PEROMYSCUS NEWSLETTER

NUMBER ELEVEN

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MARCH 1991

COVER: *Peromyscus* grooming.
(Courtesy Victoria Hollowell)

Still just a plain old newsletter.....

PEROMYSCUS NEWSLETTER is only one of many informal publications originated to convey casual or routine information within a specialized scientific interest group. Many of these publications have centered on the genetics of particular kinds of organisms, *e.g. Drosophila Information Service, Neurospora News Letter, Mouse News Letter, Hamster Information Service, Rat News Letter, Mammalian Chromosomes Newsletter, Carnivore Genetics Newsletter, etc.* Most of these began inauspiciously, but gradually became more sophisticated, particularly with the advent of desktop publishing. Last year *Mouse News Letter* went upscale, was redesignated "*Mouse Genome*" and established itself as a formal journal. *Rat News Letter* was recently upgraded also. For the most part these transformations have been desirable, but in the process the mood of spontaneity and simplicity characteristic of the earlier issues has disappeared.

PEROMYSCUS NEWSLETTER was modeled on *Mouse News Letter*. However, we feel that the nature of the two has diverged. We hope to retain PN as a strictly informal publication and there are no plans to significantly change the format or directions. It is also clear that the interests of the readership of PN are considerably more diverse than is the case for *Mouse Genome* or *Rat News Letter*. While there is a strong genetic component among our readership, most of our subscribers have primary interests in ecology, behavior, systematics or physiology. Therefore, it will continue to be our policy 1.) to **remain informal**, 2.) to include **all aspects of** *Peromyscus* biology, and 3.) to be **sent free of charge**.

We thank each of you for your interest and support. However, since there is no financial cost to our readers for this service, you can help demonstrate your support by periodically providing us an entry informally describing your research involving *Peromyscus*, and communicating with us about people and happenings of interest to deer mouse biologists.

The next issue, *PEROMYSCUS NEWSLETTER* Number 12, is scheduled for September. Please mail your entries or other information before 15 September 91 for inclusion in the issue.

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Peromyscus Genetic Stock Center
South Carolina Institute of Biological Research and Technology
University of South Carolina
Columbia SC 29208

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Jim Layne has a recent article on "The Florida Mouse" in the volume *Burrow Associates of the Gopher Tortoise* (Proceedings of the 8th Annual Meeting of the Gopher Tortoise Council, Florida Museum of Natural History. 1990)

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Joaquin Arroyo-Cabrales has called our attention to the omission of the extinct species Peromyscus maldonadoi from the list of Peromyscus species given in PN #10. P. maldonadoi was described in 1966 by Ticul Alvarez (Acta Zool. Mex., 8:1ff).

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Harold Klein, of the Department of Biological Sciences, State University of New York at Plattsburg, writes that he is working on the behavior and ecology of Peromyscus leucopus *and* P. maniculatus.

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David Ribble's work demonstrating a monogamous mating pattern in *P. californicus* using a combination of molecular markers and fluorescent dye-marked animals was featured in the UP FRONT section of the December 1990 issue of *Discover* magazine.

We also noted that Rodney Honeycutt in one of many molecular evolutionists in the "academic pedigree" of Alan Wilson's lab illustrated in the 22 Feb issue of *Science*.

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In PN #10 (September 1990), in our Peromyscus Pioneer essay on Jack King, we overlooked mentioning two of his former graduate students who published on *Peromyscus*: **Lincoln Gray** and **Richard Tardif**. Gray published several papers on deermice, including one with King (1986. Am. Nat. 127:577ff) showing that a multidimensional-scaling technique, INDSCAL, can be useful in detecting influences on animals when they select from an array of choices. Gray and Tardif (1979. J. Comp. Physiol. Psych., 93:1127ff) showed that different subspecies of *P. maniculatus* have different food preferences.

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The new technique of in situ hybridization of biotinylated molecular probes to chromosomes is now being employed in Peromyscus by Robert Baker of Texas Tech University and his collaborators. See Evolution 44:2083ff (1990).

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We received a letter from William C. Guest, University of Arkansas, who tells us he has retired. Dr. Guest related that an encounter with Lee R. Dice in 1962 at the University of Alabama led to his interest in Peromyscus. *At that time Dr. Dice had retired and frequently spent time with his daughter, Dorothy Dice Foster, who was at then on the faculty of Mississippi State College for Women. Dr. Guest states that he invited Dice to Tuscaloosa to present a seminar. Dr. Guest also mentions that he spent a sabbatical year in T.C. Hsu's lab. Dr. Guest is moving "out west".*

WHO USES THE *PEROMYSCUS* STOCK CENTER??

We are often asked: "Who uses the *Peromyscus* Genetic Stock Center, since these rodents occur just about anywhere in the wild in North America? Why don't people just go out and trap them?"

Of course, there are many answers to this question. For some it is a matter of convenience: "I don't have the time or the traps. It's worth $5/animal to get them from the Stock Center."

