Experimental Brain Tumors

I. Tumors Produced with Methylcholanthrene*

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Efforts to produce intracranial neoplasmia by various chemical carcinogens have been attended with scant success prior to the work of Seligman and Shear (2). By intracerebral implantation of pellets of 20-methylcholanthrene, these workers produced 11 gliomas and 2 fibrosarcomas in a series of 20 male mice of the C3H strain. Seligman and Shear reported also successful subcutaneous transplantation of several of these tumors, one of which was stated to be a glioma.

Utilizing the same technic, the present writers reported a preliminary experiment (3) in which they found 66 intracranial tumors in 51 C3H mice. These tumors, occurring during the first 10 months of the experiment, consisted of oligodendroglioma, glioblastoma multiforme, medulloblastoma, unclassified glioma, and meningeal sarcoma.

More recently Peers (1) implanted cholesterol pellets containing 10 per cent methylcholanthrene in the brains of 99 mice, of which 87 survived into the tumor-bearing period. In all, 32 intracranial tumors were produced—17 sarcomas and 15 gliomas.

These observations were significant in that they suggested the future possibility of studying the incidence, histiogenesis, and growth behavior of experimentally induced primary brain tumors. From such a study it was felt that certain deductions could be drawn regarding the human counterparts of these neoplasms. The present investigation was thus undertaken for a threefold purpose; namely, the determination of the incidence, the histiogenetic origin, and the growth behavior of experimental brain tumors.

Materials and Method

Care of animals.—All the animals employed in these experiments were male mice of the C3H strain between 3 and 4 months of age. They were housed in groups of 4 in pyrex glass jars having wire mesh covers. The jars were sterilized weekly. Each group of animals was inspected at least twice daily for evidences of tumor development.

The diet consisted of Purina Fox Chow and oats. This and tap water were available to the animals at all times ad libitum.

Carcinogen.—The carcinogen employed for intracranial implantation was 20-methylcholanthrene (Hoffman-LaRoche, Inc., Nutley, N. J.) which was purified by chromatographic adsorption on Al2O3. The specimen used had a corrected melting point of 179.8-180.4°C. Cylindrical pellets of this hydrocarbon were prepared with a diameter of about 1 mm. and a length of about 1.5 mm., the average weight of each pellet being 1.5 mgm.

Operation.—Anesthesia was accomplished by the subcutaneous injection of 0.25 cc. of a solution containing 100 mgm. nembutal in 15 cc. of 0.9 per cent sodium chloride solution. The top of the head was shaved and washed with 7 per cent alcohol. For intracerebral and subdural implantations a right paramedian incision 5 mm. in length was made in the skin; the periosteum was scraped off the right parietal bone; a hole about 2 mm. in diameter and anterior to the occipital suture was made in this bone with a dental burr. For intracerebellar implantations the scalp incision was made in the midline over the occipital bone and the burr hole in the area between the occipital suture and the attachments of the occipitalis muscles. Muscle bleeding, which sometimes occurred in this location as the result of trauma, was readily controlled with hot wet sponges. With fine forceps the pellets were pushed through the craniotomy opening and dura for about 3 mm. into the right parietal lobe subcortex or into the cerebellum. Those intended for subdural implantation

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were left in the longitudinal fissure in contact with the meninges between the two cerebral hemispheres. The skin margins were then approximated and a drop of collodion was applied over the wound. This never required any further attention, healing occurring promptly and without infection. Until full recovery from the anesthetic, which usually occurred in from 2 to 3 hours, the animals were kept warm on a padded hot plate which was set at about 40\degree C. When recovery was complete, the mice were returned to their cages in the specially ventilated and heated animal room.

Subcutaneous transplantation of tumors.—To study certain phases of the growth behavior of the cerebral neoplasms more effectively, subcutaneous transplantation of a number of these tumors was made into male and female mice of the C3H strain. The animals used were 2 to 3 months of age and the sexes were represented in about equal numbers. Mating was prevented by strict segregation. As a rule, 8 mice received transplants from each tumor, although in some instances 4 mice were used. Subtransplants were made from the subcutaneous growths when the latter attained sizes of 1 cm. or more in diameter, subtransplantation being carried out through 9 to 14 passages. These mice received the same general care and food as those in which the pellets of methylcholanthrene were implanted.

