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The pharyngeal hypophysis in some laboratory animals

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INTRODUCTION

In Man, an extrasellar collection of active adenohypophysial tissue known as the *pharyngeal hypophysis* is a constant feature of the mucoperiosteum of the roof of the nasopharynx. In the course of an investigation into the mechanism of control of this organ in Man, the need for a suitable model for animal experimentation became apparent (McGrath, 1972, 1973). Conflicting reports as to the presence or absence of a pharyngeal hypophysis in a wide range of animals have been published (Arai, 1907; Atwell, 1918; Kingsbury, 1942; Oboussier, 1944 and Boyd, 1956). A re-investigation of the incidence, site, dimensions and histology of the pharyngeal hypophysis in some common laboratory animals was therefore undertaken.

MATERIALS AND METHODS

The heads of adult dogs, monkeys, sheep (female), cats, rabbits, rats (male) and guinea-pigs which had been used in various laboratories for experiments unconnected with the endocrine system were studied.

Dogs

Six dogs were used (one pug, four long-nosed mixed breed and one greyhound). In two dogs the pharyngeal mucosa underlying the inferior surface of the sphenoid in the median plane was removed, embedded in paraffin and sectioned in the sagittal plane at 10 μm. In the pug the *en bloc* specimen of the body of the sphenoid was decalcified, embedded in celloidin and sectioned in the coronal plane at 50 μm. In three dogs, including the greyhound, the *en bloc* specimens of the body of the sphenoid were decalcified, double-embedded in paraffin and sectioned in the sagittal plane at 15 μm. All sections were stained with PAS-orange G.

Monkeys

Seven monkeys were available (six rhesus monkeys and one pig-tail monkey). In five rhesus monkeys the pharyngeal mucosa underlying the inferior surface of the sphenoid in the median plane was removed, embedded in paraffin and sectioned in the coronal or sagittal plane at 10 μm. In one rhesus monkey and the pig-tail monkey, the *en bloc* specimens of the body of the sphenoid were decalcified, embedded in celloidin and sectioned in the sagittal and coronal planes respectively at 50 μm. All sections were stained with PAS-orange G.

Sheep, cats, rabbits, rats and guinea-pigs

Five animals of each species were used. *En bloc* specimens of the body of the sphenoid were decalcified and double-embedded in paraffin. Three specimens of each species were sectioned at 15 μm in the coronal plane and two specimens in the sagittal plane. All sections were stained with PAS-orange G.

In Man the larger posterior part of the pharyngeal hypophysis is in the midline in the mucoperiosteum underlying the more anterior part of the inferior surface of the postsphenoid. The postsphenoid is defined as that part of the body of the sphenoid which lies posterior to the plane of the tuberculum sellae, and which forms the floor of the sella turcica. In attempting to locate the pharyngeal hypophysis in the animals under study, particular attention was given to that part of the sphenoid which corresponds to the human postsphenoid. The animal postsphenoid supports the cranial hypophysis superiorly and, except in the monkey, is clearly demarcated anteriorly by a band of cartilage. Dimensions of the postsphenoid were determined using a millimeter rule and an ocular micrometer. The length was taken as the maximum antero-posterior extent of the inferior surface, as defined by cartilage when present, and otherwise by the distance between a plane through the tuberculum sellae and a plane just posterior to the dorsum sellae. The width was taken as the maximum lateral extent of the clearly defined part of the body of the sphenoid. The depth was taken as the minimum depth of the postsphenoid in the median plane. A mean of these measurements was obtained in each species.

For convenience the term 'sellar adenohypophysis' has been used to designate the intracranial adenohypophysis, even in those species which lack a well defined sella turcica. On developmental grounds the term 'pharyngeal hypophysis' has been used to describe the structure with specific histological characteristics in the mucoperiosteum of the roof of the nasopharynx in the median plane.

The pharyngeal hypophysis was identified in all six dogs, all five cats, all the rabbits and guinea-pigs, and in three of the five rats. The pharyngeal hypophysis was studied in serial section throughout its extent in the mucoperiosteum underlying the inferior surface of the postsphenoid. In the cat and guinea-pig serial section studies were also made of the extension of the pharyngeal hypophysis upwards through the postsphenoid.

Dimensions of the sellar and pharyngeal hypophyses were determined using a millimeter rule and an ocular micrometer. The length of the sellar adenohypophysis was taken as its maximum extent in the sagittal plane, while the width and depth were taken as its maximum extent in the lateral and vertical directions respectively. Dimensions of the pharyngeal hypophysis within the mucoperiosteum of the pharyngeal roof were determined in a similar manner. A mean of these measurements was obtained in each species. The volume was calculated from the means and must be accepted as no more than an approximation.

RESULTS

The pharyngeal hypophysis in the laboratory animals under study presented a varied histological picture with squamous cell nests, tubular diverticula, cysts and

Table 1. *Incidence of the pharyngeal hypophysis, and dimensions of the postsphenoid, in some laboratory animals*

Species	Number	Incidence of pharyngeal hypophysis (%)	Dimensions* of postsphenoid (mm) Length	Depth	Width
Dog	6	100	14·0	3·4	7·4
Monkey	7	0	14·0	5·5	8·0
Sheep	5	0	21·5	5·1	9·3
Cat	5	100	10·0	1·7	4·7
Rabbit	5	100	10·0	2·0	2·5
Rat	5	60	7·3	1·2	4·7
Guinea-pig	5	100	6·0	0·5	1·8

* See text.

Table 2. *Dimensions* of the sellar adenohyophysis and pharyngeal hypophysis in some laboratory animals*

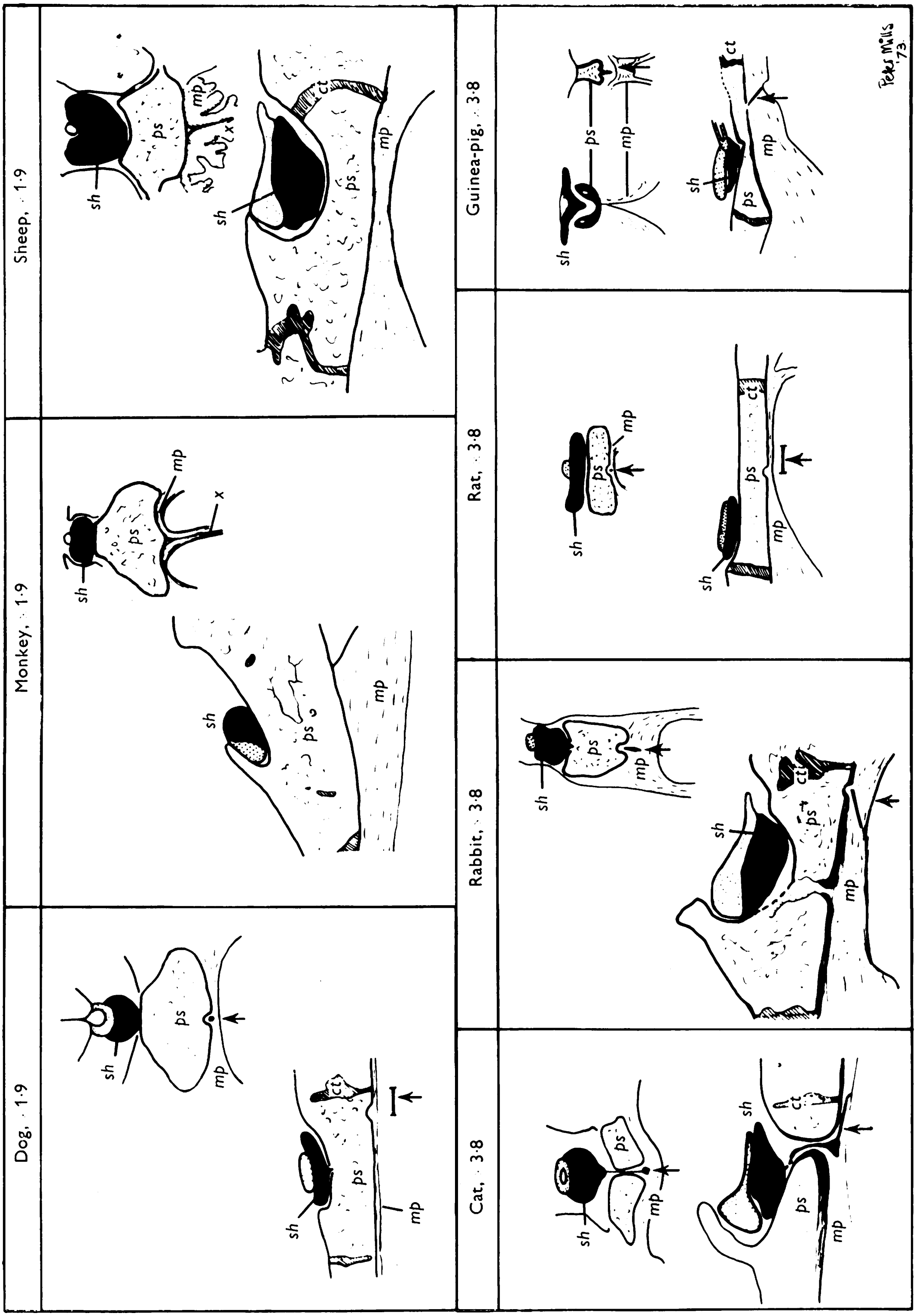
	Sellar adenohypophysis				Pharyngeal hypophysis			
Species	Length (mm)	Depth (mm)	Width (mm)	Vol. $(mm)^3$	Length (mm)	Depth (mm)	Width (mm)	Vol. $(mm)^3$
Dog	5·8	1·8	3·1	32·4	2·1	0·6	0·6	0·76
Monkey	4·3	2·8	5·0	60·0	—	—	—	—
Sheep	9·2	5·9	6·6	358·2	—	—	—	—
Cat	3·1	1·6	3·6	17·9	2·1	0·1	0·3	0·07
Rabbit	3·6	2·1	2·9	23·0	1·7	0·3	0·2	0·10
Rat	2·9	0·7	3·3	6·7	0·5	0·1	0·4	0·02
Guinea-pig	3·4	1·0	3·1	10·5	0·6	0·3	0·2	0·04