Others, for example those working with Lyme disease, want animals negative for common murine viruses and other pathogens.

Still others want certain mutants or animals of known pedigree.

To assess the uses of animals from the Stock Center for the past six years (4-85 through 3-91), we analyzed utilization as reflected by requests from investigators external to the home institution (University of South Carolina). We thought it would be of interest to share this information with our PN readers.

What kinds of *Peromyscus* are requested? We filled 75 separate orders providing 2,369 specimens (living animals, preserved specimens and fresh tissue or blood). The breakdown is as follows:

Description	Number supplied	Number requests*
Live Wild-types		
P. maniculatus BW stock	1,047	28
P. leucopus LL stock	439	25
P. polionotus PO stock	119	8
Other wild-type	31	2
Live Genetic Variant Types.		
P. maniculatus ADH variants	96	4
P. maniculatus Coat color mutants	82	7
P. maniculatus Behavioral mutants	20	1
TOTAL LIVE ANIMALS	1,834	
PRESERVED SPECIMENS	360	5
FRESH OR FROZEN TISSUES	175	6

*Some requests are for more than a single type.

Where do Stock Center requests originate? During the survey period we received external orders from 22 states, the District of Columbia and two foreign countries. More orders originated from and more animals were shipped to Maryland than to any other state. Part of this reflects the fact that two major users, NIH and Johns Hopkins University, are located in this state.

State or Country	Number of Orders	Number of Animals or Specimens
Maryland	13	508
New York	7	163
Texas	6	318
South Carolina	6	167
Ohio	6	158
North Carolina	5	96
Missouri	4	160
Virginia	4	54
Oklahoma	3	60
Illinois	3	32
Washington	2	384
Florida	2	23
Georgia	2	23
JAPAN	1	54
Nevada	1	50
Colorado	1	30
GERMANY	1	24
Arizona	1	20
California	1	20
Indiana	1	12
Utah	1	8
Wisconsin	1	6
Pennsylvania	1	5
Dist. of Columbia	1	4
Vermont	1	1

What kinds of institutions use ***Peromyscus?*** Most requests (57 of 75) originate in academia. The others come from non-university public research organizations, museums and exhibits and from private individuals or corporations.

Type of Organization	Number of Requests Filled
Universities	51
Colleges (2-4 year)	6
Non-university Public Organizations and Institutes	15
Non-affiliated researchers or proprietary	3

What purposes are the *Peromyscus* specimens being used for? The types of research involved usually are indicated by the mission of the request-originating department or organizational unit. This breakdown indicates that most requests are for basic scientific studies, followed closely by medically-related research.

Type of Department/Unit	Number of Requests Supplied
Academic Biology, Biological Sciences and Zoology	30
Medical or Health Science	17
Psychology and Behavioral Science	8
Wildlife and Conservation	6
Veterinary Sciences	4
Museums and Exhibits	4
Miscellaneous	3

How many research articles have been published during the survey period based on animals provided from the *Peromyscus* Genetic Stock Center? More than 30 that we are aware of.

Is there internal utilization of the Stock Center? The Stock Center has provided animals for several internal projects funded from extramural sources. For example, the Stock Center provided 738 animals for projects funded by NIH and Upjohn Corporation. These provided $ 11,377 in user fees to the Stock Center. Another 1,022 animals were used in University-supported projects.

Does the Stock Center make money? No way!! The $ 5/animal user fee represents less than 15% of the actual costs to provide these animals. During the period 1985-90 most of the cost was generously subsidized by South Carolina state-appropriated (taxpayer) funds, and about 20% by NSF. Recently, NSF increased its proportional share.

Is the Stock Center approved for humane animal care? Definitely! The University is fully accredited by AAALAC and is in full compliance with all relevant laws and regulations. We are inspected regularly by the IACUC, USDA, *etc*.

We'll be happy to answer any additional questions..........just call or write:

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PEROMYSCUS STOCK CENTER

What is the Stock Center? The deer mouse colony at the University of South Carolina has been designated a genetic stock center under a grant from the Biological Research Resources Program of the National Science Foundation. The major function of the Stock Center is to provide genetically characterized types of **Peromyscus** in limited quantities to scientific investigators. Continuation of the center is dependent upon significant external utilization, therefore potential **users are encouraged to take advantage of this resource.** Sufficient animals of the mutant types generally can be provided to initiate a breeding stock. Somewhat larger numbers, up to about 50 animals, can be provided from the wild-type stocks.

A user fee of **$5 per animal** is charged and the user assumes the cost of air shipment. Animals lost in transit are replaced without charge. Tissues, blood, skins, etc. can also be supplied at a modest fee. Write or call for details.