The material used for subcutaneous transplantation consisted of a piece of tissue removed from the main tumor mass, with careful avoidance of obviously necrotic and hemorrhagic areas. This was cut in sterile saline into fragments about 1 mm. in diameter. The fragment of tumor tissue was deposited in the subcutis of the right axillary region or in the right flank by means of a trocar introduced into the right groin through skin washed with alcohol.

Necropsy technic.—Mice which were moribund were invariably killed by sectioning the cervical spinal cord and a complete necropsy was performed immediately thereafter. The brain was removed with sterile precautions and, when a tumor was encountered, a piece was usually excised for subcutaneous transplantation. The brain was then fixed in neutral formalin (U.S.P. formaldehyde 1:10). Animals which were found dead were necropsied immediately on discovery and the brains fixed in the same manner. It proved expedient in a few instances, because of onseting post-mortem softening, to harden the contents of the partially opened crania in the fixative for 4 hours before removing the brains. Since tumors were not found in any of the other viscera of these animals the organs were not saved.

With a few exceptions the brains were embedded in paraffin and sectioned serially. Hematoxylin-eosin was the stain employed routinely, but at regularly spaced intervals sections were prepared with the Masson tri-chrome stain and with the Wilder silver carbonate method for reticulin. Where it seemed indicated, preparations were stained with Heidenhain’s iron-hematoxylin and with phosphotungstic acid-hematoxylin. Frozen sections impregnated with silver and gold salts offered such little additional aid in histologic study that their preparation was abandoned early.

Results

For purposes of convenience in presentation, the data of this study will be presented in two parts; I, the results of the intracranial implantation of the methylcholanthrene pellets and, II, the subcutaneous transplantation of the intracranial neoplasms thus induced.

1. INTRACRANIAL IMPLANTATION OF METHYLCHOLANTHRENE

The pellets of methylcholanthrene were implanted in three different locations in groups of mice as follows: the right parietal subcortex, 57 mice; the cerebellum, 30 mice; and the subdural space, 16 mice. The incidence of the various types of neoplasms as they occurred at the different sites of pellet implantation in the three groups of the 103 mice of this experiment is shown in Table I.

Extreme conservatism was employed in the classification of the neoplasms, which accounts for the fact that such noncommittal designations as unclassified tumor and unclassified glioma appear in Table I. The three tumors under the first designation, although genuine neoplasms as indicated by their invasiveness and the presence of cells in mitosis, were nevertheless too small to permit more detailed study and classification. The ten tumors designated as unclassified glioma were
Glioblastoma multiforme.—Mouse No. 14. This animal died 207 days after the intracerebral implantation of the hydrocarbon. At necropsy the methylcholanthrene pellet (MCA) was found buried deep in the right parietal lobe, which was replaced in large part by a hemorrhagic neoplasm measuring 1 cm. in diameter (Figs. 1-A and 1-B). This tumor eroded the overlying calvarium and lay as a flattened, partially necrotic, and partially calcified mass beneath the scalp. It was composed of pleomorphic cells, many of which had bipolar processes. These cells were frequently arranged in pseudopalisades around foci of necrosis (Fig. 1-C). Many were mitotic division and many were multinucleated, some nuclei containing spheroid, pink-staining structures resembling inclusion bodies (Fig. 1-D). The choroid plexus of the right lateral ventricle was infiltrated with tumor cells and the leptomeninges likewise contained clusters of these cells. There was no stroma of reticulin in this neoplasm as demonstrated by the Wilder silver impregnation method (Fig. 1-E).

Mouse No. 40. This animal survived 314 days the pellet implantation in the cerebellum. At necropsy the calvarium was found intact, but much of the cerebellum was replaced by a gray, semigelatinous, infiltrating glioma (Figs. 2-A and 2-B). Many of the cellular elements of this tumor were identified as unipolar and bipolar spongioblasts, but other glial elements such as astrocytes were also present. There were moderate numbers of cells in mitotic division and of multinucleated giant cells. Numerous zones of necrosis were seen around which spongiosans were arranged in pseudopalisades (Fig. 2-C). Small foci of hemorrhage and of calcium salt deposition were found scattered in the tumor. The neoplastic cells had infiltrated the leptomeninges and extended along the Virchow-Robin spaces into the nervous parenchyma (Fig. 2-D). There was no evidence of a vascular proliferative reaction. What little stroma was visible in the neoplasm was not formed by reticulin, as the Wilder preparations revealed (Fig. 2-E).