* See text.

collections of differentiated cells. It was, however, a distinct entity, and when present was readily identified in the midst of the mucoperiosteal tissue underlying the appropriate part of the postsphenoid. The incidence of the pharyngeal hypophysis is shown in Table 1. A pharyngeal hypophysis was not identified in the monkey or the sheep. In both species a median nasopharyngeal septum (Fig. 1) added to the difficulties of locating a structure buried in the mucoperiosteum. However, in the sheep the five *en bloc* specimens were scrutinized in serial section at 15 μm and so it is unlikely that a pharyngeal hypophysis is present in mature female sheep. In the monkey the five mucoperiosteal segments were of little value in the absence of orientation, and the *en bloc* specimens were sectioned at 50 μm.

The general features of the *en bloc* specimens of the body of the sphenoid are shown in Fig. 1. The dimensions of the postsphenoid are given in Table 1 and the dimensions of the sellar hypophysis in Table 2.

The sellar hypophysis in the monkey, sheep, cat and rabbit presented as a compact mass of tissue. In the rat, and to a lesser extent in the dog, the sellar hypophysis was flat. In the guinea-pig the shape was irregular. The dimensions of the sellar adeno-


Sheep, · 1·9
Monkey, · 1·9
Dog, · 1·9
Guinea-pig, · 3·8
Rat, · 3·8
Rabbit, · 3·8
Cat, · 3·8
sh
ps
mp
ct
x
Peter Mills '73

hypophysis appeared to be of the expected order, relative to species size, except in the sheep where the calculated volume was relatively large (Table 2).

The postsphenoid consisted chiefly of cancellous bone. The superior surface consisted of compact bone, except in the rabbit and in some dogs where part of the superior surface was formed by fibrous tissue. The inferior surface consisted of compact bone in all species. The postsphenoid was clearly demarcated from the presphenoid by cartilage in all species except the monkey. The dimensions of the postsphenoid appeared to be of the expected order relative to species size. A well-defined sella turcica was present in the monkey, sheep, cat and rabbit. In the dog the sella was very shallow. In the rat the superior surface of the postsphenoid was flat. In the guinea-pig the sellar adenohypophysis extended into a deep fossa lined by compact bone. In all species the firm attachment of the capsule of the sellar hypophysis to the superior surface of the postsphenoid was readily seen. In the dog, cat, rabbit and guinea-pig, penetration of the superior surface of the postsphenoid by sellar adenohypophysial tissue was a regular feature. Such penetration was not seen in the monkey, sheep or rat in this series.

Both the superior and inferior surfaces of the postsphenoid showed numerous vascular foramina, particularly in the median plane. A regular feature of the dog, rabbit and rat was the presence of a deep median fossa in the inferior aspect of the postsphenoid. This fossa occurred close to the anterior border of the postsphenoid in the rabbit and dog, and about the midpoint of the inferior surface in the rat. In the guinea-pig there was a median foramen in the inferior surface of the postsphenoid. In every cat in the series a cranio-pharyngeal canal lined by compact bone was seen to extend in the midline from the sella turcica, through the anterior part of the postsphenoid, to open on the inferior surface. A typical canal was 2 mm long and 0·2 mm in diameter, with its inferior opening 2 mm behind the anterior border of the postsphenoid. In every rabbit in the series a trans-sphenoid canal passed from the sella turcica through the posterior part of the postsphenoid to open in the median plane on the inferior surface. The canal passed through cancellous bone, and only its inferior opening was lined with compact bone. This opening was about 5 mm behind the anterior border of the postsphenoid.

As mentioned earlier, a pharyngeal hypophysis was present in all species examined except the monkey and sheep. The extent of the pharyngeal hypophysis in the

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All histological sections are at 15 μm except where otherwise indicated. All sections are stained with PAS-orange G. In all sagittal sections the anterior aspect is to the right.

Fig. 1. *En bloc* sections of the body of the sphenoid are drawn in the coronal plane above, and in the sagittal plane below. Sellar adenohypophysis (*sh*), cartilage (*ct*), postsphenoid (*ps*), pharyngeal mucoperiosteum (*mp*), median nasopharyngeal septum (*x*), extent of pharyngeal hypophysis in mucoperiosteum (arrow).

The pharyngeal hypophysis is shown extending into a median fossa on the inferior surface of the postsphenoid in the dog, rabbit and rat. The pharyngeal hypophysis penetrates this surface in the guinea-pig, and extends upwards through a cranio-pharyngeal canal in the cat. As the sellar and pharyngeal hypophyses do not occur in the same coronal plane in the guinea-pig, the coronal plane depicted on the left passes through the sellar hypophysis, and that on the right passes through the pharyngeal hypophysis.

For further details see text.

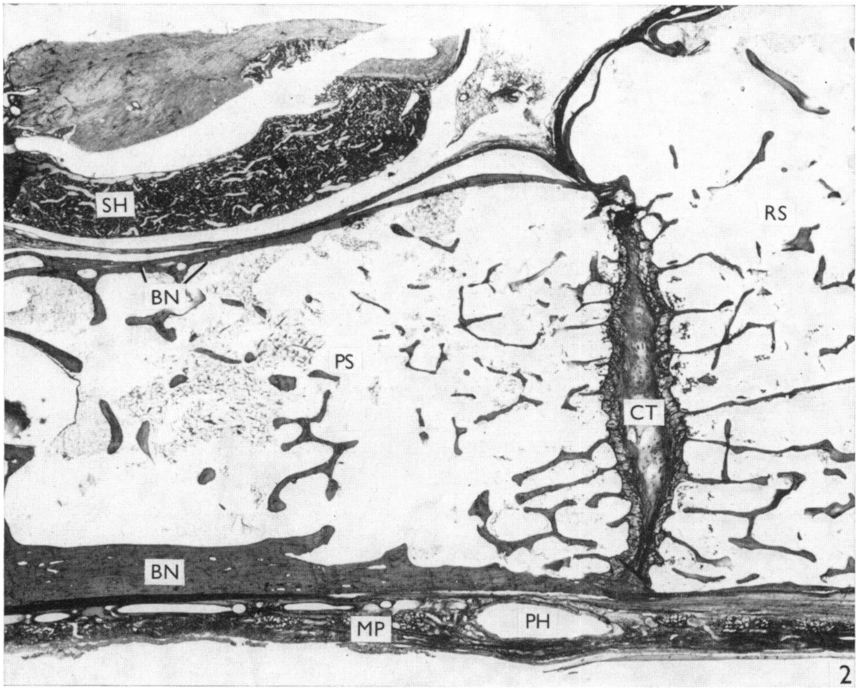


Fig. 2. Sagittal section of the postsphenoid of a greyhound. Sellar adenohypophysis (SH), presphenoid (RS), cartilage (CT), postsphenoid (PS). Compact bone (BN) forms the superior and inferior surfaces of the postsphenoid. A cystic pharnygeal hypophysis (PH) lies in the pharyngeal mucoperiosteum (MP). ×9.

mucoperiosteum in each species is indicated in Fig. 1 and the dimensions are given in Table 2.