Stocks Available in the Peromyscus Stock Center:

WILD TYPES	ORIGIN
P. maniculatus bairdii (BW Stock)	Closed colony bred in captivity since 1948. Descended from 40 ancestors wild-caught near Ann Arbor MI
P. polionotus subgriseus (PO Stock)	Closed colony since 1952. Derived from 21 ancestors wild-caught in Ocala Nat'l. Forest FL. High inbreeding coefficient.
P. polionotus leucocephalus (LS Stock)	Derived from mice wild-caught on Santa Rosa I., FL. Bred by R. Lacy. 3rd to 5th generation in captivity
P. leucopus (LL Stock)	Derived from 38 wild ancestors captured between 1982 and 85 near Linville NC. Sixth to eighth generations in captivity.
P. maniculatus X *P. polionotus* F_1 Hybrids	Sometimes available.

MUTATIONS AVAILABLE FROM THE STOCK CENTER

Coat Colors	**ORIGINAL SOURCE**
Albino *c/c*	Sumner's albino deer mice (Sumner, 1922)
Ashy *ahy/ahy*	Wild-caught in Oregon ~ 1960 (Teed *et al.*, 1990)
Black (Non-agouti) *a/a*	Horner's black mutant (Horner *et al.*, 1980)
Blonde *bl/bl*	Mich. State colony (Pratt and Robbins, 1982)
Brown *b/b*	Huestis stocks (Huestis and Barto, 1934)
Dominant spotting *S/-*	Wild caught in Illinois (Feldman, 1936)
Gray *g/g*	Natural polymorphism. From Dice stocks (Dice, 1933)
Ivory *i/i*	Wild caught in Oregon. (Huestis, 1938)
Pink-eyed dilution *p/p*	Sumner's "pallid" deer mice. (Sumner, 1917)
Platinum *pt/pt*	Barto stock at U. Mich. (Dodson *et al.*, 1987)
Silver *si/si*	Huestis stock. (Huestis and Barto, 1934)
White-belly non-agouti a^{w}/a^{w}	Egoscue's "non-agouti" (Egoscue, 1971)
Wide-band agouti $A^{Nb}/-$	Natural polymorphism. Univ. Michigan stock (McIntosh, 1954)
Yellow *y/y*	Sumner's original mutant. (Sumner, 1917)

Note: Some of the coat color mutations are immediately available only in combination with others. For example, silver and brown are maintained as a single "silver-brown" double recessive stock. Write the Stock Center or call (803) 777-3107 for details.

Other Mutations and Variants	ORIGIN
Alcohol dehydrogenase negative *Adh°/Adh°*	South Carolina BW stock. (Felder, 1975)
Alcohol dehydrogenase positive *Adh^f/Adh^f*	South Carolina BW stock. (Felder, 1975)
Epilepsy *ep/ep*	U. Michigan *artemisiae* stock. (Dice, 1935)
Flexed-tail* *f/f*	Probably derived from Huestis flexed-tail (Huestis and Barto, 1936)
Hairless-2 *hr-2/hr-2*	Egoscue's hairless (Egoscue, 1962)
Juvenile ataxia *ja/ja*	U. Michigan stock. (VanOoteghem, 1983)

Enzyme variants. Wild type stocks given above provide a reservoir for several enzyme and other protein variants. See Dawson *et al.* (1983).

*Available only on pink-eye dilution background.

Other Resouces of the *Peromyscus* Genetic Stock Center:

Preserved or frozen specimens of types given above.

Tissues, whole blood or serum of types given above.

Flat skins of mutant coat colors or wild-type any of the species above.

Purified DNA from *P. maniculatus, P. leucopus, P. polionotus* and other species upon request.

P. maniculatus genomic library.

P. maniculatus liver cDNA library.

Several behavioral (neurological) variant deer mice held in the *Peromyscus* Behavior Genetics Stock Center at the University of South Carolina Aiken Campus. See PN #10 for additional information.

Limited numbers of other stocks, species, mutants and variants are on hand, or under development, but are not currently available for distribution. For additional information or details about any of these mutants or stocks contact:

