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Ochrotomys nuttalli.

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Ochrotomys Osgood, 1909

Ochrotomys Osgood, 1909:222. Type species *Arvicola nuttalli* Harlan, 1832.

CONTEXT AND CONTENT. Order Rodentia, Superfamily Muroidea, Family Muridae, Subfamily Cricetinae. The genus includes only the species *Ochrotomys nuttalli*.

Ochrotomys nuttalli (Harlan, 1832) Golden Mouse

Arvicola nuttalli Harlan, 1832:446. Type locality Norfolk, Norfolk Co., Virginia.

Mus (Calomys) aureolus Audubon and Bachman, 1841:98. Type locality Oak forests of South Carolina (neotype designated by Packard, 1969:395, from Marshall, Madison Co., North Carolina, approximately 45 mi. NW South Carolina state line).

CONTEXT AND CONTENT. Context as noted above. The species contains five currently recognized subspecies, as follows:

O. n. nuttalli (Harlan, 1832:446), see above (*lewisi* Howell is a synonym).

O. n. aureolus (Audubon and Bachman, 1841:98), see above.

O. n. flammeus (Goldman, 1941:190). Type locality Delight, Pike Co., Arkansas.

O. n. floridanus Packard, 1969:397. Type locality Welaka, Putnam Co., Florida.

O. n. lisae Packard, 1969:398. Type locality 1 mi. E Stephen F. Austin State College (University) campus, Nacogdoches, Nacogdoches Co., Texas.

DIAGNOSIS. The genus *Ochrotomys* is monotypic; the following diagnosis thus applies to both genus and species. Size is medium among cricetine mice (figure 1). Skull (figure 2) resembles that of peromyscoid mice except somewhat squarish in appearance from above; posterior palatine foramina are nearer interpterygoid fossa than posterior terminus of anterior palatine foramen; mental foramen of mandible situated laterally and in medial plane of ramus. Molariform teeth tend toward brachyodonty; enamel folds are compressed and thick, those of the two sides of molar touch when worn, resulting in five subtriangular islands of dentine in M1 and m1, four in M2 and m2; prominent accessory lophs and styles are on all molars; full mesoloph (-id), mesostyle (-id), ectoloph, and ectostylid, mesoloph (-id) apically; loph extends laterally from mure. Entepicondylar foramen in humerus is absent. Baculum distinctly capped with long cartilaginous cone; glans penis has unusually large spines. Plantar tubercles are six, plus a rudimentary seventh adjacent to the large tubercle at base of fifth digit. There are six mammae, two inguinal pairs and one pectoral pair. Color is golden or tawny ochraceous above in adults, somewhat duskier in young; creamy on underparts. Dental formula is i 1/1, c 0/0, p 0/0, m 3/3, total 16. See Packard (1969) for extensive diagnosis.

GENERAL CHARACTERS. The golden mouse is unique in its burnished to golden color within the neotomyine-peromyscine group. Color of pelage of young is slightly duskier than that of adults, varying on dorsum from 7.5 YR 5/6 (young) to 5 YR 5/8 (adult) on the Munsell (1954) system; adults are tawny ochraceous on upper parts and ears, creamy with ochraceous wash on underparts; tail is faintly bicolor; feet are similar to underparts in color. Pelage is extremely dense and soft. Enamel of upper teeth is thick, particularly in worn teeth; dentine areas are generally not confluent; in some cases a raised cingulum is present. Ranges of some measurements in millimeters in adults (for a detailed analysis of variation of external and cranial measurements, see Packard, 1969) are: total length, 127 to 180; length of head and body 51 to 115; length of tail, 50 to 97; length of hind foot, 12 to 29; length of ear, 11 to 26; condylobasal length, 17.0 to 25.1; zygomatic breadth, 10.6 to 14.7; depth of braincase, 8.0 to 10.9; length of rostrum, 5.9 to 10.8; length of upper molar toothrow, 3.1 to 4.2; postpalatal length, 6.2 to 10.5; length of lower molar toothrow, 3.2 to 4.5; least interorbital breadth, 3.6 to 4.8. Golden mice from the same population and grouped into comparable age and sex categories vary little from each other (for a detailed analysis of age and secondary sexual variation see Packard, 1969). The diploid

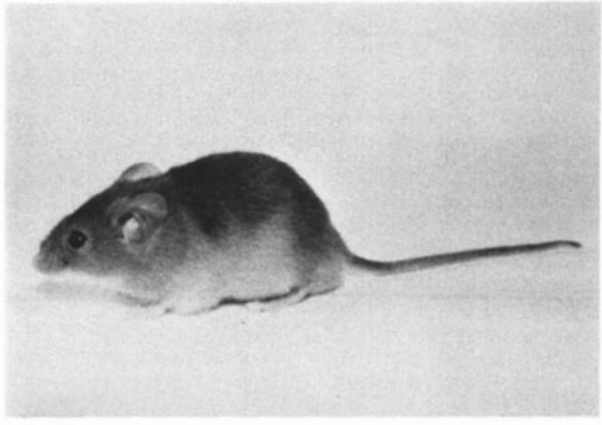

FIGURE 1. Adult male golden mouse. Photograph by D. W. and A. V. Linzey.