Medulloblastoma.—Mouse No. 52. This mouse died 295 days after the intracerebellar implantation of methylcholanthrene and after a course which was characterized by disturbances of balance and paralysis of the left hind leg. At necropsy, the brain was found adherent to the skull. The cerebral hemispheres were involved, but the left half of the cerebellum was bulging and brown in color. On section it was seen that this was due to a hemorrhagic and semigelatinous tumor mass surrounding the pellet (MCA) (Figs. 3-A and 3-B).

The microscopic picture revealed an infiltrating glioma composed of a remarkably uniform type of cell. This had a prominent oval or round nucleus of medium size with numerous chromatoid granules. The cell body had scant cytoplasm and a more or less uniform staining. The latter resembled this variety were frequently arranged in pseudosorites (Fig. 3-D). Mitotic division was present in abundance. The tumor had almost no stroma; the Wilder preparations were negative (Fig. 3-C). Calcium salt deposits were found in several regions (Fig. 3-E). There was widespread invasion of the cerebral leptomeninges and of the Virchow-Robin spaces in many parts of the brain. Tumor cells were found in the fourth ventricle, the aqueduct of Sylvius, and the third ventricle (Fig. 3-F).

Mouse No. 49. This mouse was killed 296 days after methylcholanthrene was implanted in the cerebellum, when the animal developed paralysis of both hind legs and a disturbance in balance which was characterized by a tendency to fall to the left in walking. The cranial sutures were found separated at necropsy, which accounted for a slight increase in the size of the head of this animal. The hydrocarbon was found embedded in a somewhat gelatinous tumor mass replacing the left half of the cerebellum (Fig. 4-A). Part of this tumor was removed for transplantation in other mice, the results of which will be reported below.

The tumor was found microscopically to be poorly demarcated from the surrounding cerebellar parenchyma and was composed of a remarkably uniform type of cell. The latter resembled all important features the cell described in mouse No. 52 (Figs. 4-B and 4-C). For the most part the neoplastic elements failed to form any definite architectural pattern, lying helterskelter, but a faint suggestion of pseudosorite formation was seen in some regions. The nearby meninges and choroidal plexus were infiltrated with tumor cells (Fig. 4-D). The stroma was scant and indifferent stained; Wilder preparations were negative (Fig. 4-E).

Oligodendroglioma.—Mouse No. 16. The animal died 366 days after pellet implantation in the right cerebral hemisphere where, at necropsy, a gray, opaque, and partly hemorrhagic tumor mass was found (Figs. 5-A and 5-B). The midline of the brain had shifted to the left. An infiltrating glioma was found, microscopically composed of cells having an exceptionally uniform appearance. They were of small size with scant, pink-staining cytoplasm and small, dark, round nuclei (Fig. 5-C). Frequently the nuclei seemed to lie naked in clear, unstained halos, but occasionally they were surrounded by narrow rings of cytoplasm which lay within the halos. Some of the cells were in mitotic division. The tumor was hemorraghic in spots but was devoid of reticulin.

Pleomorphic xanthoastrocytoma—Mouse No. 55. Four days before this animal was found dead on the 314th day of the experiment, its head was noted to be peculiarly deformed. Necropsy disclosed this to be due to a bulge of the cranium in the right parietal region due to a large tumor mass which replaced most of the right cerebral hemisphere (Fig. 6-A). The pellet of methylcholanthrene presumably had been placed in the subdural space in contact with the meninges, but it could not be located there at necropsy, nor could it be found in the cerebral tumor mass. The histologic picture of the intracerebral neoplasm (Fig. 6-B) revealed invasiveness and a number of deep-seated hemorrhages.
Large zones were composed of parallel rows, bands, or whorls of spindle-shaped cells with elongated nuclei and bipolar processes. These cells resembled spongioblasts. Intermingled with them were medium-sized cells with uniform dark nuclei (Fig. 6-C). A few calcium salt deposits were encountered in this portion of the tumor. In other parts there were present closely packed bizarre-shaped giant cells, some multinucleated (Fig. 6-D). The cytoplasm of these cells was abundant and formed prominent processes. There were many glia cells in mitotic division. The tumor had very little stroma, none of it of mesodermal origin as the negative Wilder stain proved (Fig. 6-E).

Multiple gliomas.—Mouse No. 11. The animal was found dead on the 192nd day of the experiment. On reflecting the scalp, a tumor mass of about 4 mm. diameter was found protruding through the skull at the site of the trephine wound. It was found originating in the right cerebral hemisphere, destroying the basal ganglia and shifting the midline to the left (Figs. 7-A and 7-B). There was some hemorrhage in this tumor and some necrosis.