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PEROMYSCUS PIONEER

Harold J. Egoscue

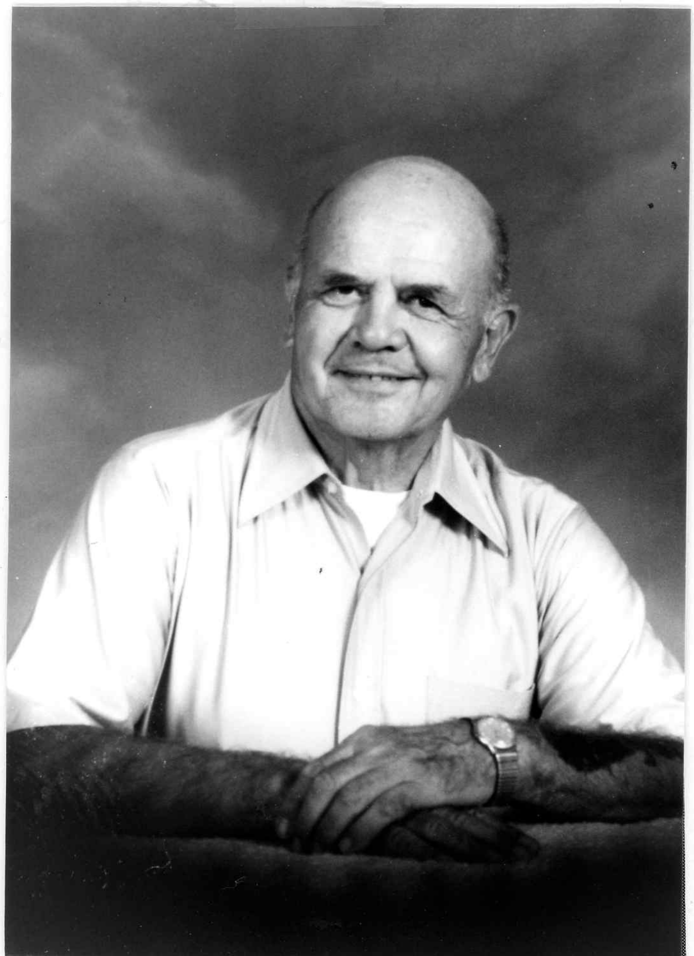
Most readers of PEROMYSCUS NEWSLETTER are likely to be familiar with Harold Egoscue for his contributions in one or the other, but probably not both, of two distinct areas of deer mouse research: formal genetics or ectoparasitology. It is also true that many who are aware of his work with *Peromyscus* or fleas are unacquainted with his studies of ecology of foxes and weasels or his expertise in captive animal breeding and American Indian archeology. These truths speak to the many diverse interests and activities in the remarkable life of Harold Egoscue.

Harold Egoscue (pronounced uh-GOS-q) was born in 1917 in Winnemucca, Nevada, the eldest of four children of Laura and Peter Egoscue. Harold's father, who immigrated at age 16 from the Basque region of southern France in 1905, had become one of northern Nevada's leading sheep ranchers. In this rural setting Harold spent his childhood, where his natural surroundings undoubtedly stimulated his interest in the outdoors and animal life. When Harold was 7 his father died and his mother continued to operate the sheep business for a few years, but then the family moved back to western Oregon where her relatives resided. Harold's mother nurtured his interest in wildlife tolerating a wide variety of creatures (but drawing the line at rattlesnakes!). Upon graduation from high school at Forest Grove, Oregon, in 1934 with the Great Depression still underway, Harold enlisted in the Marine Corps for a four year hitch, after which he worked in logging camps, on a mining lease in Nevada, at a vegetable cannery or wherever else he could locate employment. Two weeks after Pearl Harbor he joined the Navy for his second tour of military duty, spending World War II in the Pacific theater. During the war years he met his wife, Ozel, a girl from Oklahoma, who was employed at the Presidio Hospital in Monterey, California. Soon thereafter, in 1943, they were married. Their son, Peter, was born on Christmas eve, 1945. A daughter, born in 1947, died in infancy.

After the war Egoscue took advantage of the GI Bill of Rights, and at age 31 enrolled in college at Utah State University, graduating in 1952 with a degree in wildlife management. Professor J.S. Stanford at Utah State further stimulated Harold's interest in small mammals, and was the first to point out to him that fleas were worthy of study. Later, Dr. C. Andresen Hubbard also was important in promoting his interest in siphonapterans.

Upon completing college Egoscue applied for three positions, and received three offers. Two of these were from state fish and game departments who needed game wardens. These two did not appeal to Harold, but the third was from Dugway Proving Ground where a biologist was needed to work with small mammals. He accepted this position and spent the following 18 years at Dugway. The Army was involved in research on vector-transmitted diseases, such as typhus, tick fever, Q fever and plague. Harold's interests in small mammals and fleas coincided ideally with the Army's concern with these organisms.

A year after Harold started at Dugway, the University of Utah was awarded a contract for research at the Proving Ground. He became a Research Mammalogist affiliated with the University. Angus Woodbury, the first Director of the Ecological and Epidemiological Research Activity, selected Harold to establish the Faunal Laboratory, giving him a large vacant building, which had the distinction of being the only air-conditioned building on the post at that time, and plenty of mouse cages and racks.



Harold J. Egoscue

Egoscue was assigned responsibility for modifying the building, trapping the animals and initiating the captive colonies. He was also provided assistance by qualified military personnel. One of these was Billy N. Day, who had a master's degree in animal physiology and a background in genetics. Others were J.G. Bitterman and J.A. Petrovich, who stayed on as civilian employees.

During the years of operation of the Faunal Laboratory, Egoscue and his assistants produced more than 100,000 animals of 17 different species, including, in addition to *Peromyscus*, kangaroo rats, harvest mice, grasshopper mice, wood rats, voles, gerbils and skunks. The Faunal Laboratory also was charged with field work and collection of mammals on the Dugway reservation. An extensive population study Egoscue conducted of 300 wild-captured kit foxes is classic and has served as a model for other such studies.