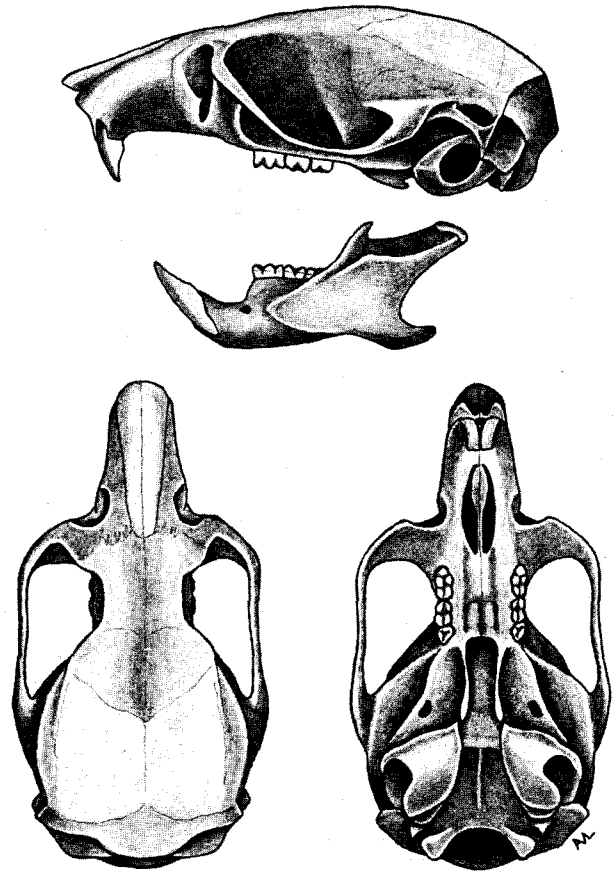

FIGURE 2. Skull of male *Ochrotomys nuttalli nuttalli* from Route 32 at Fish River, Baldwin Co., Alabama, collected on 3 July 1968 (Univ. South Alabama no. 406). Skull length, 25 mm. Illustrations by Alicia V. Linzey.

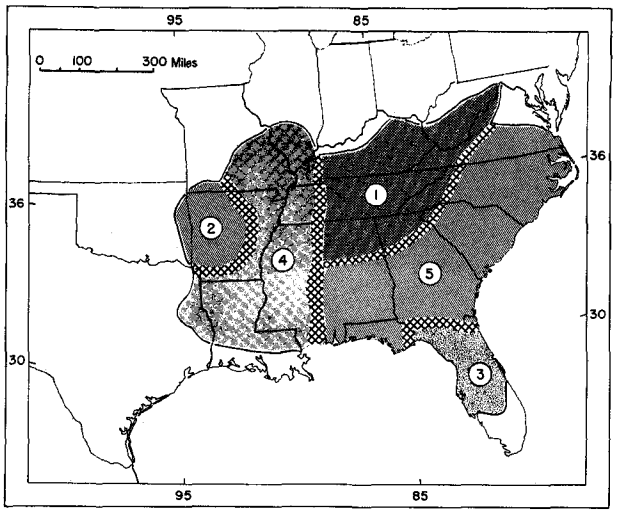

FIGURE 3. Map of southeastern United States showing the geographic distribution of subspecies of *Ochrotomys nuttalli*: 1, *O. n. aureolus*; 2, *O. n. flammeus*; 3, *O. n. floridanus*; 4, *O. n. lisae*; 5, *O. n. nuttalli*. Cross-hatching indicates areas of intergradation (after Packard, 1969).

number of chromosomes is 52. The gastric anatomy of *Ochrotomys* is unique in several ways (see Packard, 1969).