Microscopically the neoplasm was composed of several different zones. In one, the cells were nearly all spongioblasts, the processes of which pointed to centers of necrosis. These cells were arranged in pseudopalisades (Figs. 7-C and 7-D). The endothelial cells of many blood vessels were proliferated. Giant cells and mitotic figures were present in small numbers. The cell constituents and architecture were typical of glioblastoma multiforme. In other large areas the tumor cells contained, round, remarkably uniform nuclei surrounded by clear halos (Fig. 7-E). Here mitotic figures were rare. These portions of tumor represented oligodendroglioma.

Meningeal sarcoma.—Mouse No. 83. A tumor appeared beneath the scalp on the 312th day of the experiment. During the next 3 days it increased so rapidly in size that it was deemed essential to kill the mouse in order to save material for subcutaneous transplantation. The vertex of the skull was eroded on November 7, 2017. © 1941 American Association for Cancer Research.

II. SUBCUTANEOUS TRANSPLANTATION OF EXPERIMENTALLY PRODUCED BRAIN TUMORS

The following section includes descriptions of representative cases of successful transplantation of various induced brain tumors.

Medulloblastoma.—Mouse No. 49. The tumor of this animal was described above as an example of an invasive malignant cerebellar neoplasm which was classified as a medulloblastoma. Reference to the description of this tumor and to Fig. 4 in which it is illustrated will, perhaps, raise some doubt as to the justification for this classification. The results of subcutaneous transplantation, however, leave no doubt on this point and demonstrate the value of this method of study, especially in difficult cases.

In Fig. 11-A is shown the tumor which developed in 45 days after implantation in the subcutaneous tissues of the right flank. Subtransplantation was carried out in 10 generations, involving a total of 44 animals. In general, the microscopic appearance of the transplants resembled rather closely the primary neoplasm, but the characteristic architecture was more pronounced. Thus, pseudorosette formations were more numerous and better formed (Fig. 11-B). It is of interest to note that in spite of the fact that the gliogenous tumor grew in the subcutaneous tissues, it grew as a "pure" medulloblastoma uncontaminated by mesodermal elements (Fig. 11-C).

Unclassifed glioma.—Mouse No. 74. Reference has already been made above to the problem presented by this tumor. The primary neoplasm appeared in the right parietal lobe 240 days after the implantation of the carcinogen. The microscopic structure of the tumor (Fig. 12-A) was densely cellular with poor demarcation from the surrounding brain tissue. There was great cellular pleomorphism with many cells identifiable as astrocytes, spongioblasts, and even medulloblasts. Cells in mitotic division were seen frequently; however, no characteristic architecture was present to aid classification. Tumor cells were found diffusely infiltrating the leptomeninges (Fig. 12-B).

The first subcutaneous transplant revealed tumor cells of two varieties. One was a rather small cell with scant cytoplasm and round, chromatin-rich nucleus. Groups of such cells had a tendency to form pseudorosettes (Fig. 12-C). The other was a larger cell with oval nucleus and a conspicuous cytoplasmic body from which originated many processes. In hematoxylin-cosin preparations the latter cell type resembled epithelioid cells which were frequently arranged in wide bands around blood vessels in the manner of astroblasts. This is illustrated in Fig. 12-D, which is derived from the 11th subcutaneous sub-
transplant. Multinucleated giant cells, like those seen so frequently in glioblastoma multiforme, were present in small numbers in all of the 12 generations of transplants from this tumor (Fig. 12-E).

A total of 96 mice received subcutaneous transplants from this neoplasm, only 5 mice in all revealing a completely similar tumor architecture. The fluctuation in the histologic appearance from one generation of transplants to another made a rigid diagnosis of the tumor unwarranted, but certainly the resemblance to glioblastoma multiforme was the most frequently observed.

Astrocytoma.—Mouse No. 60. After 270 days this animal succumbed to the neoplasm which arose in the right parietal lobe at the site of methylcholanthrene implantation (Fig. 13-A). The eyes were constantly closed during the last days of life and the head was misshaped from the tumor growth and as a result of the separation of the cranial sutures.