Dog

In the dog the anterior part of the pharyngeal hypophysis showed a median tube opening on the pharyngeal mucosal surface just anterior to the anterior border of the postsphenoid. The tube was flattened in the coronal plane and was lined with columnar ciliated epithelium. It passed posteriorly and almost horizontally in the pharyngeal mucosa to the median fossa described above. In five specimens it was continuous with a multilocular cyst. The loculi varied in size, with the main one lying in the median sagittal plane (Figs. 2, 3). The lining epithelium of the cysts was either squamous, ciliated cuboidal or columnar. The cysts contained a mixture of colloid and cell debris (Fig. 4). In the specimen from the greyhound a vasculo-cellular mass continuous with the deep wall of the cyst extended into the median fossa in the inferior surface of the postsphenoid. The mass filled the fossa and was composed mainly of thin-walled vessels. Eosinophil, basophil and chromophobe cells were present, the latter in alveolar formation about small connections of colloid. The small vessels opened into a large vessel passing through the wall of the median fossa into the postsphenoid (Fig. 3). In the specimen from the pug dog the tube became continuous with an encapsulated collection of cells. As this specimen was sectioned at 50 μm,

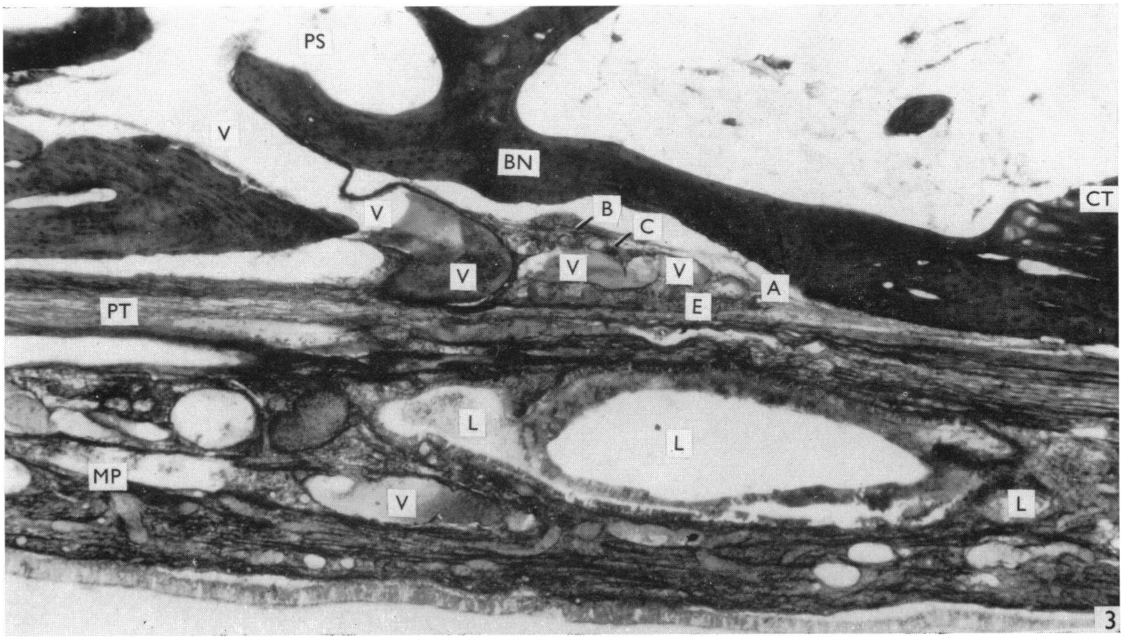
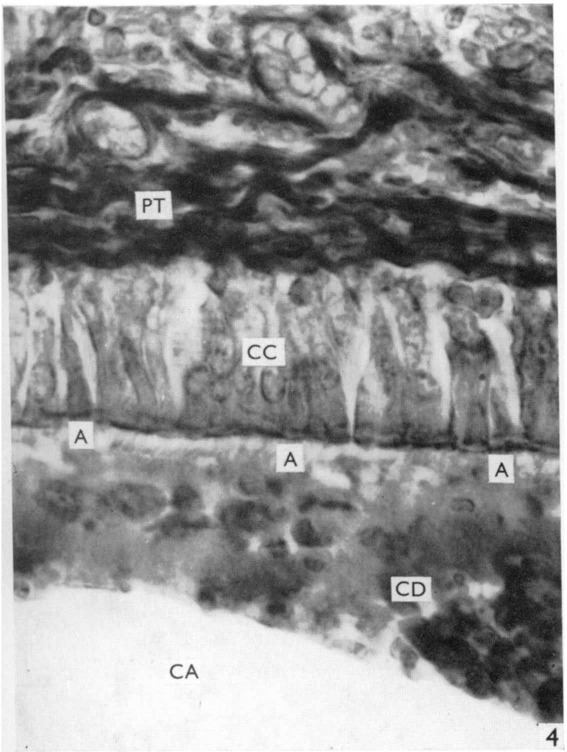


Fig. 3. Median sagittal section, same specimen as in Fig. 2. Cartilage (CT). Compact bone (BN) forms the boundaries of a median fossa in the inferior surface of the postsphenoid (PS). Periosteal layer (PT) of the pharyngeal mucoperiosteum (MP). The larger part of the pharyngeal hypophysis presents as a loculated cyst (L). The smaller deep part fills the median fossa and presents as a vasculo-cellular mass. Vessel (V), colloid (C), chromophobe cells in alveolar formation (A), basophil cell (B), eosinophil cells (E). × 32.

identification of cell type could not be made. The cellular mass was invested by large vessels which emptied into a vessel passing through the median fossa into the postsphenoid (Fig. 5). In both the greyhound and the pug the cellular component of the pharyngeal hypophysis was quite distinct from that of surrounding tissues. Its vascularity resembled that of the sellar adenohypophysis in its richness (Fig. 6), but the material available for histological study of the cellular component of the pharyngeal hypophysis was inadequate for positive identification of adenohypophysial tissue.

Cat

In the cat the anterior part of the pharyngeal hypophysis presented as a median tube opening on the pharyngeal mucosal surface anterior to the anterior border of the postsphenoid. The tube was flattened in the coronal plane and was lined with cilated columnar cells distended with colloid. The tube extended posteriorly in the depths of the pharyngeal mucosa to the inferior opening of the cranio-pharyngeal canal, where it became continuous with a cellular mass (Figs. 7, 8). This cellular mass was surrounded by a thin capsule from which vascular trabeculae projected inwards between cell clusters. The cell clusters were mainly composed of chromophobe cells. A few eosinophil and basophil cells could be seen. Cells arranged in alveolar fashion



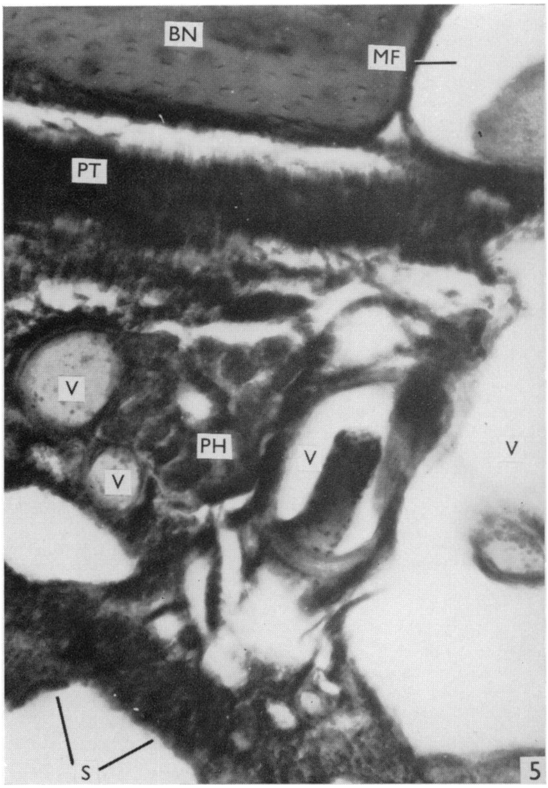


Fig. 4. Detail of Fig. 3. Deep wall of cystic part of pharyngeal hypophysis. Periosteal layer (PT) of pharyngeal mucoperiosteum. The cavity of the cyst (CA) is lined by columnar cells (CC) which are ciliated (A). The content of the cyst is a mixture of cell debris and colloid (CD). × 320.

Fig. 5. Coronal section, at 50 μm after latex injection, through the postsphenoid of a pug dog. A median fossa (MF) is bounded by the compact bone (BN) forming the inferior surface of the postsphenoid. Periosteal layer of pharyngeal mucoperiosteum (PT), vessel (V), squamous cells of pharyngeal epithelium (S). The pharyngeal hypophysis (PH) presents as a cellular mass invested with vessels which communicate with a large vein passing through the median fossa into the postsphenoid. Compare the histological appearance in the rat (Fig. 17). × 80.

about small amounts of colloid were a common feature. From the deep aspect of the cellular mass an extension passed upwards through the cranio-pharyngeal canal. The tissue within the canal presented as an elongated cellular mass with columns of chromophobe cells, a few basophil and eosinophil cells, alveoli, and colloid-filled cysts lined with columnar ciliated epithelium. Vessels were evident on the surface and between the cell columns (Figs. 9, 10). At the upper end of the cranio-pharyngeal canal the elongated mass became continuous with the antero-inferior aspect of the sellar adenohypophysis in the median plane while the surface vessels opened into the vascular spaces in the floor of the sella turcica (Fig. 8). The histological appearance of the cellular mass and its cranial extension were similar to that of the sellar adenohypophysis and in particular to that of the pars tuberalis (Fig. 11).