DISTRIBUTION. The species occurs in the southeastern United States (see figure 3) westward to eastern Texas, north as far as northern Kentucky and central Virginia, and south to central Florida. The distribution corresponds closely to the southeastern deciduous (oak-hickory) hardwood and pinestands, Lower Austral and portions of the Upper Austral life-zones (Austroriparian and part of Carolinian biotic provinces). Golden mice occur from densely forested lowlands and flood plain communities to pine uplands on sandy soils with considerable under-brush and lianas. Occurrence is relatively continuous throughout the geographic distribution of the species, but the denser populations are in deciduous lowlands. The presence of major river systems seems to impose no limitations on distribution.

FOSSIL RECORD. A single Pleistocene record exists, from Missouri (see Olson, 1940), although *Ochrotomys* may represent a quite primitive member of the neotomyine-peromyscine phyletic line (see Hooper and Musser, 1964; Arata, 1964; Hibbard, 1968).

FORM. Rinker (1963) and Packard (1969) reported on the myological anatomy. The rich golden pelage varies less between young and adults than in *Peromyscus* (Osgood, 1909). Ears are similar in color to upperparts. Vibrissae are black to gray. Variation in color between age groups was discussed in detail by Packard (1969). Young adults (age 3 of Packard, 1969) have upper parts a golden-red tone (color 5YR 5/8 middorsally on Munsell system); belly is whitish with yellow-orange overtones, basal part of pelage is gray; tail is indistinctly bicolored; hind feet are whitish above; ears are orange-red. Changes in colors of dorsum, from young to old result mostly as the golden-red agouti band broadens at expense of grayish base. Pelage is soft and individual hairs are fine. Color of pelage of populations from Atlantic Coastal Plain of Virginia, the Carolinas, and Georgia is somewhat brighter (more reddish yellow) than in populations from the Piedmont and mountainous areas to the west, where pelage is somewhat more brownish. Populations from Texas, northern Louisiana, Arkansas, Missouri, and Illinois have more yellowish overtones. Mice from the Florida Peninsula are rich yellowish brown.

Gastric structure is peromyscoid-like but an internal fold delimits the pyloric region from rest of stomach, as in *Baiomys*; the thin paler area on ventral floor of stomach that is typical of peromyscoids is lacking; instead there is thickened epithelium typically delimited by an *incisura angularis* fold.

FUNCTION. Few physiological data are available for *Ochrotomys*. Gough and Kilgore (1964) presented hematological data (from Louisiana). Mean blood values were: red blood cells, $10.69 \times 10^6/mm^3$; hemoglobin concentration, $140.1 \mu g/mm^3$; white blood cells, $3100/mm^3$; packed cell volume (hematocrit), 43.34%; mean corpuscular volume, 41.19 μm^3; mean corpuscular hemoglobins, 14.55 picogram; and mean corpuscular hemoglobin concentration, 32.37%. Erythrocytes of *Ochrotomys* are smaller in volume and larger in number than those of *Peromyscus gossypinus*, but contain approximately the same amount of hemoglobin. Paper electrophoretic hemoglobin migration patterns revealed a greater similarity between *Ochrotomys*, *Peromyscus maniculatus*, and *Mus* than between *Ochrotomys* and *Peromyscus gossypinus*. Foreman (1968) reported a single hemoglobin in *Ochrotomys* during a study of hemoglobin ionographic properties in small mammals.

Thermoregulation, metabolism, and water economy in this species were discussed by Layne and Dolan (1976). Mean body temperature was 36.38°C. The thermal neutral zone was between 29.5 and 36°C., whereas the basal metabolic rate of oxygen use was 1390 $mm^3/h/g$ of body weight. Normal water consumption averaged 233 $mm^3/d/g$, mean pulmocutaneous water loss averaged 2.7 mg/h/g, and mean urine production ranged from 24 to 61 $mm^3/d/g$. The mean fecal water content varied between 48% and 56%. When compared with mice of the closely related genus *Peromyscus*, *Ochrotomys* was found to have comparable thermoregulatory ability, a low basal metabolic rate, and water relationships generally resembling those species and subspecies of *Peromyscus* that inhabit mesic habitats.

