & Co. New York.
Smith, P. E., 1916 Experimental ablation of the hypophysis in the frog embryo. Science, *44,* 280-282.
Smith, P. E., 1927 The disabilities caused by hypophysectomy and their repair. J. A. M. A. *88,* 158.
Smith, P. E., 1930 Hypophysectomy and a replacement therapy. Am. Jour. Anat. *45,* 205-273.
Todd, T. W., 1926 Skeletal adjustment in jaw growth. Dent. Cosmos, *68,* 1168-1184.
Toyofuku, T., 1911 Über die parathyreoprive Veränderung des Rattenzahnes. Frankf. Zeit. f. Path. 7, 249-294.



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