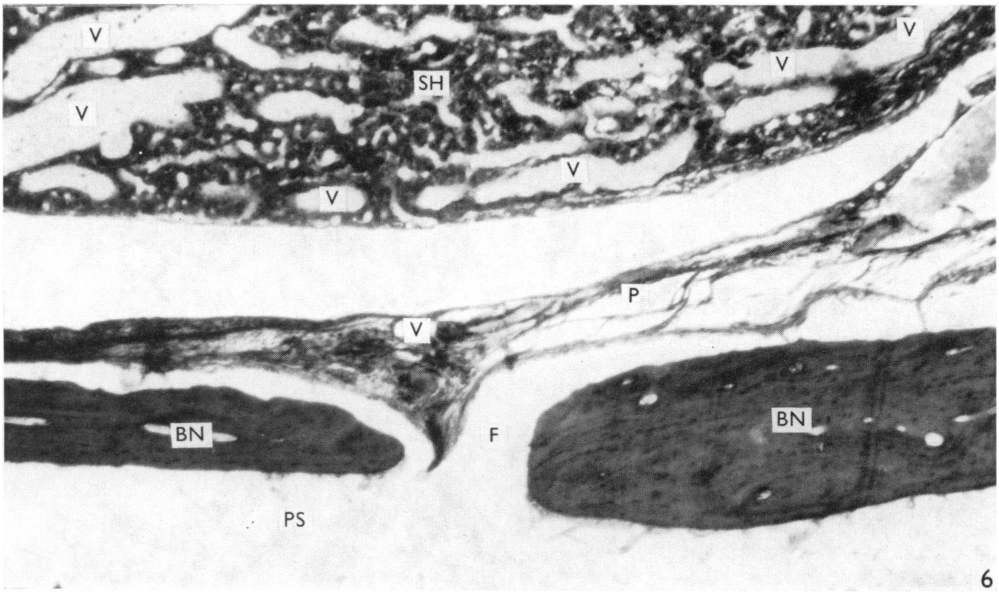


Fig. 6. Median sagittal section through postsphenoid in a dog. The greater part of the sellar adenohypophysis (SH) has retracted from its capsule (P). Adenohypophysial tissue adherent to the capsule can be seen entering the postsphenoid (PS) through a wide foramen (F) in the superior surface formed by compact bone (BN). Note the number and the width of the vessels (V) within the sellar adenohypophysis. ×44.

The dimensions of the pharyngeal hypophysis of the cat given in Table 2 refer only to that part within the pharyngeal mucoperiosteum.

Rabbit

In the rabbit the superficial part of the pharyngeal hypophysis presented as a small median indentation in the pharyngeal mucosal surface associated with a mass of undifferentiated cells. The cellular mass passed anteriorly and deeply to open into an elongated tubulo-squamo-cystic structure extending into a median fossa in the inferior surface of the postsphenoid (Fig. 12). This structure was invested with a layer of fibrous tissue. The cystic component was multilocular and appeared to have originated through a degeneration process in a mass of squamous cells (Fig. 13). The lining of the cysts in some specimens appeared hyaline. The content of the cysts was mainly cellular debris. Cells of the adenohypophysial type were not present in the pharyngeal hypophysis, and its general histological picture does *not* resemble that of the sellar adenohypophysis (Fig. 14).

Rat

In the rat the anterior part of the pharyngeal hypophysis presented as a wide median diverticulum in the pharyngeal mucosa underlying the anterior part of the post-sphenoid. When followed posteriorly and deeply the diverticulum became a cylindrical tube with a well-defined fibrous wall and a lining, in the main, of tall columnar

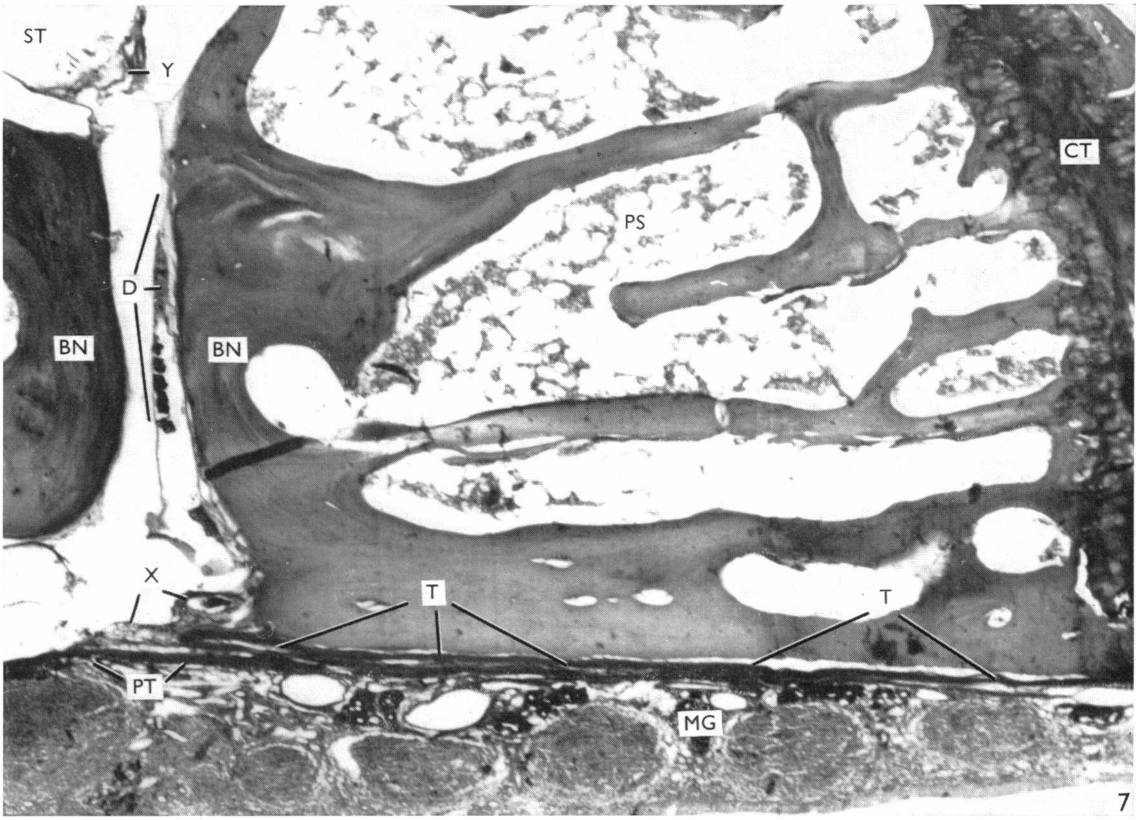
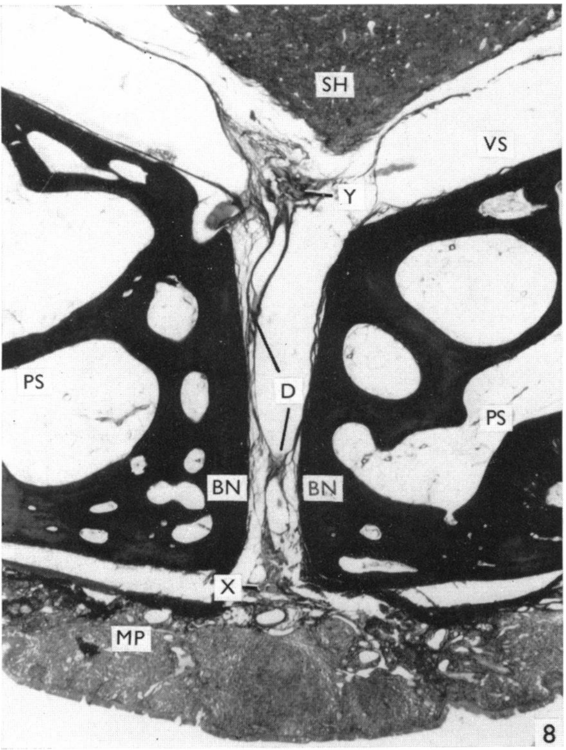


Fig. 7. Median sagittal section through the postsphenoid of a cat. Cartilage (CT), postsphenoid (PS), periosteal layer of the pharyngeal mucoperiosteum (PT), mucous gland (MG). The tubular part of the pharyngeal hypophysis (T) becomes continuous posteriorly with the cellular part (X). A cranial extension of the pharyngeal hypophysis (D) passes up the craniopharyngeal canal lined by compact bone (BN) to a cellular mass (Y) in the sella turcica (ST). Note the collections of colloid in X and D. ×36.

ciliated cells distended with colloid. The tube extended into the median bony fossa in the inferior surface of the postsphenoid. In one specimen sectioned in the sagittal plane the deeper part of the pharyngeal hypophysis presented as an elongated cellular mass lying in the periosteum of the median fossa (Fig. 15). In coronal section the median tube appeared flattened (Fig. 16). Posteriorly it became continuous with a mass of cells enclosed in a fibrous capsule from which trabeculae extended inwards (Fig. 17). The histological appearance of the mass of cells seen in coronal section was similar to that seen in the pug dog (Fig. 5). Differentiated cells in the pharyngeal hypophysis in the rat could not be positively identified.