ONTOGENY AND REPRODUCTION. Studies by Linzey and Linzey (1967*b*) revealed that golden mice in captivity continued to breed throughout the year, although there were marked peaks in breeding activity during early spring and late summer. In eastern Tennessee, breeding extended from mid-March through early October, with peaks in late spring and early autumn (Linzey, 1968; Linzey and Linzey, 1968). Layne (1960) recorded breeding over at least an eight-month interval in Florida with peaks possibly occurring in early summer and autumn. Pregnant golden mice were recorded by Goodpaster and Hoffmeister (1954) in March, April, July, and October in Kentucky. In Texas, McCarley (1958) found that the breeding season began in September and extended through winter and spring, with little reproduction during summer months. Lowery (1974) reported breeding throughout the year in Louisiana, but that more young probably were produced in late autumn and early winter than at any other time. Additional data on reproduction in various parts of the range of *Ochrotomys* have been reported by Howell (1921), Brimley (1923, 1945), Harper (1927), Welter and Sollberger (1939), Hamilton (1943), Ivey (1949), Odum (1949), Barbour (1951), Howell and Conaway (1952), McCarley (1954), Starner (1956), Layne (1958*a*), deRageot (1964), Packard and Garner (1964), Easterla (1968), and Wallace (1969). McCarley (1959*b*) noted a tendency for pairs to remain together during the breeding season in Texas.

Intervals between births for 62 litters recorded by Linzey and Linzey (1967*b*) were as short as 25 days for three litters, with the female in each instance still nursing a previous litter during part of the pregnancy. Other maximum gestation periods for lactating females were 26 days (five litters), 27 days (15 litters), 28 days (eight litters), 29 days (three litters), and 30 days (three litters). The shortest intervals between births for nonlactating mice were 25 days (one litter), 26 days (one litter), 27 days (one litter), and 28 days (two litters). The remaining 21 periods between births ranged from 31 to 70 days for both lactating and nonlactating mice. Although Goodpaster and Hoffmeister (1954) noted that "the female is impregnated shortly after parturition, the next day in one case," this apparently is not always true.

Litter size for 85 litters of *Ochrotomys* from Tennessee (Linzey and Linzey, 1967*b*) averaged 2.65. Seven births were of only one young, 30 litters contained two, 33 litters three, and 15 litters four. A significant difference was found between spring (2.4 per litter) and autumn (3.1 per litter). Layne recorded a mean of 2.7 young per litter in Florida. Both Goodpaster and Hoffmeister (1954) and McCarley (1958) noted litter sizes of two or three in Kentucky and Texas, respectively. Litter sizes and latitudinal variation were discussed by Blus (1966*a*).

Golden mice produce several litters annually. Linzey (unpublished data) has studied fecundity of the species in captivity. Some females have produced as many as 17 litters within 18 months. Females as old as 6½ years of age have borne young. McCarley (1959*b*) presented evidence showing that irradiation of 500 r on the testes of male *Ochrotomys* decreased the reproductive rate and the population density through a decrease in the number of litters produced.

The growth and development of *Ochrotomys* has been studied by Layne (1960), Linzey and Linzey (1967*b*), and Wallace (1969). Newborn young are reddish and have relatively smooth skin. The digits are not separated, and the viscera are visible through the walls of the abdomen. The pinnae are folded over and sealed. The eyelids are also sealed. The mystacial vibrissae are well developed. Short hairs are present on the lips and chin and widely-scattered longer hairs are present on the dorsum. Average weights and measurements of 47 newborn *Ochrotomys*

were: total length, 50.8 mm (38 to 58); tail, 15.3 (13 to 18); hind foot, 7.2 (6.0 to 8.0); weight, 2.7 g (1.8 to 3.6). Dark hairs are visible on the crown, nape, and shoulders at day 1. The pinnae normally unfold on day 1 and become fully erect by day 2. By this time, the dark hairs of the dorsum extend to the rump and the ankle patch contains hairs. Epidermal scales become evident on both dorsal and ventral surfaces at approximately day 2. By the end of day 7, the dorsum is covered by a sleek, velvety, reddish-brown pelage and the young are readily identifiable as golden mice. The eyelids are covered by a fairly dense growth of hair and the digits are separated and well haired. The lower incisors are visible below the surface of the gums on day 4 and erupt at about day 6. The upper incisors generally erupt between days 7 and 8. By day 21, the lower incisors are approximately 4 mm long and the upper incisors are between 1.5 and 2.0 mm long. By day 10, epidermal scales disappear and the external auditory meatus opens (mean 9.8 days). The first reaction to sound occurs at about day 10 (range 8 to 12 days). On the average, the eyes of young golden mice are completely open at 12.7 days (range 11 to 14 days). Goodpaster and Hoffmeister (1954) recorded the opening of the eyes between days 11 and 15, with the average being 12.8 days. Weaning begins at about day 17 or 18 and apparently is complete by about day 21. The postjuvenile molt commences during week 4 or 5 and requires an average of 3½ to 4 weeks for completion. The postjuvenile molt has been described in detail by Linzey and Linzey (1967*a*). Although *Ochrotomys* attains adult size between weeks 8 and 10, data show a continual slow growth throughout life (Linzey and Linzey, 1967*b*).