Four species of *Peromyscus* were bred at the Dugway Faunal Laboratory: *P. maniculatus*, *P. crinitus*, *P. truei* and *P. californicus*. Egoscue chose deer mice (*P. maniculatus sonoriensis*) to initiate the Faunal Lab because they were the easiest to obtain and were known to breed well in captivity. This species was the predominant one throughout the history of the Dugway lab, with a total of about 75,000 reared. E.A. Shippee assisted him in collecting most of the animals used in founding the *Peromyscus* stock. By the late 1960's the Dugway *Peromyscus* colony was the largest in existence with an average population of more than 2,000 animals. Most of the deer mice were used in disease research under the Army contract, but Egoscue took advantage of access to these animals to make observations and conduct studies of his own on reproduction, physiology, behavior and genetics.

Among *Peromyscus* geneticists Harold Egoscue is best known for his discovery of several distinctive autosomal mutations in the deer mouse. Three of these were formally described in the *Journal of Heredity*. The first mutation, which was reported in 1958 in a paper co-authored with Day, was orange-tan (symbol *ot*), an autosomal recessive coat color variant (*J. Hered.*, 49:189ff). The phenotype of the adult orange-tan deer mouse fits its name. The orange-tan mutant deer mouse is now known to be an allele at the brown (*b*) locus.

In 1971 Egoscue reported "non-agouti" deer mice (*J. Hered.*, 62:372). This report was exciting because Dice, McIntosh and others had long sought a deer mouse mutant parallel to the non-agouti house mouse (*Mus*). The non-agouti mutant described by Egoscue was essentially a black deer mouse with a white ventrum. A few years later, when a completely black non-agouti was described by Horner *et al.* (*J. Hered.*, 71:49ff), Egoscue's non-agouti was renamed white-bellied non-agouti. Both mutations are alleles at the agouti locus.

Perhaps the most intriguing of Harold Egoscue's deer mouse mutants is hairless-2 (symbol originally *n*, but now *hr-2*) (*J. Hered.* 53:192ff). This mutation differs in several respects from a previously known hairless variant (*hr-1*). Most recognizably, the hairless-2 mutant has stubby vibrissae whereas hairless-1 has long vibrissae (See PN #6,p.15-16). The hairless-2 mutant was used recently by Upjohn Corporation in research involving the hair restorer minoxidil. Research with the hairless-2 variant continues to be conducted at the *Peromyscus* Genetic Stock Center, where scanning EM, molecular and other studies are in progress (Knapp, *et al.* unpub.).

In addition to these, Harold Egoscue identified several other variants in the deer mouse and other rodent species. One deer mouse mutant, which he named "recessive buff", was a brownish-tan variant. He also initiated a collection of skins and color slides of the *Peromyscus* variants for posterity.

Egoscue published several papers on flea-host associations involving *Peromyscus* (*Great Basin Nat.* 26:71ff, 48:530ff) including transfer of fleas between deemice and other small mammals (*ibid.*, 36:475ff).

When the Army contract with the University of Utah terminated in 1970, Egoscue's position with Dugway was abolished. He placed his name on a register for a federal position and was soon offerred a curatorship of mammals with the National Zoo in Washington, D.C. Harold's previous experience with captive breeding served him well in this new job where he helped in planning facilities for various exhibits and in developing the Small Mammal Exhibit. He was promoted to a senior staff position and became a liaison between the Zoo and the parent Smithsonian Institution, as well as with the Zoo extension at Front Royal, regarding matters of breeding rare and endangered species. One of his major contributions was bringing the prairie dog to the National Zoo. This provided an opportunity to study a prairie dog burrow system and identify previously unknown facets of burrowing and hiberation behavior.

After his retirement from the National Zoo in 1979, Harold and his wife returned to Grantsville, Utah, not far from Dugway, and where he had built a home a dozen years earlier. However, retirement has not been idle for Egoscue. He served as a consultant for a study of the San Joaquin kit fox in southern California, assisted graduate students at the University of Utah with wildlife projects and undertook a study of the ecology of fleas of the Great Basin. He continues to research fleas of *Peromyscus* and other small mammals, having collected around 12,000 flea specimens. After his wife passed away in 1984, Harold undertook a search for his Basque roots. At the outset he had very little information since all of the documentary evidence his father had brought to America had been destroyed in a fire. After three years of substantial detective work he discovered the location of his father's home village in the Pyrenees Mountains of southern France. Travelling there in 1988, he discovered the home where his father had been born. He was able to obtain copies of records concerning his family and visited the family ancestral town of Egozscue, where his surname originated, a pusuit of considerable satisfaction. Harold also is an enthusiastic gardener, and his home has won two beautification awards. His son, Peter Egoscue, has become well-known among celebrities and in athletic circles for his somewhat controversial holistic approach to fitness therapy and sports medicine. Harold has three college-age granddaughters.