Guinea-pig

In the guinea-pig the anterior part of the pharyngeal hypophysis presented as a median tube opening on the pharyngeal mucosal surface underlying the anterior



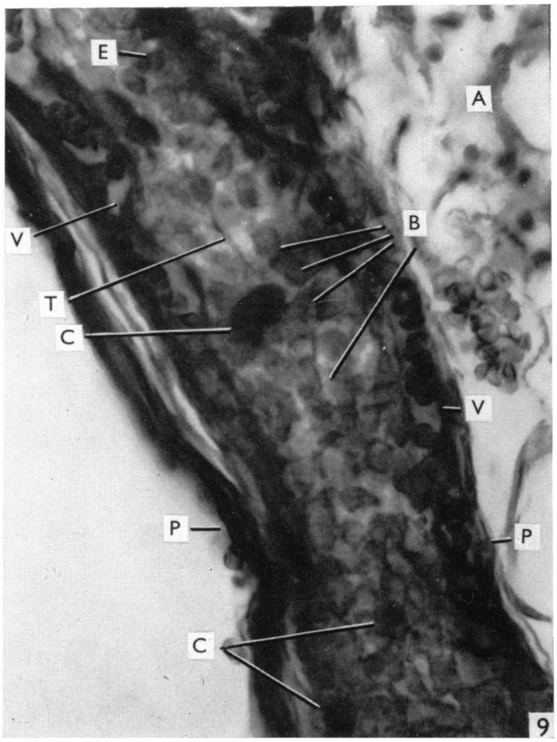


Fig. 8. Coronal section through the anterior part of the postsphenoid in a cat. Sellar adenohypophysis (SH), venous sinuses (VS), postsphenoid (PS), compact bone lining the craniopharyngeal canal (BN), pharyngeal mucoperiosteum (MP), cellular part of the pharyngeal hypophysis (X). A cranial extension of the pharyngeal hypophysis (D) passes upwards through the craniopharyngeal canal to a cellular mass (Y) which in adjacent sections is in continuity with the sellar adenohypophysis. × 25.

Fig. 9. Section through the cranial extension of the pharyngeal hypophysis in a cat. Same specimen as in Fig. 7. Areolar tissue in the canal (A), capsule of the extension (P), vessel (V), trabecula (T), eosinophil cell (E), basophil cell (B), colloid collection (C). Most cells are chromophobes. × 125.

part of the postsphenoid. The tube was cylindrical. Both the tube, and the cyst into which it developed posteriorly, were lined with cuboidal or columnar cells which appeared to be ciliated. Colloid and cell debris occurred within the cavity (Figs. 18–20). In four specimens the pharyngeal hypophysis penetrated the inferior surface of the postsphenoid. A complete cranio-pharyngeal canal in the guinea-pig was not demonstrable in any one section in this series, but in three specimens structural continuity with the sellar adenohypophysis was evident in serial sections (Fig. 18). In two specimens the histological picture also included squamous cell nests and, in one specimen, collections of differentiated cells (Fig. 19). The cellular collection was enclosed in a fibrous capsule from which vascular trabeculae extended inwards between clusters of cells. Within the cell clusters eosinophil, basophil and chromophobe cells were evident. The general picture was that of adenohypophysial tissue,

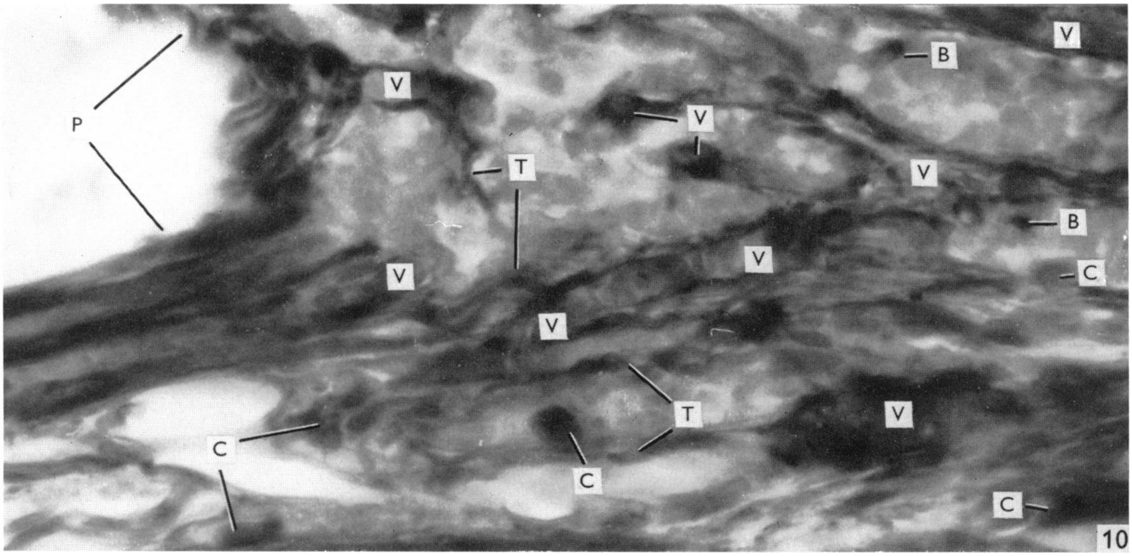


Fig. 10. Section through the cellular part of the pharyngeal hypophysis of a cat. Same specimen as in Fig. 7. Fibrous capsule (P), trabecula (T), vessel (V), colloid collection surrounded by cells in alveolar formation (C), basophil cell (B). Most cells are chromophobes. × 125.

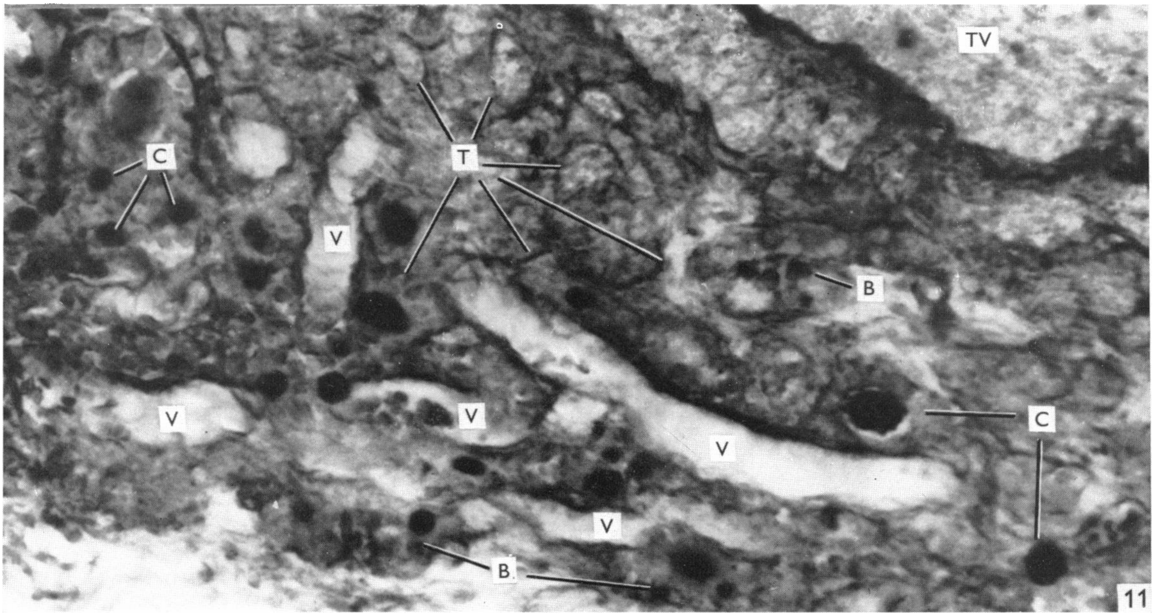


Fig. 11. Section through the pars tuberalis of a cat. Same specimen as in Fig. 7. Floor of the third ventricle (TV), trabecula (T), vessel (V), colloid collection surrounded by cells in alveolar formation (C), basophil cell (B). Most cells are chromophobes. × 125.

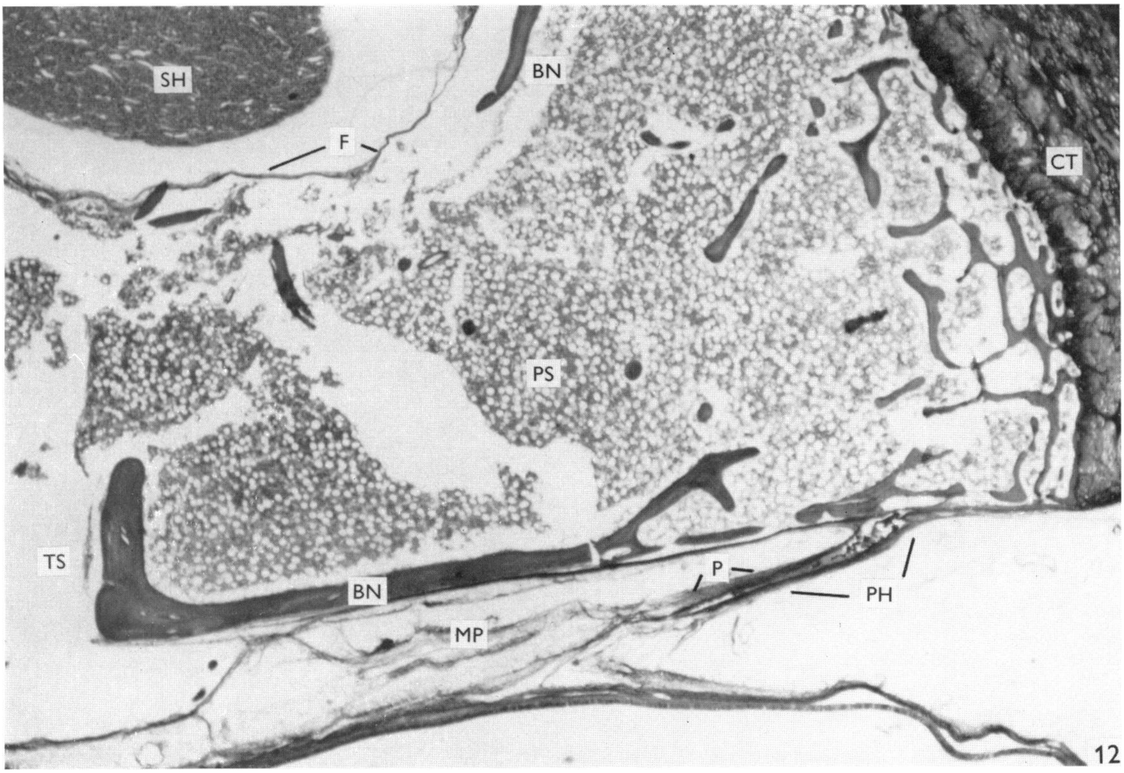


Fig. 12. Median sagittal section through the postsphenoid of a rabbit. Cartilage (CT), sellar adenohypophysis (SH). Compact bone (BN) forms the inferior surface of the postsphenoid (PS) and the inferior opening of the canal passing through the posterior part of the postsphenoid (TS). The superior surface of the postsphenoid is formed partly by compact bone and partly fibrous by tissue (F). The pharyngeal hypophysis presents as a tubulo-cystic structure surrounded by a fibrous capsule (P) and extending forwards and deeply through the pharyngeal mucoperiosteum (MP). ×30.

