From the scanty evidence furnished by case reports, it is apparent that carcinoma of the pancreas is relatively rare in other animals as compared to its occurrence in man. According to the review of the literature on carcinoma of the pancreas in man by Kiefer (1), in 174,803 autopsies 1420 primary carcinomas of the pancreas were found, about 0.8 per cent, and among 50,494 admissions to Johns Hopkins Hospital there were recognized 58 cases of pancreatic cancer. From these and other reports it appears that the pancreas is the site of about one per cent of all the primary carcinomas. This is in marked contrast with our experience in finding but two primary carcinomas of the pancreas in 125,000 mice examined after natural death, among approximately 20,000 other spontaneous tumors.

The statement has been made that new growths of the pancreas are common in old dogs (as by Mayo Robson and Cammidge, quoted by Kiefer), but we have been unable to locate specific evidence of a sufficient number of cases to support this generalization. Schlegel (2) says: "Malignant epithelial neoplasms of the pancreas have so far been observed only a few times in dogs and cats." He reported a case of pancreas adenoma in a six-year-old male St. Bernard. One might expect dogs to show this condition more frequently in view of the fact that nodular hyperplasia is often found in the canine pancreas. Baumgärtner (3) examined the pancreas in 121 dogs, mostly old, and found nodular hyperplasia in 88; of 101 dogs over seven years old, 86 (85.1 per cent) showed hyperplasia, but in none was there any evidence of malignancy. Cohrs (4) has also noted the frequency of such hyperplasias, also without observing malignant growths. From his extensive experience Kitt (5) reports but one case of scirrhous carcinoma of the pancreas in a dog, and refers to one reported by Nocard. Of particular interest is the case reported by Bru (6) of what seemed to be a primary carcinoma arising in the islands of Langerhans in a dog, with metastases in the lung, heart, liver, and lymph nodes. Borrel (7) has reported as cancer of the pancreas, a tumor associated with a mesenteric

1 While this article was in press we performed an autopsy on a dog with clinically diagnosed hyperinsulinism, exhibiting multiple pancreatic tumors with the structure of the islands of Langerhans. This case will soon be reported in detail.
mass containing a worm, but we can find no adequate description of this growth to permit judgment of its character. There is also much doubt as to the nature of the growth reported by Marek (8) as a "sarcoma of the omentum and pancreas in a dog," as no description of microscopic findings is given. In his review on the comparative pathology of tumors Winkler (9) refers to a case of sarcoma of the pancreas of a dog reported by Otto, but gives no reference. In the great compilation of animal tumors by Sticker (10) are included among 766 cases of primary carcinoma in dogs but two cases of pancreas carcinoma, those of Kitt and Nocard, to which we have already referred.

Bovines also seem to exhibit nodular pancreatic hyperplasias in old age, although rarely developing carcinoma. Schlegel (2) reports seven such growths, called by him adenomas, occurring in old cows observed during fifteen years, the pancreas weighing from 500 to 700 grams. He says that no cases of primary carcinoma of the bovine pancreas have previously been reported, and describes as the first such case on record a growth weighing 570 grams, found in the pancreas of an old cow, not evidently ill. It invaded the portal vein but no metastases were found. Joest (11) says that "adenomas" in old bovines are the most common of all pancreatic tumors in domestic animals, but mentions no malignant growths arising from such adenomatous hyperplasias, although in an earlier publication (12) he referred to a case of carcinoma of the pancreas in a cow. A case report on "sarcoma of the pancreas in a cow" by Huntermann (13) is not accessible to us for critical consideration.

Dr. L. E. Day informs us that in the enormous material of the Chicago Stock Yards no case of pancreatic tumor has even been observed in any animal slaughtered there.

Horses have also yielded few pancreatic tumors. Fölger (14) in a compilation of 213 cases of carcinoma in horses mentions but one pancreatic tumor, reported by Eichler (15). Sticker (10) mentions one case of carcinoma of the pancreas in a horse, but as no such case can be found among his references to primary carcinomas, it was probably a secondary growth. Joest (12) mentions four cases of round-cell sarcoma in a horse reported by Destroye and by Fröhner, and a melanosarcoma (primary?) reported by Käsewurm. Feldman quotes the report by Quentin (16) of a case of carcinoma of the pancreas in a horse, with invasion of the stomach; and Claus (17) reported round-cell sarcoma arising in the pancreas of a horse.