During the week following birth, weight showed a higher instantaneous growth rate, 9.5%/d, than did any linear measurement. A decline in the growth rate was evident during the second week and a significant break in the growth curve occurred at week 3. Weight gain dropped below 1%/d at week 6. The tail showed the highest growth rate, 7.85%/d, of any linear measurement during week 1, and continued at the highest rate through week 9. Body length showed the lowest growth rate of any linear measurement for the first two weeks following birth. A major break occurred in this curve at week 3, when the growth rate fell below 1%/d. The hind foot grew at a relatively rapid rate during the first two weeks, after which it levelled off and continued to grow at a rather slow rate.

Spring and autumn litters differ in growth patterns (Linzey and Linzey, 1967*b*). Spring-born mice were found to be heavier than autumn-born mice, but were shorter in tail length and total length. After the second day, the hind foot of spring-born mice was also smaller than that of autumn-born individuals. These differences remained through 12 weeks of age.

ECOLOGY. Golden mice may live in a variety of habitats including moist thickets, brushy areas, and woods, usually in association with honeysuckle and greenbrier; canebrakes; swampy woodlands; in areas of hemlock among moss-covered boulders; rhododendron thickets in virgin hemlock; along the borders of broomsedge fields and brier patches; thick timber bordering cypress swamps; hammocks; palmetto; rocky oak hillsides; moist, rock-strewn ravines; forested hardwood floodplains; pine thickets; turkey oak thickets; and pine-oak woodlands (Howell, 1921; Lowery, 1936, 1943, 1974; Komarek and Komarek, 1938; Kellogg, 1939; Welter and Sollberger, 1939; Barbour, 1942; Hamilton, 1943; Moore, 1946; Handley and Patton, 1947; Handley, 1948; Odum, 1949; Ivey, 1949; Pournelle, 1950; Barbour, 1951; Pearson, 1953, 1954; Eads and Brown, 1953; Goodpaster and Hoffmeister, 1954; Howell, 1954; Starner, 1956; Hoffmeister and Mohr, 1957; Sealander and James, 1958; Layne, 1958*a*; Redman and Sealander, 1958; McCarley, 1958, 1959*a*, 1959*b*; Schwartz and Schwartz, 1959; Davis, 1960; Golley, 1962, 1966; Brown, 1963; Andrews, 1963; Packard and Garner, 1964; deRageot, 1964; Blus, 1966*b*; Easterla, 1968; Packard, 1968; Linzey, 1968; Wallace, 1969; and Linzey and Linzey, 1971).

Golden mice live in populations consisting of loosely knit communities. They appear to have specific habitat preferences because large areas of presumably suitable habitat may contain no animals whereas other similar-appearing areas are well inhabited. McCarley (1958) stated that the main factor controlling the ecologic distribution of this species was density of underbrush. Pearson (1953) noted a reciprocal relationship in occupancy of a given habitat in Florida between *Ochrotomys* and *Peromyscus gossypinus*. A similar density relationship, with *Ochrotomys* usually present in fewer numbers, also was reported by McCarley (1958) in Texas.

Howell (1954) recorded a density of only 0.5 per hectare in Tennessee, whereas McCarley (1958) recorded population densities ranging from none in summer to as many as 5.4/h in early spring in forested hardwood floodplain habitat in Texas. Shadowen (1963) reported densities ranging from 0.47 to 6.89/h in a rolling upland cutover area of loblolly and shortleaf pine in Louisiana. In the Great Smoky Mountains National Park in Tennessee, Linzey (1968) recorded densities ranging from 0.5 to 8.9/h in an area where the dominant understory vegetation was greenbrier and the dominant tree species were pine, maple, yellow poplar, and sumac. Blus (1966*b*) recorded population densities ranging from 1.7 to 74.1/h in Illinois. Lowery (1974) noted that the number of golden mice in an area was directly correlated with the ground cover, particularly the amount of underbrush and vine entanglements.

Sex ratios in Texas and Tennessee did not depart significantly from the expected one to one (McCarley, 1958; Linzey, 1968). McCarley (1959*a*) studied the effects of flooding upon this species in Texas. Short-term flooding of up to eight days duration produced no detrimental effect upon the mice. Flooding for a three-week period, however, caused a marked decrease in the population. Even during long periods of flooding, individual *Ochrotomys* showed a tendency to remain within their established home ranges.