although it did not readily relate to any particular part of the sellar adenohypophysis as seen in the guinea-pigs in this series (Fig. 21).

The dimensions of the pharyngeal hypophysis in the dog, cat, rabbit and guinea-pig appeared consistent with species size.

DISCUSSION

The first stage in the development of the adenohypophysis in Man is the appearance in the 2–3 mm embryo of an angular depression in the roof of the oral cavity anterior to the bucco-pharyngeal membrane. This depression, known as Rathke's pouch, deepens progressively. Its distal end develops into the sellar adenohypophysis. The proximal part of the pouch narrows and elongates into an hypophysial stalk. By the 20 mm stage the stalk has become fragmented. That part which passes through the developing postsphenoid usually disappears completely before birth. However, a cranio-pharyngeal canal which follows the same general course as that of the early

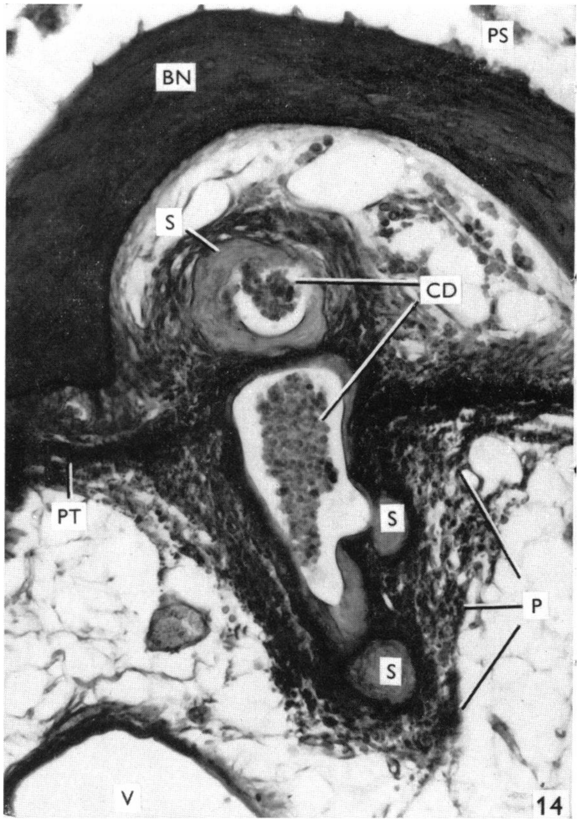


Fig. 13. Coronal section through the anterior part of the postsphenoid in a rabbit. Sellar adenohypophysis (SH). Compact bone (BN) forms superior and inferior surfaces of postsphenoid (PS). The pharyngeal hypophysis (PH) extends into a median fossa in the inferior surface of the postsphenoid. Pharyngeal mucoperiosteum (MP). Note the penetration of the superior surface of the postsphenoid by sellar adenohypophysial tissue (Y). ×25.

Fig. 14. Detail of the pharyngeal hypophysis in Fig. 13. Compact bone (BN) bounds a median fossa in the inferior surface of the postsphenoid (PS). Periosteal layer of the pharyngeal mucoperiosteum (PT), vein (V). The pharyngeal hypophysis presents as a squamo-cystic mass surrounded by a condensation of fibrous tissue (P). The cysts appear to have developed as a result of degeneration within a nest of squamous cells (S), and the content of the cysts is mainly cell debris (CD). ×80.

hypophysial stalk is said to occur in 0·42% of human adults, and, very rarely, adenohypophysial tissue occurs in such a canal. It might be assumed that the human cranio-pharyngeal canal is the persistent trans-sphenoidal track of the hypophysial stalk, but Arey (1950) is of the opinion that the canal is merely a vascular channel formed during osteogenesis. The proximal part of the hypophysial stalk persists and develops into the pharyngeal hypophysis (McGrath, 1967). In the animals studied in the present investigation, the development of the sellar adenohypophysis is similar to that of Man, but the fate of the hypophysial stalk appears to be different in the different species.

The presence of a cranio-pharyngeal canal has been reported in dogs of the

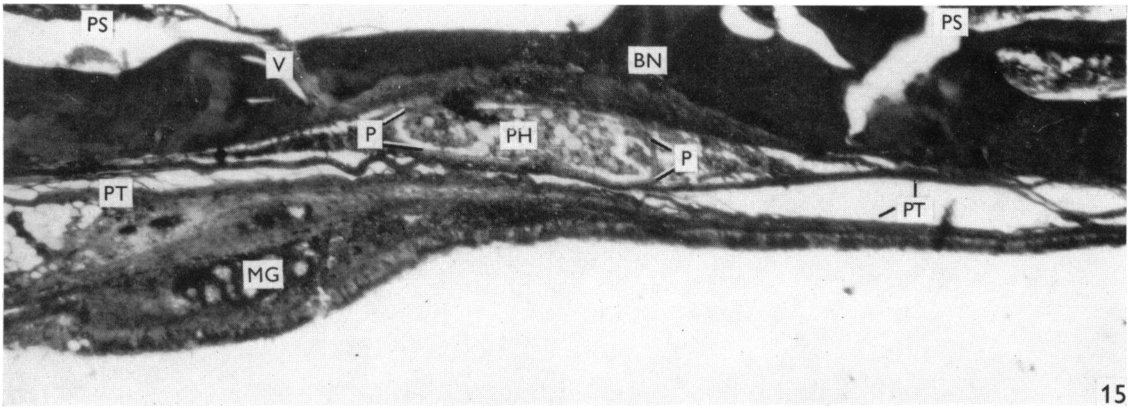


Fig. 15. Median sagittal section through the postsphenoid of a rat. Compact bone (BN) bounds a median fossa in the inferior surface of the postsphenoid (PS). Periosteal layer of the pharyngeal mucoperiosteum (PT), mucous gland (MG). The pharyngeal hypophysis presents as a cellular mass (PH) surrounded by a fibrous capsule (P) deeply placed in the median fossa. A vessel from the fossa penetrates the inferior surface of the postsphenoid (V). × 32.

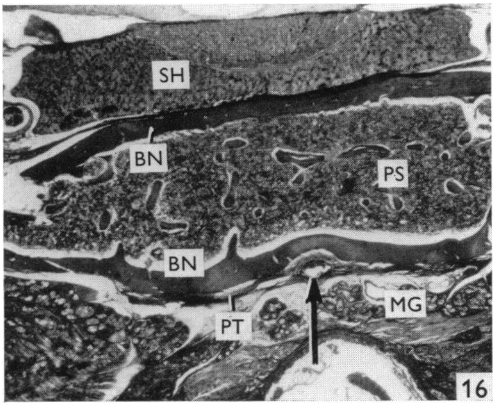


Fig. 16. Coronal section through the postsphenoid of a rat. Sellar adenohypophysis (SH). Compact bone (BN) forms the superior and inferior surfaces of the postsphenoid (PS). Periosteal layer of the pharyngeal mucoperiosteum (PT), mucous gland (MG). The pharyngeal hypophysis (arrow) presents as a flattened tube deeply placed in the median fossa in the inferior surface of the postsphenoid. × 18.

short-nosed type (Oboussier, 1944) and in the cat (Arai, 1907). In this investigation, what looked like the lower end of such a canal was present as a median fossa, associated with a pharyngeal hypophysis, in the inferior surface of the postsphenoid of the dog, rabbit and rat. In the dog and the rabbit the site of penetration of the superior surface of the postsphenoid by the sellar adenohypophysis may be taken as the upper end of the canal. In the guinea-pig both the sellar adenohypophysis and the pharyngeal hypophysis extend into the postsphenoid, and an oblique cranio-pharyngeal canal is probably present throughout life. In the cat, observations on the site, structure and dimensions of the cranio-pharyngeal canal were in agree-

