PEROMYSCUS NEWSLETTER

NUMBER THIRTY

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Cover: Peromyscus Stock Center External Advisory Committtee.
Members attending the annual meeting 17 November 2000:
Left to right (top row): Meredith Hamilton, Victor
Sanchez-Cordero, Duke Rogers, Gary Van Zelt
(front row) Priscilla Tucker, George Smith, Ira Greenbaum
Not in photo: James Womack and Terry Yates.
(photo by Clint Cook)

ISSUE NUMBER 30.

Well here we are with issue #30 of *PEROMYSCUS NEWSLETTER.* I think that many of us had our doubts that we could sustain *PN* for this long, but we still keep chugging along. We are pleased that we enjoy a loyal core of supporters, that continue to encourage us, despite some naysayers who insist that we could do it all "on line." No doubt, we could do it via Internet, but, call us old fashioned, I still feel there is some advantage to having the hard copy arrive in the mail, where you can immediately turn to the pages that are of interest to you, rather than clicking through an unfamiliar menu of options. We have strived to maintain an expected regularity to our issues - the most recent *Peromyscus* literature is always listed at the end, the "News and Comment" at the beginning, with special features and readers contributions between. We ran 175 copies of *PN* #1. We will run about 900 copies of *PN* #30.

Just prior to final editing for this issue we were informed that **Dr. Van T. Harris** had died on November 1, 2000. We had planned to feature Dr. Harris as the next essay in our "Peromyscus Pioneer" series. Although we do not have all of the biographical data that we had hoped to receive from Van, we will proceed with the planned feature. Van Harris was another of those productive proteges of Lee Dice who studied at the University of Michigan during the 1940s. Our abbreviated account is given on page 9. We extend our deep sympathy to his wife and family.

We are planning the next issue of *PN* (# 31) to be the first of our triennial "genome" issues. This issue will summarize the current state of knowledge of the genetics of peromyscine rodents, as it becomes more significant as a "non-traditonal" species for genome research. As you recall, we decided to reduce the repetitive tables of genetic content and concentrate and update that information, once in each sixth issue. For the forthcoming issue, we particularly want to encourage contributions from those who are conducting genetic (including genomic) research with deer mice and their allies. However, other (non-genetic) reports from our readers and other peromyscologists are welcome, as always.

The deadline for entries or other material for inclusion in the March "genomic" issue is **March 1st, 2001.**

wd

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NEWS, COMMENT and ANNOUNCEMENTS

The **Bruce Buttler Bibliography of Peromyscus** is now on-line in the current version of *Pero***Base**. At this point the bibliography can be searched by author or key title words. In due course, it will be possible to hot link reference citations elsewhere in the database directly to the bibliographical citation. See: *http://wotan.cs.sc.edu/perobase/*

Also in *Pero***Base** entries for the many peromyscine species are being added regularly. An editorial decision was made to have the content of the individual species accounts be presented in more depth than is seen in the typical field guide, but in less detail than is found in the *Mammalian Species* accounts. The idea was to make the species accounts more useful to field biologists and novices, without being overwhelming. More comprehensive information on specific topics, (*e.g.* behavior, reproduction, genetics) will become available elsewhere in the database.

<<<<<<>>>>>>

We received a very welcome letter from **Charles Foreman** who retired from the Biology faculty at the University of the South (Sewanee) in 1993 at age 70. Readers will recall that Charlie was one of the very first to use electrophoretic analysis to describe genetic variation in *Peromyscus*. He demonstrated Mendelian segregation of hemoglogin alleles in *P. leucopus* and *P. leucopus* X *P. gossypinus* hybrids. (See PN# 18). It was good to hear from Dr. Foreman. He reportd that he and his wife, Betty, are traveling a good bit to visit their daughters in Washington state and Winston-Salem NC.

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We regret to report the October death of **Dr. Walter Dalquest.** Dr. Dalquest was a faculty member at Midwestern State University (Texas) for many years. Walter was prominent in Pleistocene mammalian paleontology of western North America. Among his finds were many rodents, including Peromyscus. He was associated with many peromyscine biologists during his long career. We are saddened by this loss.