Harold Egoscue has published 44 research articles plus other informal reports during his career. Sixteen of these appeared in *Journal of Mammalogy*. He also published in *Science*, *Journal of Heredity* and *Southwestern Naturalist*. He prepared the entry for swift fox (*Vulpes velox*) for *Mammalian Species* (#122). Although officially retired for more than ten years, Egoscue has published seven papers in the past decade, describing a new flea species as recently as 1989 (*Bull. So. Cal. Acad. Sci.*, 88:131ff). Almost certainly, there will be other reports yet to come. He is highly regarded as an expert on maintenance of rodents in captivity and as an authority on fleas of the Great Basin region. Among *Peromyscus* geneticists he is recognized widely for the genetic variants he formally described. Among those who are aware of his contributions and the breadth of his knowledge and interests he is regarded as truly a naturalist's naturalist.

References.

The Salt Lake Tribune. Aug. 6, 1967. Bald deer mouse shows what makes him tick. (R. Halliday)

Tigertalk. March 1979. Harolod J. Egoscue, mammalogist, retires.

The Grantsville Gazette. Aug. 3, 1988. Harold J. Egoscue - his life and career have reflected his love of nature, animals and people. (M.R. Hammond)

Cross Reference to Tables Listing Genetic Loci

Tables listing genetic loci in *Peromyscus* were published in previous issues of PEROMYSCUS NEWSLETTER. Below is a cross reference to the most recently published tables and literature citations for each species or species group.

Tables of Genetic Loci Identified by Formal Mendelian Analysis:

Peromyscus maniculatus species group. Tables 1A, B, C and D. **PN # 9** pp. 13 - 18.

Peromyscus leucopus species group. Table 1. **PN # 8** pp. 12 - 13.

P. truei, P. eremicus and *P. californicus.* Table 2. **PN # 8** pp 12 - 13.

Tables of Presumptive Genetic Loci Identified as Protein Electrophoretic or Immunological Variants:

Peromyscus maniculatus species group. Table 2. **PN # 9** pp. 19 - 22.

Peromyscus (Megadontomys) thomasi. Table 3. **PN # 8** p. 15.

Peromyscus (Podomys) floridanus. Table 4. **PN # 8** p. 16.

Peromyscus californicus. Table 5. **PN # 8** p. 17.

Peromyscus eremicus. Table 6. **PN # 8** p. 18.

Peromyscus boylii species group. Table 7. **PN # 8** p. 19 - 21.

Peromyscus truei species group. Table 8. **PN # 8** p. 22 - 23.

Peromyscus leucopus species group. Table 9. **PN # 8** p. 24 -26.

Table of Linked Loci and Linkage Map:

Peromyscus maniculatus. **PN # 7** pp. 19 - 21 (map) and **PN # 9** Table 3 p. 23.

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NOTICE

PEROMYSCUS NEWSLETTER IS NOT A FORMAL SCIENTIFIC PUBLICATION.

Therefore ...

*INFORMATION AND DATA IN THE "CONTRIBUTIONS" SECTION
SHOULD NOT BE CITED OR USED
WITHOUT PERMISSION OF THE CONTRIBUTOR.*

THANK YOU !

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TAXONOMIC STATUS OF *PEROMYSCUS GOSSYPINUS ANASTASAE* (ANASTASIA ISLAND COTTON MOUSE)

ABSTRACT. (submitted to Journal of Mammalogy) Four subspecies of cotton mice (*Peromyscus gossypinus*) were examined to assess the taxonomic validity of *P. g. anastasae* and the taxonomic affinity of the mice on Cumberland Island, Georgia. For genetic analysis, 44 loci in 379 mice from 14 populations (6 island, 8 mainland) were examined, and for morphometric analysis, 27 characters on 683 mice from 20 populations were examined. Polymorphic loci and heterozygosity per population averaged 40% and 10%, respectively, and there was no reduction of genetic variability on islands. Insular mice tended to be smaller than mainland mice. Every population was genetically and/or morphologically different from all other populations for at least one character in pairwise comparisons. However, when all populations were examined simultaneously, the pairwise differences were not significant. While each population was statistically distinct, none was unusually distinct, and neither the Cumberland Island nor Anastasia Island populations of *P. g. anastasae* warrant recognition as separate subspecies.

CONTINUING STUDIES OF *PEROMYSCUS*

The above paper deals strictly with the taxonomy of *P. g. anastasae*. My professors and I are continuing this taxonomic study and looking at the entire range of the species. We have found what appears to be an unusual distribution of genetic variance in this species, where adjacent populations are as different as some *Peromyscus* species, but there appears to be no geographic pattern to this variation. If this trend continues, these results would invalidate all of the current subspecies boundaries, but would not suggest new boundaries (other than to describe individual populations). We believe that we have also found temporal variation within sample sites, and we continue to examine this question. Of particular interest are the conservation and taxonomic implications of this dynamic distribution of genetic variance.