At necropsy the tumor was found involving both hemispheres, and the pellet was located in the subcortex at the junction of frontal and parietal lobes. This tumor had a gelatinous consistency and was poorly demarcated from the surrounding brain tissue. It consisted of cells whose cytoplasm was scant and gave rise to multipolar processes. The nuclei were intensely stained and often had one or more nucleoli. Frequently they were arranged around spaces containing homogenously pink-staining (in hematoxylin and eosin preparations), colloid-like material (Fig. 13-B). Cells in division were rather numerous and occasional large bizarre elements were also seen. There was no invasion of the meninges except for one small focus. The vast majority of the cells were thus readily identifiable as astrocytes, although the cellular division was a discordant feature. Mesodermal constituents were absent (Fig. 13-C).

A series of 10 subtransplants involving 48 mice was made of this neoplasm. In general, the microscopic features of the transplants were similar to those in the original tumor. There were seen the same cystic spaces filled with coagulated material and the same multipolar astrocytes. In addition, however, the cells began to assume a pseudorosette formation in the second subtransplant (Figs. 13-D and 13-E) which became progressively more distinct in subsequent subtransplants and reached its full development in the 7th generation (Fig. 13-F). Here the pseudoglandular structure was quite conspicuous and was arranged around blood vessels or tissue spaces in the form of minimum amount of stroma (Fig. 14-F). Many of these cells were dividing and there was a definite tendency for them to be arranged around blood vessels or tissue spaces in the form of pseudorosettes. Reticulin could not be demonstrated in either of these tumors (Fig. 14-G).

Thus it was shown conclusively that the primary neoplasm was composed in part of mesodermal and in part of gliogenous elements. Unfortunately, subtransplants were made only of the mesodermal tumor, which went through 9 generations in a total of 37 mice. In each animal the tumor remained a “pure” sarcoma without a gliogenous component. From the previous experiences with subcutaneous transplants of gliomas there is no reason to suspect that the gliomatous portion of the primary neoplasm could not have been perpetuated had subtransplants been made.

Discussion

The incidence of brain tumors induced by the intracranial implantation of methylcholanthrene in C3H male mice was 46.6 per cent (48 out of 103 mice). The pellets of carcigen were found within the cranial cavities in association with the neoplasms in the animals which developed tumors and were embedded in normal tissue in the mice which failed to develop them. Yet the pellets removed from both the positive and negative tumor groups were equally effective in inducing brain tumors later when implanted in other C3H mice. This experience suggests that other factors in addition to the carcigen are important in the induction of tumors. Also the fact that only 46 per cent of the mice developed brain tumors points to factors, in addition to the carcigen, which influence tumor production. The present experiment, however, was not devised to throw light on this question.

It was originally felt that the site of origin of the brain tumor might influence its type and it was for this
reason that the pellets of carcinogen were implanted in 3 different locations; namely, in contact with the meninges, the cerebrum, and the cerebellum. Of the 9 tumors which developed in the first named location, 7 were sarcomas, as was to be expected, and 2 were gliomas. In each of the latter 2 instances, however, the pellet actually came in contact with the nervous parenchyma. The converse of this also occurred; namely, the development of sarcomas following the implantation of pellets in the cerebrum. Thus, even 2 rhabdomyosarcomas were produced, but this undoubtedly could be ascribed to the fact that the carcinogen had worked its way out through the burr hole and came to lie in contact with the temporalis muscle.

Of the gliomas that were produced in the cerebrum, only 2 examples need special mention. One was the medulloblastoma, an unusual site for this tumor, and the other was the instance of multiple gliomas. In the cerebellum, the glioblastomas that were found there could not have been anticipated, but the 3 medulloblastomas were entirely in keeping with clinical experience. With certain definite reservations, therefore, it could be stated that the site of origin of the neoplasm had an influence in determining its type. This, however, is not to be interpreted as implying that any considerable light has been shed on the histogenesis of the gliomas. That still remains a moot question. It was at first hoped that a study of the beginnings of a glioma in a young tumor would explain its histogenesis. In reality, however, the malignant cells in early stages were unidentifiable with respect to the subsequent type of tumor and remained so until they proliferated sufficiently to produce a recognizable architectural pattern. The subcutaneous transplants aided almost as much in the study of the histogenesis as of the growth behavior of these tumors, but it is still not possible to state what the factors are which determine whether a given glial cell will form an astrocytoma, an oligodendroglioma, or any other type of glioma.

A striking difference was noted in the rate of development between the primary sarcomas and gliomas. Of the 13 sarcomas, the first appeared on the 125th day and the last on the 372nd day. The average, however, was 195 days and, more striking still, was the mean of 165 days. Of the 25 gliomas, the first was noted on the 125th day and the last on the 378th day. The average day of appearance was the 279th and the mean, the 330th day. Accurate determinations of the first appearance and the rates of growth of the tumor transplants were not made, but the generalization is justified that the gliomas grew much more slowly than the sarcomas. Signs of growth of the latter tumors were often noted within 3 weeks, whereas the gliomas frequently took at least twice this time.