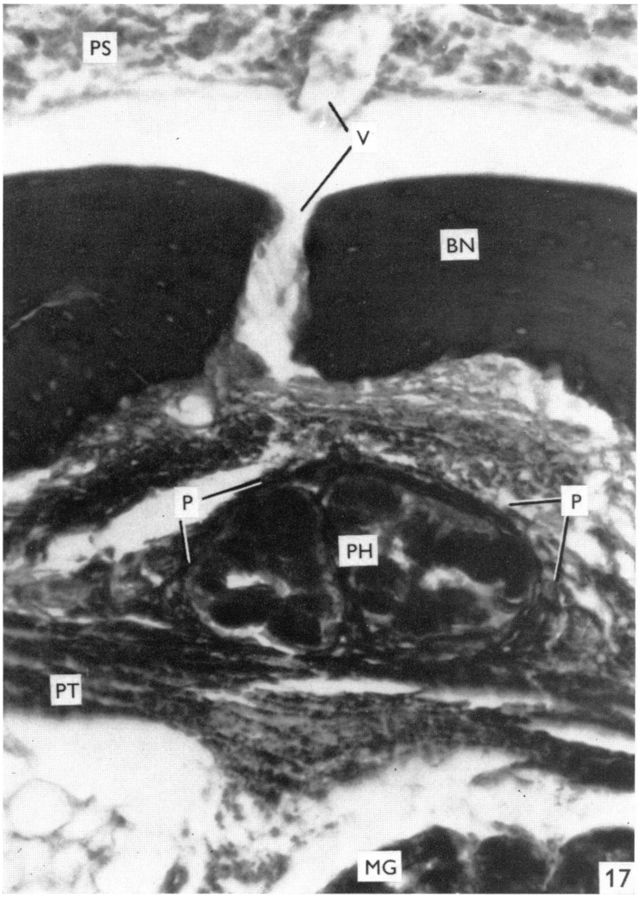


Fig. 17. Coronal section through the pharyngeal hypophysis in a rat. Same specimen as in Fig. 16. Compact bone (BN) bounds a median fossa in the inferior surface of the postsphenoid (PS). A vessel (V) from the fossa penetrates the inferior surface of the postsphenoid. Periosteal layer of the pharyngeal mucoperiosteum (PT), mucous gland (MG). The pharyngeal hypophysis (PH) presents as a cellular mass surrounded by a fibrous capsule (P). Compare the histological appearance with that of the pug dog (Fig. 5). ×125.

ment with what has been previously reported. A vascular canal passing through the posterior part of the postsphenoid in the rabbit was described by Arai (1907).

Little has been published on the non-human pharyngeal hypophysis. Data obtained in the present investigation concerning the incidence and site of the pharyngeal hypophysis in the dog are in general agreement with published reports (Kingsbury, 1942; Oboussier, 1944). The presence of adenohypophysial tissue in the pharyngeal hypophysis of the dog has been denied by Kingsbury. This worker studied the pharyngeal hypophysis in segments of pharyngeal mucoperiosteum, rather than in *en bloc* specimens, and it is possible that such segments did not include the more deeply placed cellular component. Oboussier found adenohypophysial tissue in some dogs, particularly those of the short-nosed type. Data obtained in the present investigation

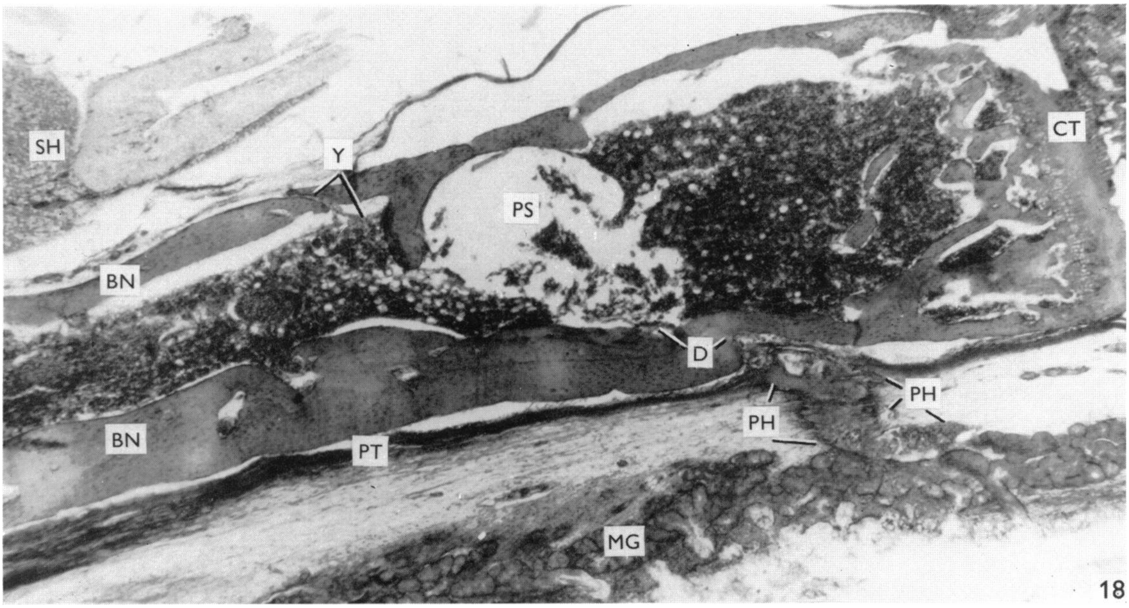


Fig. 18. Median sagittal section through the postsphenoid in a guinea pig. Cartilage (CT), sellar adenohypophysis (SH). Compact bone (BN) forms the superior and inferior surfaces of the postsphenoid (PS). Periosteal layer of pharyngeal mucoperiosteum (PT), mucous gland (MG). The pharyngeal hypophysis (PH) presents as a squamo-cystic-cellular structure extending into the median foramen in the inferior surface of the postsphenoid. Sellar adenohypophysial tissue (Y) and pharyngeal hypophysial tissue (D) extend into the postsphenoid. $\times 40$.

on the incidence and site of the pharyngeal hypophysis in the cat and rabbit confirm the findings of Arai (1907) and Atwell (1918). Arai described the pharyngeal hypophysis in the cat as having the histological appearance of adenohypophysial tissue. Both authors noted the absence of such tissue in the pharyngeal hypophysis of the rabbit. The presence of a pharyngeal hypophysis in the rat and guinea-pig has not been reported previously. From the data obtained in this investigation it appears unlikely that a pharyngeal hypophysis occurs in sheep, at least in adult females. In view of the inadequacy of the monkey material, further investigation of this species is indicated.

It is of some interest to note that the sellar adenohypophysis penetrates the superior surface of the sphenoid in the dog, cat, rabbit and guinea-pig. This should render total sellar hypophysectomy difficult, if not impossible, in these animals. No such penetration was found to occur in the rat, monkey or sheep.

The main purpose of the present investigation into the non-human pharyngeal hypophysis was to obtain data on which to base the selection of a suitable experimental model for use in the investigation of possible mechanisms of control of the human pharyngeal hypophysis. The human pharyngeal hypophysis is consistently present in the pharyngeal mucoperiosteum underlying the vomero-sphenoidal fossa, formed by the posterior articulation of the vomer with the inferior surface of the postsphenoid. It consists mainly of normal adenohypophysial tissue, but the presence