In an unrelated study, Dr. Laerm and I are attempting to develop a discriminant model to separate the four southeastern *Peromyscus* species using only cranial measurement data. If successful, this model will allow us to identify questionable and possibly misidentified specimens in our museum. Thus far, we have only been partially successful, in that we must use at least eight characters to reliable separate them. Contrary to our work, other authors have found this to be quite a simple problem; comments and suggestions would be appreciated.

* * *

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INTERACTIONS OF DEER MOUSE SEED CACHING, BITTERBRUSH GERMINATION AND CATTLE GRAZING

Deer mice (*Peromyscus maniculatus*) are fairly abundant in habitats dominated by antelope bitterbrush (*Purshia tridentata*). In telemetry studies we found that deer mice are found in and under bitterbrush plants much more frequently than expected by chance. Others have indicated that deer mice consume large quantities of bitterbrush seed but that deer mouse caching of these seeds can promote germination. In Montana, bitterbrush habitats are also frequently grazed by cattle.

Beginning in April 91, we are going to investigate the effect of cattle grazing on the deer mouse - bitterbrush interaction. We will use radio collared deer mice to determine habitat selection in bitterbrush habitats before, during and after cattle are grazed in the habitats. Essentially we will be using cattle to modify habitats to test microhabitat selection data. This will be done in a series of replicates with appropriate controls. Grazing replicates will be contained within portable electric fences. We will also attempt to locate food caches of radio collared mice in an attempt to clarify the caching-germination relationship.

This will be logistically very difficult but we feel confident that it will at least provide a rather direct indication of what deer mice do while giants (cows) are busy stomping their habitat.

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We are interested in the sense of taste in *Peromyscus* and how it may influence the feeding habits of free-ranging mice. Specifically, we are comparing the feeding responses of several *Peromyscus* species (*melanotis*, *aztecus*, *maniculatus*, *leucopus* and *polionotus*) to bitter and astringent foods. Present projects address the following questions. What is the relative importance of taste versus post-ingestional factors in determining responses to bitter-tasting foods? Are certain species generally insensitive to a variety of bitter compounds? Do salivary proteins influence ingestive responses to bitter and/or astringent foods?

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Temporal and Spatial Genetic Variation of *Peromyscus* in Virginia

The white-footed mouse, *Peromyscus leucopus noveboracensis*, and the cloudland mouse, *P. maniculatus nubiterrae*, occur sympatrically in the southern Appalachian Mountains at elevations greater than 800m. Below this elevation, however, only *P. leucopus* occurs. Populations of *P. maniculatus* and *P. leucopus* at Mountain Lake Biological Station (Virginia) have been monitored for the past eleven years, and documented densities fluctuate from 3-60 mice/ha. During the summer of 1990, the highest *Peromyscus* population densities were recorded. Based on the patterns of population fluctuations, it is predicted that the *Peromyscus* populations will experience severe declines due to low production of acorns. Preliminary surveys in the fall of 1990 suggest that there is a severe decline in over-wintering food availability (Wolff, personal communication). Thus, it is likely that these species will experience a population bottleneck in the near future.

The predictability of population fluctuations allows for the genetic analysis of the populations prior to environmental stress. The general objective of this study is to investigate the spatial and temporal genetic variation of these *Peromyscus* species during the time preceding and succeeding limited food resource availability. Areas of interest include: 1) levels of genetic variation within and among populations of each species and the patterns these exhibit on a temporal scale; 2) species differences in the genetic structure of populations with respect to variation in their dispersal patterns; 3) temporal changes in behavioral and morphological characteristics that may be correlated with genetic variation.

P. leucopus and *P. maniculatus* were live trapped at three locations in the vicinity of Mountain Lake Biological Station. On Mountain Lake, two series of trapping grids are separated by approximately 500m; a third grid series was trapped on Peter's Mountain, approximately 10km from the Mountain Lake study site. On the grids that have been monitored for the past 11 years, only blood samples were collected; heart, kidney, liver, muscle and blood samples were collected on the remaining grids. The animal carcasses were frozen and will be used for analyzing morphological variation and fluctuating asymmetry. The first year's samples were collected in summer of 1990, the season prior to the expected population "crash". Tissue and blood samples will be collected and analyzed over the next two years (1991-1992) following the expected decline in *Peromyscus* population densities.

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Peromyscus leucopus is one of three species studied to determine the role of acetylcholine (ACh) receptor in the toxicity of organophosphorus (OP) insecticides. These receptors mediate important cellular processes critical to maintenance of normal physiology and behavior. Regulation of receptor number is thought to be involved in the tolerance or resistance to these compounds often observed after repeated exposure. We are specifically interested in the muscarinic ACh receptor in two areas: (1) the direct action of OP insecticides on the receptor and (2) regulation of muscarinic receptor subtypes during subacute sub-lethal exposure to OPs.

