MAMMALOGY.—*Two new long-tailed pocket mice* (Perognathus formosus) *from Arizona*. E. Lendell Cockrum, University of Arizona. (Communicated by Charles O. Handley, Jr.)

In the summer of 1953 I spent some time in Washington, D. C., studying the mammals from Arizona in the collections of the United States National Museum (including the Biological Surveys collection). Long-tailed pocket mice occur, in Arizona, only in the Arizona "strip," that is, the area north and west of the Colorado River. Attempts to determine the subspecific status of the specimens in the Biological Surveys collection revealed the presence of two heretofore unnamed subspecies. The following descriptions were, in part, prepared at that time.

In December 1953 I visited the Museum of Vertebrate Zoology, at the University of California, Berkeley, California. In this collection are a number of long-tailed pocket mice from Arizona. Discussion with Dr. Seth B. Benson revealed that, on the basis of the specimens in that collection, he had recognized the presence of the two unnamed subspecies. Dr. Benson has kindly given me permission to publish the descriptions, incorporating the data available from the specimens in his care.

Grateful acknowledgement is made to the National Science Foundation for a research grant (G-333, Investigations of the Mammals of Arizona) for financial assistance; to Drs. Remington Kellogg, David Johnson, and Henry Setzer, of the U. S. National Museum; to Dr. John W. Aldrich and Miss Viola Schantz, of the U. S. Fish and Wildlife Service; and to Drs. Alden Miller and Seth Benson, of the Museum of Zoology at Berkeley for permission to examine the material in the collections under their care as well as for their personal kindnesses.

Perognathus formosus domisaxensis,[1] n. subsp.

Type.—Adult female, skin and skull, U.S.N.M. no. 249006, Biological Surveys collection; from Houserock Valley, 15 miles west of [the Navajo] bridge, Coconino County, Ariz., collected August 6, 1929, by Vernon Bailey, original number 10758.

Distribution.—Insofar as is now known, this subspecies occurs in Arizona west of the Colorado River, north of the Kaibab Plateau, south of the Paria Plateau, and east of the Kanab Plateau.

Diagnostic characters and comparisons.—A small-sized race of *Perognathus formosus*. Similar to *P. f. formosus* in general color but much smaller in size (see measurements). The occipitonasal length, the frontonasal length, the length of the bullae, and the basilar length are all less than in *P. f. formosus* or *P. f. mohavensis*. The auditory bullae are least inflated in *P. f. domisaxensis*, but the inflation of the brain case is, proportionally, about as in *P. f. formosus*.

Color.—Basal portions of hair near Gray (Gull Gray)[2]; subterminal band close to Light Buff; terminal portion of hairs tipped with dusky. The color of subterminal portion dominates the color of the dorsal surface.

Measurements.—Type: Total length, 185; tail vertebrae, 111; hind foot, 24; ear, 11. Two topotypes, 1 male and 1 female, respectively, 184, 175; 105, 100; 23, 23; 11, 11. *Skull* (type, followed by measurements of 1 male and 1 female topotype): Occipitonasal length, 25.3 (00.0, 24.9); frontonasal length, 16.9 (00.0, 16.8); mastoidal breadth, 13.6 (13.6, 13.5); length of bulla, 8.7 (8.6, 8.2); interorbital constriction, 6.6 (6.4, 6.5); alveolar length upper tooth row, 3.8 (3.6, 3.7); length of interparietal, 3.7 (3.4, 3.4); width of interparietal, 6.4 (6.1, 6.0); basilar length, 18.1 (17.9, 17.5).

Remarks.—Two of the three specimens from the type locality show considerable rosaceous staining. This strain is evident on the usually white hairs of the venter as well as on the dorsal surface. As a result these appear to be much lighter and brighter.

Specimens examined.—Total, 32, distributed as follows: 6 mi. se. of Fredonia, 1, BS; Houserock Valley, 15 mi. w. of Bridge, 3 (BS); Soap Creek, 15 mi. sw. Lees Ferry, 1 (BS); 2 mi. w. of Lees Ferry (BS); 3,250 ft., 11 (MVZ); 6 mi. w. of Grand Canyon Bridge, Marble Canyon, 3,800 ft., 13 (MVZ).

[1] From *domus*, house, and *saxum*, rock, as this subspecies is known from Houserock Valley.

[2] Capitalized color terms after Ridgway, *Color standards and color nomenclature*, 1912.

Perognathus formosus melanocaudus, n. subsp.