McCarley (1958) calculated the average life span of this species to be approximately 6.5 months. He recorded an adult male that lived for 19 months on his study area. The longest known natural life span of a wild golden mouse is the record of Pearson (1953) of a male that lived for at least 2½ years. Pearson also noted that 60% of the resident *Ochrotomys* population lived longer than three months after reaching adulthood. Linzey (1968) recorded 10 individuals that were on his study area for eight months or longer, two of which were present 12 months. In captivity, D. W. Linzey found that 60% of golden mice reaching adulthood survived longer than one year, 29% longer than two years, and 11% (17 animals) three years or longer. Of these 17, five lived for six years or longer and one, a female, lived for 8 years, 5 months. This is the longest life span ever recorded for any North American cricetine rodent.

Komarek (1939) found that the golden mouse was more sedentary than several other species of small mammals studied. Pearson (1953) recorded one individual that was trapped 1½ years after its release within 30 m of its release point. Goodpaster and Hoffmeister (1954) believed the home range to be small and nightly forays to be made only a short distance from the nest. Dunaway (1955) used the minimum area method of calculating home range and recorded an average range of 0.105 h for three mice in Alabama. Using the inclusive boundary strip method in Arkansas, Redman and Sealander (1958) obtained an average home range size of 0.053 h for five individuals, whereas McCarley (1958) reported an average of 0.591 h for male golden mice and 0.567 h for females in Texas. Shadowen (1963) calculated a mean home range of 0.530 h in Louisiana by allowing the two most widely separated points of capture to serve as the diameter of the home range. Blus (1966*b*) used the inclusive boundary strip method in calculating an average home range of 0.486 h in Illinois. Linzey (1968) recorded an average home range of 0.259 h for males and 0.239 h for females by using the exclusive boundary strip method. When computed by the inclusive boundary strip method, these values were 0.445 h and 0.340 h, respectively. McCarley (1958) reported considerable overlap in home ranges and no evidence of territoriality. During a portion of Linzey's study, the population being studied decreased drastically in size. During this period, the male home range averaged 0.627 h, whereas the female home range averaged 0.206 h. Population density may govern to a large extent the size of home range of male *Ochrotomys*, but has little, if any, effect upon home range size of females.

Linzey (1968) recorded average distances between successive captures of 31.4 and 31.7 m for males and females, respectively, in Tennessee. During the period of low population density, the average distance between successive captures for males increased to 59.3 m, whereas the distance for females averaged 27.1 m. Blus (1966*b*) recorded an average distance between captures of 73.2 m.

Barbour (1942) and Goodpaster and Hoffmeister (1954) described two types of arboreal structures constructed by this species—the nest and the feeding platform or shelter. The nest is a globular mass of leaves, shredded bark, and grass and serves as the home site. The feeding platform is a structure similar to, but not as bulky as, the nest and serves as the place where the mice carry their seeds, open them, and eat their contents. Golden mice are known to construct and utilize arboreal nests throughout their range (Howell, 1921; Black, 1936; Barbour, 1942, 1951; Hamilton, 1943; Moore, 1946; Handley, 1948; Ivey, 1949; Goodpaster and Hoffmeister, 1952, 1954; Pearson, 1954; Dunaway, 1955; Layne, 1958*a*; Packard and Garner, 1964; Blus, 1966*b*; Linzey, 1968). In certain habitats, and possibly during hot weather, these mice may build nests on the ground inside a stump or fallen log or beneath a log or rock (Strecker and Williams, 1929; Barbour, 1942; Eads and Brown, 1953; Goodpaster and Hoffmeister, 1954; McCarley, 1958; Blus, 1966*b*; Easterla, 1968; Lowery, 1974).

Nests may be located from near the ground to a height of approximately 10 m, although most nests are located between 1.5 and 4.5 m above the ground (Black, 1936; Ivey, 1949; Goodpaster and Hoffmeister, 1954; Packard and Garner, 1964; Blus, 1966*b*; Linzey, 1968). They generally are constructed among, and supported by, greenbrier, honeysuckle, or grape vines (Black, 1936; Goodpaster and Hoffmeister, 1954; Packard and Garner, 1964; Blus, 1966*b*; Linzey, 1968). Ivey (1949) noted that the majority of nests in Florida were either in tangles of greenbrier vines or in hanging Spanish moss. Those nests in Spanish moss generally had the living plant woven into and around them, anchoring the nest securely. Welter and Sollberger (1939) found nests most frequently in pine thickets. Barbour (1942) also recorded nests from pine, whereas the majority of nests located by Linzey (1968) were in pine and cedar trees. Packard and Garner (1964), however, found no nests in coniferous trees, nor did they find any in understory vegetation beneath pines.