In reporting a case of pancreatic carcinoma of a cat, Scott and Moore (18) quote Gross as saying that in twenty years' autopsy work on animals he had never seen a pancreatic carcinoma. Their report concerns an icteric male cat with a pancreatic mass \(6 \times 2 \times 1.5\) cm. with the structure of a fibrotic carcinoma, which metastasized to the retroperitoneal nodes. Hjarre (19), who says that the cat pancreas often contains hyperplastic nodules in which no islet tissue is found, reports as adenoma an unusually large and isolated nodule of this character.

Several authors mention a case of carcinoma of the pancreas oc-
curring in a cat reported by Petit, but the references given were incorrect and we have been unable to locate the original report. It may be that the case of carcinoma of the pancreas of a rabbit reported by the same author (22) has been erroneously referred to as occurring in a cat. Schlegel (2) and Joest (11) also refer to a case reported by Ball and Roquet.

Several cases of pancreatic tumors in wild animals and birds have been observed in the laboratory of the Philadelphia Zoological Society, and reported by Herbert Fox and his associates. Some of these are mentioned in the report of Ratcliffe (20), and others are mentioned in Fox’s book, “Diseases of Captive Wild Mammals and Birds.” In mammals the following definite primary pancreatic tumors have been described:

1. Adenoma of the pancreas in a female racoon (Procyon lotor).
2. Adenocarcinoma of the pancreas in a male Malayan palm civet (Paradoxurus hemaphroditus).
4. Adenocarcinoma of the head of the pancreas in a female grivet monkey (Cercopithecus sabaeus).
5. A nodule in the pancreas of a female yellow baboon (Papio cynocephalus), considered as an early carcinoma, but about the malignant character of which there is some doubt.

Apparently in view of the five tumors found in the Philadelphia Zoological Garden, pancreatic tumors are more common in wild animals than in domestic animals. The fact that these tumors are the only pancreatic tumors in wild animals that can be found recorded, probably depends on lack of equally careful study in other institutions having such material available. Among the birds studied in the same institution, two pancreatic tumors were found. One was an adenocarcinoma in a male Abyssinian ground hornbill (Bucorvus abyssinicus) and the other was a similar tumor in a fan-tailed grackle (Megaquiscalis major).

We have found no other reports of pancreatic tumors in birds, except that Curtis (21) states that in 880 fowls examined, 79 tumors were found, of which one was in the pancreas; but as no microscopic examination was made of these “tumors” we cannot be sure whether or not this pancreatic growth was neoplastic.

Other animals also yield few pancreatic tumors. Petit (22) has reported a growth found in a rabbit, which Borrel considered to be a glandular carcinoma arising in an aberrant pancreas in association with a Cysticercus, but the case is not reported in sufficient detail to permit of critical consideration.

Study of various compilations on tumors in many species of animals has failed to disclose other examples of true or probable cases of pancreatic tumors.

As far as we can learn, but one case of pancreatic tumor in a rat has been reported. Loeb (23) described this in a white rat, as “a large
tumor which distended the abdominal cavity. It was fixed to the mesentery. Six pieces were transplanted without results. . . . On microscopic examination the tumor was found to be an adenocarcinoma, probably originating from the pancreas. No metastases were present.''

In their report on 521 spontaneous tumors in laboratory rats, Bullock and Curtis (24) found none in the pancreas, and none are mentioned in the reports on spontaneous tumors of wild rats found in plague work by various authors.

