Observations in over 1,000 intracranial operations for tumors of the pituitary or for its palliative ablation by various members of the Neurosurgical Department at The New York Hospital-Cornell Medical Center have produced evidence of several hitherto unrecognized variations both in the gland and in the surrounding anatomy. To define these anatomical variations, the pituitary gland and adjacent structures were removed en bloc with a motor saw from 225 fresh autopsy cases, measured in detail, drawn, photographed, and embedded in plastic. None of these cases had had a recognized pituitary disease or operation. Attention was directed to the optic chiasm, the arachnoid cisterns, the diaphragm of the sella, the cavernous and intercanvernous sinuses, the carotid siphon, the surrounding bones, and the size and shape of the pituitary itself.

Optic Chiasm

Schaeffer12 first described variations in the chiasm and called attention to its “prefixed” and “post-fixed” positions. The chiasm normally lies directly above the central portion of the diaphragm and the pituitary (Fig. 1). The so-called prefixed chiasm overlies the tuberculum sellae (Fig. 2) whereas the post-fixed chiasm overlies the dorsum sellae (Fig. 3). These designations are rather dependent upon the length of the tuberculum sellae, which averages 7 mm but may vary from 3 to 12 mm. In this study, the length of the tuberculum was related to the length of the prechiasmal space. In 9% of the specimens, the tuberculum equalled or exceeded the length of the prechiasmal space, and these chiasms were judged to be prefixed. In 11% of the specimens, the tuberculum was shorter than the length of the prechiasmal space by 6 mm or more, and these chiasms were judged to be post-fixed. The remainder, or 80%, were regarded as normal.

Diaphragma Sellae

The prechiasmal space varied considerably in width as well as in length. The distance between the optic nerves as they enter the optic foramina averaged 13 mm, varying from 8 to 20 mm; the width of the prechiasmal space varied accordingly (Fig. 4).

The width of the chiasm itself did not vary significantly and averaged 10 mm. In 4% of the specimens, the optic nerves were noticeably distorted by the intradural portion of the carotid artery.

Despite frequent anomalies of the diaphragm described by several workers,1,12,13 the structure is commonly assumed to provide a dense connective tissue covering for the sella turcica and to possess a small opening for the penetration of the pituitary stalk. Indeed, most trans-sphenoidal procedures are designed on the assumption that the diaphragm will serve as a barrier between the sella turcica and the intracranial space.

In 39% of the diaphragms in this study, the openings for the stalk were greater than 5 mm in diameter (Figs. 5 and 6); 10% of the diaphragms were considered too thin to serve as reliable barriers against easy penetration during trans-sphenoidal procedures (Fig. 7).

The anterior and posterior attachments were found to vary considerably. Although the diaphragm is presumed (from lateral x-ray studies) to extend from the superior aspect of the posterior clinoid processes to the superior margin of the tuberculum sellae, often the attachment was found several millimeters below these points. Corresponding to the variations in the point of attachment,
the diaphragm can be tilted either anteriorly or posteriorly (Fig. 8).

**Arachnoid Cisterns**

Wislocki reported that it is not embryologically feasible for the arachnoid to surround the pituitary; yet roentgenography has occasionally demonstrated an extension of the subarachnoid space into the sella turcica. The arachnoid may balloon into the sella above a diaphragm that has a low attachment, but more often it protrudes through the large opening frequently present in the diaphragm. The incidence of a subarachnoid space that lies within the sella turcica, as would be outlined in a lateral x-ray, exceeds 20%. This correlates well with the incidence of cerebrospinal fluid rhinorrhea following stereotaxic pituitary procedures.

**Cavernous Sinus**

Although Parkinson described the anatomical details of the cavernous sinus, he gave little attention to variations. Bedford described most of the pertinent variations and stressed that the sinus did not contain bridging bands. Although it is difficult to quantitate the size and shape of the cavernous sinus, our studies indicate that there is considerable variation. In some specimens the sinus is large, while in others it is almost obliterated by the traversing nerves, arteries, and contained pituitary. Contrary to Bedford’s description, nearly all specimens had several bridging connective tissue bands that often extended from the carotid to the pituitary capsule (Fig. 9).

The venous channels connecting the right and left cavernous sinuses have been called the intercavernous or circular sinuses (Fig. 10). Most anatomy texts describe these as small spaces within the substance of the diaphragma sellae, but in this study the intercavernous sinuses were frequently large and not wholly contained within the diaphragm. In 85% of the specimens, an anterior intercavernous sinus was present; the largest was 8 mm deep (Fig. 11). Less often, vascular connections were found beneath or behind the pituitary yet within the sella turcica (Fig. 12).

**Carotid Arteries**

Since the advent of arteriography, study of the parapituitary carotid siphons has become commonplace. Bull has outlined the variations in these structures and noted the variable distances between them in the parapituitary area.

In our studies, the distance between the carotid siphons averaged 14 mm but was as great as 23 mm (Fig. 13). The carotid arteries usually were not in contact with the pituitary, but as they became more tortuous the distance between them decreased, and the gland sometimes became compressed on either or both sides. Figure 14 shows such a tortuosity of the siphons, in which the distance between the carotids is 4 mm and the pituitary is correspondingly compressed. In 22% of the specimens, the gland was distorted laterally by the carotids (Fig. 15).

**Surrounding Bones**

Mahmoud did extensive studies of the bones that join to form the sella turcica, cataloging variations and correlating the growth of pituitary tumors with the consistency of the surrounding bone. Hamburger correlated the variations in the bony floor of the sella with the ease of trans-sphenoidal hypophysectomy and noted that 87% of the cases had thin bone that was readily removed.

In 72% of the specimens in this study, the anterior floor of the sella was 1 mm or less in thickness (Fig. 16). Thicker spongiosum bone was more commonly seen toward the posterior sellar floor, and the bones forming the clivus were nearly always spongiosum. Although the floor of the sella was uniformly thick (up to 20 mm) in children (Fig. 17), the sphenoid sinus enlarged with age and the floor of the sella became thinner.

In 6% of the specimens, a bony bridge extended from the posterior to the anterior clinoids (Fig. 19). These bridges were generally bilateral and of variable diameter, the largest being 3 mm. An additional strut often extended from the middle clinoid to the anterior clinoid, immediately behind the carotid siphon, and formed a sturdy foramen for the carotid within the cavernous sinus. It must be stressed that this additional bone formation was lateral to the pituitary, not above it.

**Pituitary Gland**

The weight of the normal pituitary as recorded by A. T. Rasmussen may vary from 350 to 800 mg in males and from 450 to 900 mg in females. During pregnancy these weights may double, and related visual field