The present report deals with the occurrence of a spontaneous primary carcinoma without metastases which developed in the prostate of an old rhesus monkey. The writers know of no records of primary prostatic malignant neoplasms in primates.

Among wild birds and mammals dying in the Philadelphia Zoological Gardens from 1901 to 1932, Ratcliffe (1933) found 8 primates each having one or more tumors. The incidence of neoplastic growth in this class, however, was less than for any other order of mammals. Ratcliffe points out that while the greatest number of individual animals in the Zoo belonged to the primates, the average length of time during which these survived and were on exhibition was low, as compared with other mammalian orders. The average exhibition period in the Zoo for all the primates was 17.5 months, but for the tumor bearers was 111.8 months. It may be assumed that monkeys either in zoos or in laboratories do not commonly live to be of an age when tumors may be expected.

Among tumors of the reproductive tract, Ratcliffe lists a fibroadenoma of the uterus in a baboon, a papilloma of the cervix in a macaque, and an adenoma of the prostate in a lemur. Bagg (1931) quotes Fox (1923) as recording an adenocarcinoma of the rectum in a macaque, with extensions to the prostate.

**Case Report**

An old rhesus monkey (*Macaca mulatta*) was purchased on Jan. 5, 1940, from a dealer who had obtained it from a private zoo. It is not known how long it had been in captivity. Although in a fair state of nutrition, the animal was recognized to be an aged one, and at the time was judged to be in poor health.

It is not possible to estimate the age of older monkeys in years, and the age to which an animal might survive in its natural state is unknown. The skull of this specimen was examined by Dr. Sherwood Washburn of the Department of Anatomy, who permits us to quote his opinion:

"The skull of this animal is that of an extremely old male, as shown by the complete obliteration of the naso-maxillary and coronal sutures and partial closure of the occipito-mastoid suture. Only 5 of 121 skulls of adult male *Macaca irus* examined by Bolk (1913) could be considered as old as this individual.

"The molar teeth are worn much less than would be expected in such an old animal. This raises the question whether the animal had been in cap-

---

1 Aided by a grant from the Rockefeller Foundation, administered by Dr. Philip E. Smith.
SPONTANEOUS PRIMARY CARCINOMA OF PROSTATE IN MONKEY 335

FIG. 1. TRANSVERSE SECTION OF THE PROSTATE THROUGH THE 4 MM. NODULE

The urethra is below, the main nodule above and to the right, and there are three satellite nodules at the left.

tivity and fed on soft food. Similar conditions have been reported in the teeth of animals which had lived over twenty years in captivity (Schultz, 1933)."

The animal was kept under observation for one month, but failed to eat well, although well cared for and provided with a good and varied diet. Its weight was 7.8 kg.

As an incidental observation, it was planned to try the effects of estrogen stimulation for a short time. Accordingly, on Feb. 5, 1940, the left testis was removed, and a pellet of estradiol benzoate crystals weighing 148 mg. was placed in the prevesical space, between the os pubis and the bladder.

Since there was a continued decline in the general condition the decision was made to sacrifice the animal. Fourteen days after pellet implantation 1 mg./kg. colchicine was given. Monkeys normally tolerate this dosage well, but in this instance death occurred in eight and a half hours. Autopsy was performed immediately.

Nothing remarkable was noted in the viscera. There was no sign of tuberculosis, so frequently found in laboratory monkeys. The liver appeared cirrhotic. No bone or bone marrow was saved. Transverse sections of the prostate were made as usual. In the posterior third of the gland a small tumor was observed, above and lateral to the prostatic urethra.

The pellet of estradiol crystals was placed in a CaCl₂ desiccator and kept there until dehydrated to a constant weight. No reduction in the amount of this substance could be determined. The weight was still 148 mg.

Microscopic Examination: The left testis was found to be entirely normal with active spermatogenesis and abundant spermatozoa. The interstitial cells were not abundant, the intertubular cells appearing similar to fibroblasts. The left epididymis was normal, the lumina containing many spermatozoa. The right testis showed, in addition to normal tubules, many which were filled with
FIGS. 2 AND 3. DETAILS OF TUMOR STRUCTURE

The upper illustration shows the arrangement of the tumor cords with the peripheral zone of cylindrical cells. At A is a dilated acinus containing stringy mucoid material and lined chiefly by goblet cells. At B is a bud-like projection of tumor cells springing from the same acinus.

The lower view shows an area of squamous metaplasia with central keratinization and calcification.
cellular detritus, indicating tubular damage and cessation of normal spermatogenesis. The interstitial cells were comparable to those in the left testis. The right epididymis was similar to the left, with no cellular detritus, indicating that the tubular damage in the testis was recent and the cellular debris had not migrated to the epididymis. The seminal vesicles were normal, with low epithelium and some secretion in the lumina. No significant changes were seen in the kidney, liver (except for a small peripheral abscess), aorta, or small bowel.

The prostate was divided into four zones and most of it serially sectioned by transverse and sagittal sections. Most of the sections were stained with hematoxylin and eosin and a few with Masson's trichrome stain. The small nodule from the posterior portion of the gland was found to be a tumor composed of solid anastomosing cords of hyperchromatic cells. The cells forming the central portions of these cords were irregularly shaped, but the marginal cells were usually cylindrical with the nucleus often oriented toward the center of the cell cord. In rare instances acini had been formed and some of these contained a mucoid material which was stringy and stained faintly blue with hematoxylin and a much deeper blue with the aniline blue of Masson's trichrome stain. Some of these acini were completely lined by tumor cells, others were formed partly by tumor and partly by non-tumor cells which either resembled the normal acinar cells or else were cylindrical and secreting mucoid material. In rare instances the tumor cells showed squamous metaplasia with the formation of pearls in which there were keratinization and calcification. There was exceedingly little mitotic activity. The tumor cell cords were separated by a dense vascular collagenous stroma.

The main tumor nodule had a maximum diameter of about 4 mm. It was relatively circumscribed but lay entirely within the substance of the prostate gland, without encapsulation. A striking feature was the occurrence of tiny accessory nodules of tumor tissue within the prostate, unconnected with the main mass. These were not found anterior to it but occurred in a transverse plane above the prostatic urethra; passing posteriorly there was a free interval without any tumor, with a reappearance of the nodules in the most posterior portion of the gland. Here their number was greatly increased and they were found scattered throughout one-half of the gland parenchyma. They always remained, however, within the prostate and did not infiltrate the urethra, bladder, or the prostatic capsule.

The histologic appearance of the tumor and the formation of satellite nodules within the prostate itself in our opinion justify a diagnosis of primary carcinoma of the prostate gland. Since the estrogen pellet was implanted only fourteen days before death, the writers believe that it can be entirely excluded as an etiological factor. They feel that the neoplasm should be regarded as spontaneous.

BIBLIOGRAPHY