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THANKS TO **TONY SCHONTZ** OF MESA STATE COLLEGE FOR HIS DONATION OF THREE *PEROMYSCUS* cDNA CLONES (INTERLEUKIN 10, INTERFERON GAMMA AND TUMOR NECROSIS FACTOR) TO THE STOCK CENTER MOLECULAR BANK.

^^

Undergrad Faculty .... Consider using lab-bred deer mice or white-footed mice in undergraduate research or senior thesis projects. Maybe we can help. Call 803-777-3107.

We received a Febuary 4th Associated Press newspaper article from **Dr. E.W. Pfeiffer** of the University of Montana reporting some interesting results of a multi-year hantavirus survey in Montana conducted by Amy Kuenzi, Rick Douglass and Clifford Bond. Dr. Pfeiffer thought the article would be of interest to *PN* readers. Because of space limitations we give here an abbreviated version. For a photocopy of the entire article contact the Stock Center manager (See below).

SCIENTISTS PUZZLED AT HANTAVIRUS LEVELS

A surprisingly high percentage of deer mice tested by three Montana researchers during a three year study had been infected at one time or another with hantavirus. About one in four mice were infected. The project, dubbed "Mouse in the House" and funded by CDC, was initiated in October 1996 and continued until August 1999. The investigators trapped 2,185 deer mice and tested 2,003 of them, of which 490 exhibited antibodies for the disease. The result is especially relevant in this state, inasmuch as three Montanans have died of hantavirus infection since 1993, and several others have contracted it but survived.

Kuenzi *et al.* found three distinct deer mouse populations. Some live continually outdoors, regardless of having opportunity to enter barns and other outbuildings. Another group resides almost exclusively in buildings, while those in a third group move back and forth. The highest rate of infection occurred in the latter group. Those that lived exclusively indoors showed the second highest occurrence of hantavirus infection, while those that were found exclusively outdoors were least likely to be infected.

Since hantavirus is hypothesized to be transmitted among mice by biting, especially by males during territorial disputes, it was interesting that many of the animals showed torn ears and scarred backs. Field work on the project was done on two ranches near Butte and one near Cascade. Some animals were tracked using miniature radio collars and ear tags. Blood was also sampled.

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We welcome any news,
announcements, opinions or other information
for the "News & Comment" section of *PN*
Send your entries!

Janet Crossland, Peromyscus Colony Manager, now has an alternate phone number: **1-803-777-1212,** in the new animal facilities. Her office number, **1-803-777-3107** continues to be active.

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 Living Stocks Collection 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. Animals requested in greater numbers frequently require a "breed-up" charge and some delay in shipment.

A user fee of **$17.50 per wild-type animal** and **$ 25 per mutant or special stock animal** is charged. 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. Arrangements for special orders will be negotiated. Write or call for details.

Stocks Available in the Peromyscus Stock Center

WILD TYPE SPECIES	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 beachmice wild-caught on Santa Rosa I., FL. and bred by R. Lacy. Approximately 15 generations in captivity.
P. leucopus (LL Stock)	Derived from 38 wild ancestors captured between 1982 and 85 near Linville NC. Approximately 26 generations in captivity.
P. californicus insignis (IS Stock)	Derived from about 60 ancestors collected between 1979 and 87 in Santa Monica Mts. CA. Approximately 16 generations in captivity.
P. aztecus (AM Stock)	Derived from animals collected on Sierra Chincua, Michoacan, Mexico in 1986 Approximately 15 generations in captivity.
P. melanophrys	Originated from a group of animals collected at Zacatecas Mexico during the 1970's. Formerly maintained by R.W. Hill at Mich. State Univ.
P. eremicus	Originated from 10-12 animals collected at Carmel Valley CA in 1993. Approximately seven generations in captivity.
P. maniculatus X *P. polionotus* F_1 Hybrids	Bred to order.