Type.—Adult female, skin and skull, U.S.N.M. no. 262918, Biological Surveys collection; from the lower end of Toroweap Valley (Rim of Grand Canyon), Mohave County, Ariz.; collected July 30, 1937, by Luther C. Goldman, original number 341.

Distribution.—In so far as is now known, this subspecies is restricted to the region of the type locality.

Diagnostic characters and comparisons.—A dark-colored race of *Perognathus formosus* (similar to *P. f. formosus* in general size (see measurements) but auditory bullae and brain case more inflated and interorbital region more constricted; distinctly darker in general dorsal coloration including dorsal part of tail. These same conditions are evident when comparisons are made with *P. f. mohavensis* and *P. f. domisaxensis.*

Color.—Basal portions of hairs near Gray (Dark Dull Gray), Gray (Gull Gray) in *P. formosus formosus* and *P. f. domisaxensis*; subterminal band close to Pinkish Buff is quite narrow; terminal portion of hairs tipped with black. The basal and terminal colors dominate the color of the dorsal surface.

Measurements.—Type: Total length, 190; tail vertebrae, 111; hind foot, 25. Two adult female topotypes, as follows: 193, 188; 104, 108; 24, 24. *Skull* (type and two adult female topotypes) Occipitonasal length, 26.7 (26.5, 26.2); frontonasal length, 18.3 (18.1, 17.7); mastoidal breadth, 14.4 (13.9, 14.4); length of bulla, 9.0 (8.9, 8.8); interorbital constriction, 6.4 (6.3, 6.7); alveolar length upper cheek teeth, 3.8 (3.9, 3.8); length of interparietal, 3.7 (3.9, 3.8); width of interparietal, 6.0 (6.1, 6.3); basilar length, 18.2 (18.5, 17.8).

Remarks.—The series of animals in the Biological Survey collection from the Toroweap Valley all show signs of molting. Further, most of the animals were young when taken. However, the young are much darker than those of similar age and pelage condition from all other localities represented.

Specimens from four miles north of Wolf Hole and 12 miles north of Wolf Hole, here referred to *P. f. formosus*, are intergrades between *P. f. melanocaudus* and *P. f. formosus*. This is demonstrated by the intermediate nature of the inflation of the auditory bullae, inflation of the braincase, interorbital width, and pelage color.

Specimens examined.—Total, 52, as follows: Lower end of Toroweap Valley, 16, BS; Lower end of Toroweap Valley, 4200 ft., 36, MVZ.

Comparative material—Perognathus formosus formosus: UTAH: St. George, 17 (BS). ARIZONA: 4 mi. n. of Wolfe Hole, 1 (BS); 6 mi. n. of Wolfe Hole, 4,900 ft., 4 (MVZ); 10 mi. n. of Wolf Hole, 3,800 ft., 10 (MVZ); 12 mi. n. of Wolf Hole, 3,500 ft., on road to St. George, Utah, 17 (BS). *Perognathus formosus mohavensis:* ARIZONA: Near mouth Beaverdam Creek, 1,500 ft., just above Little field, 1 (BS); Grand Wash, 1,800 ft., 8 mi. s. of Pakoon Spring, 1 (BS). CALIFORNIA: Oro Grande, 37 (BS).

PROCEEDINGS OF THE ACADEMY AND AFFILIATED SOCIETIES

PHILOSOPHICAL SOCIETY

1397TH MEETING, OCTOBER 8, 1954

WILLIAM SHOCKLEY, of the Bell Telephone Laboratories, spoke on *Transistor physics.*

Transistor physics is the modern name for that branch of solid-state physics that treats semiconductors. The particular material discussed was germanium; its four valence electrons cause it to crystallize in the same structure as diamond. The perfect lattice of pure germanium is analogous to a vacuum; various defects act like free particles in a vacuum. The six known imperfections that contribute to the semiconductor behavior are:

(1) An excess electron.

(2) A "hole," or missing electron.

(3) Deathnium, which may be an atom of copper or nickel, or simply a structure defect. Deathnium is a generic name for centers which catalyze hole-electron pair generation and recombinations.

(4) A donor atom, which acts like a bound or anchored "hole."

(5) An acceptor atom, which is a bound negative charge, creating a freely moving "hole."

(6) A trap, which is a bound charge in a low dielectric constant crystal, and therefore tends to attract and hold free charges.

The apparent motion of a hole in an applied electric field is produced by the motion of an electron that fills the hole, and leaves a new one