As to mice, no cases of definite primary spontaneous pancreatic tumors can be found reported, if we except the incredible report of Cherry (25) that he had produced 80 tumors in 349 mice by inoculation of tubercle bacilli, with 4 cases of pancreatic carcinoma; and that by inoculation of 50 mice with tubercle bacilli 5 cases of malignant pan-

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Fig. 1. CASE 1: METASTATIC TUMOR OF A LYMPH NODE. $\times 150$

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créatic tumors had been produced (26). Neither the illustrations nor descriptions are adequate to prove the correctness of these improbable conclusions. There is also the statement by Heidenhain (27) that a mouse inoculated in the muscle with melanoma developed a carcinoma of the pancreas with metastases to the liver, spleen, and mesenteric glands; also that a mouse inoculated with autolysate of osteosarcoma developed a sarcoma of the pancreas, although the illustrations suggest rather a general leukemoid condition.

Among the Slye stock of mice we have occasionally encountered instances of invasion of the pancreas by sarcomas arising in the body wall or the abdominal lymph nodes, but we have met with only two examples of undoubted primary pancreatic tumors among 125,000 pedigreed mice examined post mortem, with microscopic study of all pancreases that showed any suggestion of abnormality. As these mice have yielded nearly 20,000 other tumors, the relative rarity of pan-
creatic neoplasms in lower mammals is further demonstrated. This is part of the general fact that cancer of all parts of the digestive tract is extremely rare in all mammals except man—a fact which must contain the source of vastly important information concerning the etiology of alimentary cancer in man and the prophylaxis thereof.

Case 1 (Autopsy 22,276): A female white foot mouse (Peromyscus novoboriensis), two years old. This mouse was descended in the tenth generation from wild ancestors obtained in Massachusetts. The pancreas and duodenum were fused into a mass measuring 10 × 12 × 10 mm., of which part seemed to be thickened intestinal wall, with a mass of tumor tissue 5 mm. in diameter at the site of the pancreas. The liver was mottled yellow and red, the surface granular and in places nodular. The spleen was diffusely enlarged and the lungs were edematous.

Microscopically the findings were as follows. The tumor was a small firm nodule which consisted of round cells with small dark nuclei and abundant cytoplasm arranged in atypical alveoli without marked stroma. Some of the alveoli contained also larger cells similar to those described near the pancreas.

Sections through the cardiac end of stomach and adherent pancreas showed some of the lymphatics of the serous coat of the stomach next the pancreas filled with a mass of large cells. Otherwise there were no changes in the stomach.

Attached to the pancreas was a lymph node with cystic dilatation of the lymph channels; also areas of necrosis. Attached both to the lymph node and to the pancreas was a solid growth of large loose cells of epithelial type, an evident metastatic growth (Fig. 1). Similar cells were found free in the lymphatics of this lymph node.

The liver was largely necrotic, with islands of well preserved liver tissue among the necrotic areas. There were also cystic spaces in the liver and bodies resembling dead worms. The remainder of the liver was approximately normal. There were no tumor metastases.

Diagnosis: Carcinoma primary in pancreas, infiltrating the adjacent duodenum and with metastasis in adjacent lymph node.

Case 2 (Autopsy 67,889): A male albino, twelve months old, a member of a third inbred generation from a hybrid cross in which carcinoma and leukemoid diseases occurred in both paternal and maternal ancestry.
The autopsy findings were as follows. Arising in the pancreas was a soft tumor mass 25 × 19 × 19 mm., with hemorrhagic areas, which replaced nearly all of the pancreas. No metastases were found except a nodule 2 × 2 × 1 mm. attached to the duodenum near the pylorus. The lung showed chronic bronchitis but no tumor growth.

Microscopically the pancreas was almost completely replaced by an atypical growth of large epithelial cells (Fig. 2), irregular in size and arrangement, composed essentially of masses of atypical tubules bearing some resemblance to those of the pancreas and forming the walls of irregular blood channels. The general structure was quite similar to many of the common adenocarcinomas of the mammary gland in mice.

**Summary**

Review of the literature indicates that tumors of the pancreas are extremely rare in all species of animals and birds as compared with their common occurrence in man. Among 125,000 mice of the Slye stock examined post mortem, but two instances of primary tumor of the pancreas, both carcinomas and herewith described, have been observed.

**References**