MUTATIONS AVAILABLE FROM THE STOCK CENTER[1]

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 *bln/bln*	Mich. State U. colony (Pratt and Robbins, 1982)
[2]Brown *b/b*	Huestis stocks (Huestis and Barto, 1934)
California blonde *cfb/cfb*	Santa Cruz I., Calif., stock (Roth and Dawson, 1996)
Dominant spotting *S/+*	Wild caught in Illinois (Feldman, 1936)
Golden nugget b^{gn}/b^{gn} [in *P. leucopus*]	Wild caught in Mass. (Horner and Dawson, 1993)
Gray *g/g*	Natural polymorphism. From Dice stocks (Dice, 1933)
Ivory *i/i*	Wild caught in Oregon (Huestis, 1938)
[3]Pink-eyed dilution *p/p*	Sumner's "pallid" deer mice (Sumner, 1917)
Platinum *plt/plt*	Barto stock at U. Mich. (Dodson *et al.*, 1987)
[2]Silver *sil/sil*	Huestis stock (Huestis and Barto, 1934)
Tan streak *tns/tns*	Clemson U. stock from N.C. (Wang *et al.*, 1993)
Variable white *Vw/+*	Michigan State U. colony (Cowling *et al.*, 1994)
White-belly non-agouti a^w/a^w	Egoscue's "non-agouti" (Egoscue, 1971)
Wide-band agouti A^{Nb}/a	Natural polymorphism. U. Mich. (McIntosh, 1954)
Yellowish *yel/yel*	Sumner's original mutant (Sumner, 1917)

Other Mutations and Variants	ORIGIN
Alcohol dehydrogenase negative Adh^o/Adh^o	South Carolina BW stock (Felder, 1975)
Alcohol dehydrogenase positive Adh^f/Adh^f	South Carolina BW stock (Felder, 1975)
Boggler *bg/bg*	Blair's *P. m. blandus* stock (Barto, 1955)
Cataract-webbed *cwb/cwb*	From Huestis stocks (Anderson and Burns, 1979)
Epilepsy *ep/ep*	U. Michigan *artemisiae* stock (Dice, 1935)
[3]Flexed-tail *f/f*	Probably derived from Huestis flexed-tail (Huestis and Barto, 1936)
Hairless-1 *hr-1/hr-1*	Sumner's hairless mutant (Sumner, 1924)
Hairless-2 *hr-2/hr-2*	Egoscue's hairless mutant (Egoscue, 1962)
Juvenile ataxia *ja/ja*	U. Michigan stock (Van Ooteghem, 1983)
Enzyme variants.	Wild type stocks given above provide a reservoir for several enzyme and other protein variants. (Dawson *et al.*, 1983).

[1]Unless otherwise noted, mutations are in *P. maniculatus*.

[2]Available only as silver/brown double recessive.

[3]Available only as pink-eye dilution/flexed-tail double recessive.

OTHER RESOURCES OF THE *PEROMYSCUS* GENETIC STOCK CENTER:

Highly inbred *P. leucopus* (I_{20+}) are available as live animals or as frozen tissues.
Several lines developed by George Smith (UCLA) are currently maintained by the Stock Center.

Limited numbers of other stocks, species, mutants, inbreds and variants are on hand, or under development, but are not available for distribution. Currently we can supply up to 10 each of the species *P. eremicus* and *P. melanophrys*.

Preserved or frozen specimens of types given in tables above.

Tissues, whole blood or serum of types given in tables above.

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

Reference library of more than 2400 reprints of research articles and reports on *Peromyscus*.
Copies of individual articles can be photcopied and mailed. Please limit requests to five articles at any given time. There will be a charge of 5 cents per photocopied page after the initial 20 pages.

Materials are available through the *Peromyscus* Molecular Bank of the Stock Center. Allow two weeks for delivery. Included is purified DNA or frozen tissues from any of the stocks listed above. Several genomic libraries and a variety of molecular probes are available. (Inquire for more information)

For additional information or details about any of these mutants, stocks or other materials contact: Janet Crossland, Colony Manager, Peromyscus Stock Center, (803) 777-3107.