Only preliminary data have been obtained and they indicate that *Peromyscus* do possess these receptors in both brain and heart and in comparable concentrations to laboratory rodents, however there may some significant differences in receptor subtype diversity among species. These differences may be correlated with the differences observed in sensitivities to OPs among species.

Peromyscus are consumers of seeds and insects and an important food source for many predators. Exposure to OPs occurs in habitats adjacent to, or within areas sprayed for the control of insect pests. Comparative data on OP neurotoxicity may help to identify those species most vulnerable to the toxic effects of these widely used insecticides and determine the applicability of laboratory rodent models to non-target field species.

The above studies are part of my Ph. D. dissertation project conducted under Prof. A. T. Eldefrawi at the University of Maryland at Baltimore, Toxicology Program, School of Medicine in conjunction with the Patuxent Wildlife Research Center where I also hold a position as a wildlife biologist.

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Patterns of Small Mammal Community Structure in the Southern Appalachians

I am currently conducting two research programs that involve studies of *Peromyscus maniculatus*. The first of these concerns patterns of local and regional abundance in small mammal communities in the southern Appalachians. The small mammals of this region comprise some of the most diverse assemblages of mammalian fauna in eastern North America. However, due to their affinity for northern boreal habitats, many of these mammals are limited in their ranges and thus restricted to isolated islands of spruce-fir and other high elevation plant communities. Between 1986 and 1988 Dr. Roger Powell (of N.C. State University) and I assessed patterns of community structure and local abundance in 23 sites (ten mountain peaks) throughout this region. Local density of the more common species, such as *Peromyscus maniculatus*, was significantly higher in the northern peaks and lowest in the southernmost peaks such as the Smoky Mountains. Patterns of local population density for all species observed was positively correlated with the overall size of the their geographic ranges and their regional abundance (the number of sites on which each species was observed). We are also currently examining patterns of community composition in this region with respect to variation in vegetation structure.

Tannins and Partial Consumption of Acorns by Small Mammals: A New Look at Seed Dispersal

Recently several colleagues and I have shown that many vertebrate seed predators, including *Peromyscus maniculatus*, exhibit a preference for the proximal portion of many acorn species. This preference corresponds with lower tannin concentrations and these partially eaten seeds still germinate following attack by seed predators, suggesting a novel mechanism of seed dispersal. Currently, my students (Wendy Bachman, John Daley, Kimberly Gavel) and I are conducting a series of field preference experiments to test the hypothesis that tannins directly encourage partial consumption by mammalian predators and thereby increase the probability of seed dispersal. Laboratory experiments are also planned to test the effects of temperature and food availability on partial acorn consumption in *P. maniculatus*. Finally, we are testing the effects of various seed predators on predation and dispersal of acorns by experimentally excluding the mammalian (primarily *P. maniculatus* and *Sciurus carolinensis*), avian, and insect consumers that feed on acorns of the bear oak (*Q. ilicifolia*).

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Summary: The population and behavioral dynamics of white-footed mice, *Peromyscus leucopus* and deermice, *Peromyscus maniculatus*, have been monitored continuously for the last 11 years at the Mountain Lake Biological Station in southwestern Virginia. The population densities of both species combined have "cycled" three times during these 11 years with densities ranging from lows of three mice/ha to highs of over 80 mice/ha. Population increases and peaks followed autumns of high mast production. The availability of mast, primarily acorns, resulted in winter breeding and high overwinter survivorship. During populations peaks, food and space were limited, animals were aggressive, home range sizes were small, dispersal and movement rates were low, juveniles remained in their natal home ranges longer, and reproduction of young-of-the-year was suppressed. On the other hand, at low densities food and space were not limited, mice were not aggressive, home range sizes were large, dispersal and movement rates were high, juveniles left their natal home ranges at a younger age, and young-of-the-year became sexually mature and reproduced in their first summer. Mast production in autumn 1989 was good resulting in summer 1990 densities of over 80 mice/ha. Mast production in autumn 1990, however, was poor and I am expecting a population decline this year and perhaps for the next two years. These results confirm the importance of long-term studies in demonstrating and explaining the behavioral variance that occurs in natural populations.

New Objectives: I am collaborating with Dr. Ed Pivorun at Clemson University on a study of torpor in the two species. Ed's previous work has shown that under reduced food ration and cold temperatures about 50% of *P. leucopus* and 75% of *P. maniculatus* from North Carolina have the ability to enter and arouse from torpor. Our preliminary results suggest that nearly 100% of the animals of both species from the Virginia population exhibit spontaneous torpor. We propose to examine the selective advantages of this physiological response as it relates to environmental pressures.

(See also summary of work being conducted by Kathryn Gubista, University of Georgia).

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