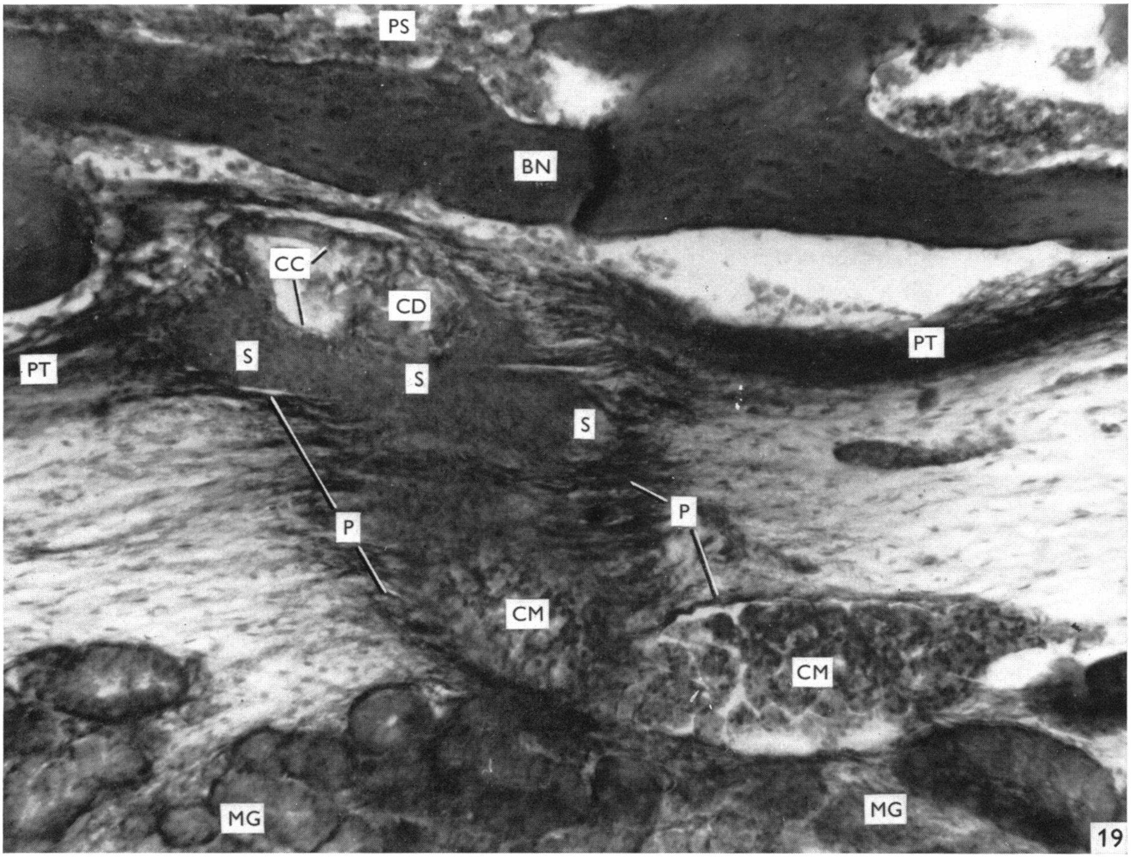


Fig. 19. Detail of pharyngeal hypophysis shown in Fig. 18. Compact bone (BN) bounds the median foramen in the inferior surface of the postsphenoid (PS). Periosteal layer of the mucoperiosteum (PT), mucous gland (MG). The pharyngeal hypophysis is surrounded by a fibrous capsule (P). Ciliated cuboidal cells (CC) line a cystic space filled with a mixture of cell debris and colloid (CD). Cellular mass (CM), squamous cells (S). ×80.

of squamous cell nests and colloid cysts is not uncommon (McGrath, 1967, 1971). The human pharyngeal hypophysis does not penetrate the inferior surface of the postsphenoid, but presents as an isolated extrasellar collection of adenohypophysial tissue. In older age groups the human pharyngeal hypophysis comes to lie in close proximity with vessels in the vomerosphenoidal fossa. Continuity between vessels in the sellar and pharyngeal hypophyses has been demonstrated by ink injection. It is presumed that hypothalamic control of the human pharyngeal hypophysis is established via a trans-sphenoidal extension of the hypothalamo-hypophysial portal system (McGrath, 1972, 1973). The basic requirement of a suitable experimental animal must be that its pharyngeal hypophysis is comparable to that of Man, both in the presence of adenohypophysial tissue, and its structural isolation from the sellar adenohypophysis.

From available data it appears that adenohypophysial tissue is present in the

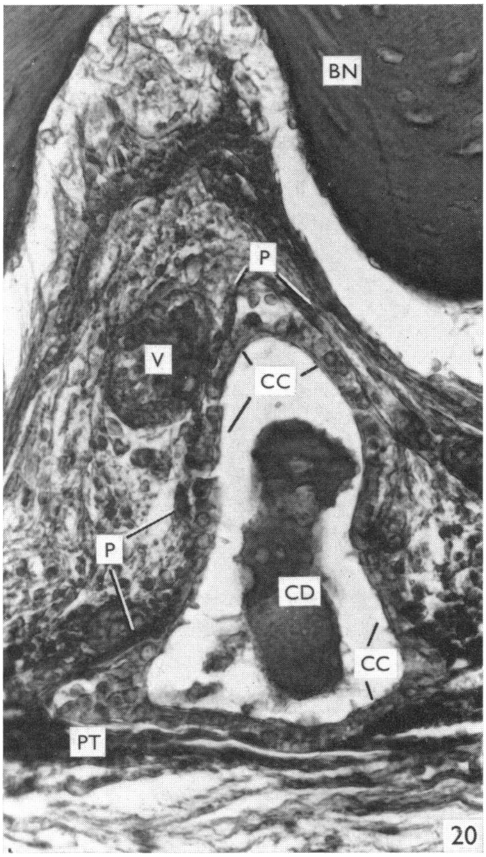


Fig. 20. Coronal section through the pharyngeal hypophysis in a guinea-pig. Compact bone (BN) bounds a median foramen in the inferior surface of the postsphenoid. Periosteal layer of the pharyngeal mucoperiosteum (PT), vein (V). The pharyngeal hypophysis is surrounded by a fibrous capsule (P). It presents as a cyst lined with cilated cuboidal cells (CC), and its contents are cell debris and colloid (CD). In this specimen a cranial extension of the pharyngeal hypophysis, with a similar histological appearance to the above, penetrates the postsphenoid to become continuous with the sellar adenohypophysis. × 125.

pharyngeal hypophysis of some dogs, and that such tissue is isolated from the sellar adenohypophysis. However, unless there proves to be a high incidence of adenohypophysial tissue in the pharyngeal hypophysis of the dog, its use cannot be regarded as a practical proposition.

A pharyngeal hypophysis consisting of adenohypophysial tissue is a constant feature in the cat. However, structural continuity between the pharyngeal and sellar hypophyses is also a constant feature. Such continuity must diminish the value of the cat as an experimental animal in the investigation of the isolated pharyngeal hypophysis, but blood flow studies of the hypothalamo-sellar-pharyngeal hypophysial portal system might afford data of considerable interest and could possibly have practical value.

Adenohypophysial tissue has not been detected in the adenohypophysis of the

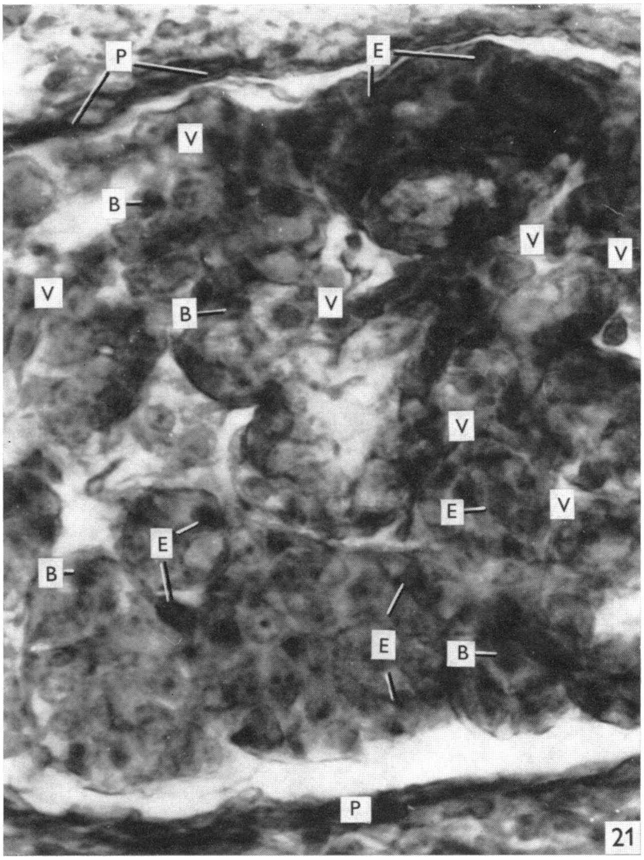


Fig. 21. Detail of the cellular component of the pharyngeal hypophysis shown in Fig. 19. The cellular mass is surrounded by a fibrous capsule (P) from which vascular trabeculae (V) pass inwards between clusters of cells. Most cells within the clusters are chromophobes. Scattered eosinophil cells (E) and basophil cells (B) are present. × 320.

rabbit, or rat, so neither of these animals can be considered suitable experimental material. However, interesting data might be forthcoming from an investigation into the pharyngeal hypophysis of the *hypophysectomized* rat, particularly as this species appears to lend itself to total sellar hypophysectomy.

In one guinea-pig in the present series the pharyngeal hypophysis presented a mixed histological picture, similar to that sometimes seen in the human pharyngeal hypophysis. The cellular component appeared to be adenohypophysial in type, but did not resemble any particular part of the normal sellar adenohypophysis. Although much less clear cut than in the cat, structural continuity between the sellar and pharyngeal hypophyses was present, and so, on the basis of available data, the guinea-pig does not appear to be a particularly suitable experimental model.

From the above one must conclude that, while interesting data have been forthcoming from this investigation of the non-human pharyngeal hypophysis, the discovery of a model animal for the investigation of the mechanism of control of the human type of pharyngeal hypophysis has not yet been made.

SUMMARY

A pharyngeal hypophysis, as a specific histological feature of the mucoperiosteum of the nasopharynx in the median plane, is readily identified in the dog, cat, rabbit, rat and guinea-pig. It has not been found in the monkey or sheep. In the dog the pharyngeal hypophysis is predominantly cystic. In two specimens in the series a cellular component was present, but positive identification of adenohypophysial tissue could not be made. In the cat the pharyngeal hypophysis consists of adenohypophysial tissue which is in obvious structural continuity with the sellar adenohypophysis through a craniopharyngeal canal. In the rabbit the pharyngeal hypophysis is squamo-cystic, and adenohypophysial tissue does not occur. In the rat the pharyngeal hypophysis is cellular, but adenohypophysial tissue has not been identified. In the guinea-pig the pharyngeal hypophysis may present a mixed histological picture: adenohypophysial tissue may occur, and structural continuity with the sellar adenohypophysis is present. It is concluded that an experimental animal suited to the investigation of the mechanism of control of the human type of pharyngeal hypophysis, has not yet been found.

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