The subject of trauma as an occasional etiological factor in the development of brain tumors has been the basis of considerable controversy and has not been totally accepted in this country. In the specific case of meningiomas, however, there have been isolated instances and statistical studies indicating that some relationship may exist. Cushing and Eisenhardt noted that the incidence of trauma in patients with meningiomas was particularly high and was recorded in nearly two-thirds of the entire number of cases in their series. They also commented that the relationship of the blow to the site of the ensuing growth is often so precise that trauma could be accepted as an etiologic factor. The well-documented case of General Leonard Wood is an excellent example. In the Cushing para-sagittal group, 20 out of 65 cases gave a history of local trauma.

Zülch cited two instances reported in the European literature in which trauma appears to have been a definite etiological factor in the development of a meningioma. Reinhardt's case was that of a 57-year-old man with a 4-year clinical history of brain tumor. At autopsy a large tumor was found adherent to the cribiform plate and extending from the frontal pole to the chiasm, in the midst of which lay a 1×0.3 cm. metal wire. There was a history that this metallic fragment had been driven in during a boiler explosion 20 years previously. Histologically the tumor was described as a “sarcomatous” meningioma. Müller's case was that of the development of a meningioma in the Sylvian fissure in an individual with a history of a superficial skull injury sustained from a grenade fragment 22 years before. Autopsy was said to have revealed a “well healed depressed fracture of the left temporal bone” not demonstrated radiologically during life. The question arises as to whether this fracture was actually a hyperostosis mistaken for a healed fracture. Crouzon was reported as believing that rarely trauma may play a role in the creating gliomas and meningiomas.

The older literature contains much discussion concerning the relationship of trauma to brain tumor in general, much of this having been reviewed in the article by Parker and Kernohan and by Fowler. More recently, however, Walshe reported 4 cases in which a local skull injury was followed by the growth of a meningioma adherent to the point of impact. He concluded that the evidence available does not allow us to reject the relationship between local skull injury and the subsequent development of a meningioma in a significant proportion of cases, particularly when the injury is related to a cranial suture and the tumor is found immediately subjacent to it. Howarth and Bunts reported an excellent example in which a meningioma developed in the

Fig. 1. Tumor involved bone removed at operation. A. (Left) Outer surface with arrow indicating the site of the healed vertical linear fracture line. B. (Right) Section through the thickness of the tumor.
left fronto-parietal region at the site of a depressed fracture sustained 21 years prior to operation.

In the case reported here, about 13 years intervened between the local trauma and the first noticeable bony swelling and while the area involved was not adjacent to a cranial suture there was comminution of the bone, evidence of which was still visible on the surface of the involved bone at the time of its removal. An added point of interest was the complete failure of a Hg\textsuperscript{203} brain scan to visualize the tumor.

**Case Report**

1st Admission. The patient, a 40-year-old Negro man was admitted to the South Unit of The Youngstown Hospital Association in December, 1948. He had suffered a penetrating gunshot wound, in which the bullet entered the right temporal region and passed across the midline, coming to rest just anterior to the coronal suture and several cm. to the left of the midline. There was a comminuted fracture of the right frontal bone with one fragment depressed about 3 mm. and another portion compounded into the right frontal sinus. There was paralysis of the superior oblique muscle and the levator palpebrae superioris on the right side. The right pupil was semi-dilated, reacted only slightly to light, and there were numerous, moderate sized hemorrhages throughout the retina. Lumbar puncture disclosed xanthochromic fluid under moderately increased pressure.

Local debridement of the wound was carried out at the time of admission and about a week later a small craniectomy was done immediately over the bullet. There was evidence that the missile had struck the inner table of the skull and had rebounded into the brain substance. The bullet was removed along with some macerated brain tissue. The patient recovered without complication. Two weeks following hospital discharge he was asymptomatic and neurological examination was normal.

2nd Admission. The patient was not seen again until January 5, 1965, when he complained of swelling in the right frontal area. He had a bony-hard swelling, measuring 5\times6\times1.5 cm., which involved much of the right forehead. The tumor mass extended to the midline of the frontal region with the most prominent portion situated about midway between the supraorbital ridge and the hairline. The mass did not pulsate, was not tender, and there was no bruit on auscultation. The swelling had first been noted about 4 years before and had shown slow but progressive, enlargement with only occasional local discomfort. There was no associated headache nor was there any visual disturbance. Other than the mass described above the only other finding was the defect at the site of the previous craniectomy; this was soft, depressed, and had a slight pulsation. The patient was admitted to the Youngstown Hospital Association for further study and treatment.

**Examination.** X-rays of the skull following admission disclosed in the right frontal area, superior to and extending lateral to the right frontal sinus, a lucent area of bone corresponding to the visible tumor. Tangential views and soft tissue films showed a raised area of bone with spiculation from the outer table, suggestive of a meningioma or possibly a vascular lesion. Spinal fluid studies were normal except for an elevated total protein content of 75 mg. per cent. A right carotid arteriogram was entirely normal. A brain scan, using 840 microcuries of Chloromerodrin Hg\textsuperscript{203} and scanning 4 hours later in the anteroposterior and right lateral projections gave a normal distribution of the isotope with no indication of any localized increased uptake.

**Operation.** The scalp was adherent to the tumor mass and when stripped away gave evidence of some involvement of the underside by tumor tissue. This was confirmed by microscopic examination. The outer surface of the bone was rough and coarsely granular with gross

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Fig. 2. Photomicrograph of tumor, H. & E. stain. A (Left) General pattern of tumor tissue; \( \times 60 \). B. (Right) Detail of cell structure; \( \times 420 \).