The average golden mouse nest is 150 to 200 mm long, 100 to 125 mm wide, 100 to 200 mm high, and usually weighs between 10 and 30 g (Packard and Garner, 1964; Blus, 1966*b*; Linzey, 1968). An opening, about 25 mm in diameter and often partially closed, is present in one end of the nest. Nests are composed of two distinct layers. The outer covering is mainly of deciduous or coniferous leaves, grasses, or Spanish moss. The inner chamber is constructed of finely shredded bark, grasses, feathers, fur, cloth, and other similar materials. Details of nest construction including frequency of occurrence and percentages of nest components may be found in Goodpaster and Hoffmeister (1954), Packard and Garner (1964), and Linzey (1968).

Several investigators have reported finding seeds in some nests. Blus (1966*b*) found nests containing as many as 2000 seed hulls. Linzey (1968) recorded seeds in 73% of the nests examined, in some cases amounting to as much as 26% of the total weight of the nest. However, no distinct feeding platforms have been found by any investigators other than Barbour (1942) and Goodpaster and Hoffmeister (1954) in Kentucky.

Goodpaster and Hoffmeister (1954), who based their food analyses upon the recovery of seeds from feeding platforms, found 23 kinds of seeds. The most numerous seeds eaten by *Ochrotomys* were of sumac (*Rhus*), wild cherry (*Prunus*), dogwood (*Cornus*), and greenbrier (*Smilax*). DeRageot (1964) noted the same preference of seeds in Virginia, whereas Layne (1958*a*) recorded *Polygonum* seeds from one nest in Illinois. Blus (1966*b*) recorded the principal food items from nests in Illinois as poison ivy seeds, blackberry seeds, bedstraw seeds, and acorns. In Tennessee, wild cherry, dogwood, and greenbrier seeds were found most commonly in *Ochrotomys* nests. Stomach analyses revealed greenbrier seeds, blackberry, and invertebrates are the dominant food items (Linzey, 1968). Invertebrate remains were found in 47% of the animals examined from the main study area and in no less than 57% of those from other nearby areas.

In comparison to other cricetid rodents, relatively few parasites have been reported from *Ochrotomys*. A coccidian, *Eimeria chryse*, was noted by von Zellen (1959), while the bacteria *Grahamella* sp. and *Escherichia coli* were reported by Linzey (1968). Wenrich (1946) and Doran (1954) recorded the protozoan, *Retortomonas* sp.

Trematodes have not been recorded from this species, but larval stages of a cestode, *Taenia rileyi*, were found in the liver of one individual from Tennessee (Linzey, 1968). Nematodes (*Longistriata* sp. and *Rictularia* sp.) also have been recorded (Linzey, 1968).

A small, mite-like parasite was reported by Pickens (1927) and "red bugs" were observed on this species by Komarek (1939) and Pearson (1954). Ewing (1938) reported *Radfordia subuliger*, whereas Morlan (1952) recorded the presence of *Bdellonyssus bacoti*. *Eulaelaps stabularis*, *Haemolaelaps glasgowi*, and *Ornithonyssus bacoti* were identified by Hays and Guyton (1958). The host index of the Animal Disease and Parasite Research Division of the U.S. Department of Agriculture at Beltsville, Maryland also includes *Euschongastia rubra* and *Laelaps nuttalli* as having been found on the golden mouse. Linzey (1968) recorded *Eulaelaps stabularis*, *Androlaelaps glasgowi*, *Androlaelaps casalis*, *Labidophorus* sp., *Lasioseius* sp., *Melichares dentriticum*, and *Myocoptes musculinus* from *Ochrotomys* in Tennessee.

The flea *Orchopeas leucopus* has been recorded by Goodpaster and Hoffmeister (1954) and Layne (1958*b*). Layne (1958*b*) also recorded the flea *Epitedia wenmanni*. Linzey (1968) found the above two species along with *Ctenophthalmus pseudagyrtes* and *Doratopsylla blarinae* on *Ochrotomys* in Tennessee. The louse *Hoplopleura hesperomydis* also was recorded by Linzey (1968).

Ticks have been observed on golden mice by Harper (1927), Komarek (1939), and Pearson (1954). Bishop and Trembley (1945) recorded *Haemaphysalis leporis-palustris* and *Ixodes cookei*, whereas Morlan (1952) and Linzey (1968) reported the occurrence of *Dermacentor variabilis*.

Pearson (1954) and Linzey (1968) have recorded larval forms of the botfly *Cuterebra* sp. from golden mice.