It is of some interest to note with what great facility the glioma transplants grew in their new mesodermal environment. This is perhaps all the more surprising since it is a well known fact that the human tumors of this variety are never found as extracranial metastases. Apparently there is no local tissue resistance against the ectodermal gliomas, but rather an absence of an available pathway for metastasis. Even the most malignant of the gliomas fail to invade blood vessels.

Among the more interesting results of these experiments were those obtained with the transplantation of the tumors designated as mixed sarcoma and glioma. In transplants it proved possible to grow the constituent parts of these neoplasms in pure form; i.e., as glioma or sarcoma. The subtransplants of these "purified" tumors remained true in many subsequent generations. Such results are comparable to the every day experience of the bacteriologist who subcultures colonies from a mixed bacterial growth to obtain several pure strains of organisms.

**SUMMARY AND CONCLUSIONS**

Pellets of purified 20-methylcholanthrene were implanted in the cerebral meninges, the right cerebral hemisphere, and the cerebellum of 103 C3H mice of the male sex.

In all, 48 tumors were produced in this manner: 25 gliomas, 13 sarcomas, 7 mixed gliomas and sarcomas, and 3 unclassified. Among the gliomas were present examples of astrocytoma, glioblastoma multiforme, medulloblastoma, oligodendroglioma, and spongioblastoma polare. Within certain limits the site of pellet implantation was a determinant of the type of intracranial neoplasm which developed.

The rate of growth of the sarcomas was much greater than of the gliomas. The average time when the sarcomas appeared was 195 days as against 279 for the gliomas.

The method of subcutaneous transplantation was employed for the study of the growth behavior of these intracranial neoplasms. From 9 to 14 subtransplants were made of many of these tumors with results that indicated a much more rapid growth of the sarcomas than the gliomas. Frequently, unclassifiable primary gliomas developed characteristic structural patterns in the transplants which made identification possible. This method of study also permitted the separation of so-called "mixed" tumors into their component parts.

**REFERENCES**


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Fig. 1.—Mouse No. 14. Glioblastoma multiforme. A. Pellet of methylcholanthrene (MCA) deep in right parietal lobe and surrounded by tumor, Note extracranial position of neoplasm in upper figure. B. Transverse section of brain showing intracerebral and extracranial portions of tumor. H & E stain.* 


Hematoxylin and eosin stain abbreviated in legends as H & E.
Fig. 5.—Mouse No. 16. Oligodendroglioma. A. Drawing of hemorrhagic tumor in situ. B. Note pellet space at top of infiltrating tumor which has shifted the midline to the left. H & E stain; mag. X 6. C. Note characteristic perinuclear halos in tumor cells. H & E stain; mag. X 400.
Fig. 6.—Mouse No. 55. Spongioblastoma polare. A. Note tumor mass replacing most of right cerebral hemisphere. B. The invasive neoplasm is seen in right hemisphere with hemorrhages on its margins. H & E stain; mag. × 5. C. Arrangement of spongioblasts in interlacing strands. H & E stain; mag. × 200. D. Multinucleated giant cells. H & E stain; mag. × 400. E. Note absence of reticulin fibers. Wilder stain; mag. × 200.
Fig. 10.—Mouse No. 44. Mixed sarcoma and glioma. A. Appearance of cerebellar neoplasm. Drawing. B. Bulk of tumor—oligodendrogloma. Note cap of sarcoma in right upper corner. H & E stain; mag. × 7. C. Sarcomatous portion in upper half and gliomatous in lower half of photomicrograph. H & E stain; mag. × 30. D. Cells of oligodendrogloma in larger portion of tumor. H & E stain; mag. × 150. E. Wilder preparation of same part of tumor to show absence of reticulin. Mag. × 150. F. Cellular detail of sarcomatous portion of tumor. H & E stain; mag. × 150. G. Wilder preparation of latter part of tumor to show abundant argyrophile fibers. Mag. × 150.
Fig. 11.—Mouse No. 49. Medulloblastoma. A. Tumor transplant in subcutaneous tissues. B. Pseudorosette in transplant. H & E stain; mag. X 400. C. Negative Wilder stain of same transplant. Mag. X 350.
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