BEHAVIOR. *Ochrotomys nuttalli* is a relatively docile, semiarboreal rodent. Its prehensile-like tail is used as a balancing organ while climbing and moving in vines and trees. The tail is wrapped around a branch or vine to stabilize the animal when it is at rest. Goodpaster and Hoffmeister (1954) and Packard and Garner (1964) observed individuals using the tail to hang almost at right angles from a branch with only the hind feet assisting in support. Individuals released in the field may enter a hole in the ground, disappear into a brush pile, or climb a nearby tree. Some individuals that climbed trees were observed to make their way to a nest, others began feeding, and still others washed and then remained motionless for extended periods. Activity is mainly crepuscular and nocturnal.

Some endogenous mechanism that can be altered or reset by shifts in the photoperiod seems to control the circadian rhythm of golden mice (Kennedy *et al.*, 1973). After an adjustment period of 3 to 4 days, animals kept on a 14-hour day showed a peak in activity about 3 to 4 hours before dawn. This activity began to taper off 30 minutes before dawn and by 30 minutes after dawn activity was generally low. Another peak occurred immediately after dusk. This pattern of activity was independent of whether the animals were on a normal 14-hour day or on a reversed 14-hour day. The only difference noted was that those animals on the reversed light-dark schedule did not spend as much time out of the nest at the peak activity hours as did mice on a normal light-dark schedule. The animals apparently used the presence or absence of light as a cue to reset timing mechanisms useful in control of activity periods. Slight activity, generally involving feeding or drinking and seldom lasting for more than 4 or 5 minutes, occurred during daylight hours.

Golden mice are fairly social and up to eight animals have been found occupying the same nest (Barbour, 1942; Ivey, 1949; Goodpaster and Hoffmeister, 1954; Howell, 1954; Dunaway, 1955; Layne, 1958*a*; McCarley, 1958).

The behavioral development of young *Ochrotomys* was studied by Layne (1960) and Linzey and Linzey (1967*b*). Newborn young are relatively well coordinated. They are able to cling to a finger inclined at a 45 degree angle and if placed on their back they roll and twist until they regain an upright position. Newborn mice are able to produce a loud, rasping squeak. By day 1, the young can take a few wobbly steps and are able to right themselves more easily. The prehensile tendency of the tail is evident by day 2. By day 4 they exhibit a good sense of balance, being able to climb up fingers and hang on upside down. They show a tendency, however, to remain quietly in one spot. By day 8, the mice can stand and walk with their venter off the substrate. They continue to remain quiet, however, and show little tendency to move. By day 10, young show a definite tendency to climb upward. First attempts at washing began as early as day 7. By day 12, mice attempt to wash the ears and hind feet, although they are still somewhat unsteady. The first attempt at washing the tail was recorded on day 13. By day 15, young mice are able to jump and to leap from a hand while being removed from the nest. By day 17 or 18, the young are more active, but when held in the hand they sit docilely. From days 12 to 21, mice groomed frequently and thoroughly. After day 21, considerably more time was spent outside the nest at night than previously. When frightened, mice either remained motionless or climbed the nearest available object. The period between days 14 and 21 seemed critical in determining the future response to handling. If handled every few days after their eyes opened, most individuals became docile and were easily managed. The docility remained evident during adult life. If not handled frequently during this period, mice usually were wild and difficult to manage.

Captive female *Ochrotomys* normally did not exhibit a tendency toward active defense of their young. They generally remained in the nest when young were removed; if they did leave the nest, they did so in a deliberate manner and proceeded to a particular corner of the cage. Because female *Ochrotomys* move about relatively slowly, young clinging to a teat were seldom subjected to rough treatment. Layne (1960) noted that the more or less deliberate movements of golden mice with or without litters may have some correlation with the fact that they spend much time climbing and moving about above the ground. Layne (1960) noted females carrying their young by grasping a point just behind the nape or by grasping the young by their back. Goodpaster and Hoffmeister (1954) stated that young observed during their study were always held from the stomach side when being transported by the mother.

Behavior of captive male golden mice was distinctly different after birth of a litter. Up until that time, both adults were close companions in the nest. After the young were born, the male would not go into the nest. He either moved nervously about the cage or settled in a corner. The female was never observed to show any aggressive actions towards the male.

Ivey (1949) noted that golden mice differed remarkably in temperament from beach mice and cotton mice. He noted that captives appeared stupid, almost reptilian in their actions, seemingly a result of extreme nervousness. When frightened in captivity, they would climb to the top of their cage and frequently remain there for half a day. Ivey noted that *Ochrotomys* engaged in no unnecessary activities: only a few laboratory-born individuals used the exercise wheel provided for them.

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