PLEASE CALL WITH INQUIRIES.

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Peromyscus Pioneer

VAN T. HARRIS

1915 - 2000

Between the mid-1930's and 1954 the Department of Zoology at the University of Michigan at Ann Arbor was the national focal point for *Peromyscus* research. There, under the tutelage of Lee R. Dice, a group of young graduate students and research associates explored many facets of the biology of these rodents. Dice had a deep interest in the still-emerging field of genetics of ecological adaptations and behaviors of small mammals, particularly deer mice (*P. maniculatus*). Among the bright graduate students in his group was Van T. Harris.

Van was born September 29, 1915 in Elkhart, Indiana. He completed his undergraduate studies at the University of Minnesota and went on to the University of Missouri for a master's degree. At this point his education was interrupted by World War II, but afterwards he entered Michigan to pursue a Ph.D. in zoology. Working with Lee Dice, Walter Howard, Betty Horner, Bill McIntosh and other talented personnel in the group, Van carried out a pioneer study of habitat selection by two subspecies (*P. m. bairdii* and *P. m. gracilis*) of deer mice in simulated conditions (Harris, 1952). This was among the first of many studies of similar nature conducted by numerous workers during subsequent years. Harris constructed artificial habitats in the lab that simulated in various ways natural habitats: (1) artificial grass made from strips of manila folder, (2) "jungle" of strips of wood in three-dimensional arrays, and (3) tree trunks with bark adhering and capped with curved cutouts of plywood. The habitats were also modified with differences in light intensity, type of food present and other factors. Animals of the two subspecies and, in one case, F_1 hybrids of the two, were introduced to a neutral zone and allowed to choose among "habitats". Animals of a given subspecies more frequently selected the "habitat" that most nearly resembled the natural habitat of that subspecies. The F_1 hybrids most often selected the artificial grass habitat, exhibiting a behavior more typical of the *P. m. bairdii* parent. Both lab-bred and wild caught animals were used.

Harris also conducted experiments demonstrating that different subspecies (*P. m. bairdii* and *P. m. gracilis*), when presented the opportunity to segregate in an artificial setting simulating natural habitats, do not, in general, segregate, but rather often aggregate as single socializing units regardless of the sex/subspecific combinations used. Only slight tendencies for formation of male-female pairs of different subspecies were noted, but some evidence for increased levels of male-female pairings within subspecies was observed (Harris, 1954). Harris (1952) demonstrated that habitat preferences of these races was genetic when tested separately. These investigations extended earlier ones conducted by Walter Howard.

Van Harris collaborated in a study of neoplasms in *P. maniculatus blandus* individuals and in a *P. m. blandus* X *P. polionotus leucocephalus* F_1 hybrid animal. All animals had a distant common ancestor in the deer mouse colony, indicating a possible genetic predeliction for tumor fomation (Fliegelman and Harris, 1948).

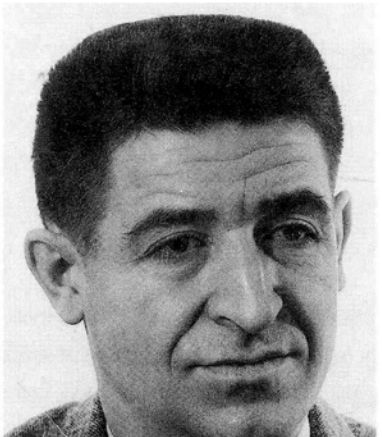
While at Michigan Van Harris collected a group of 42 *P. m. bairdii* over a two year period (1947-48) from the George Reserve about three miles west of the University of Michigan campus. A closed, random-bred stock was initiated from these animals that became known as the "BW" Stock for "*bairdii*" + "Washtenaw"

(County) where the George Reserve was located. This random-bred stock was used by John King, Walter Howard and William McIntosh, among many others, and still exists today. BW Stock animals have been bred by the thousands at the *Peromyscus* Stock Center and elsewhere. It is the most frequently used lab stock of *Peromyscus.*

Upon completion of his doctorate in 1950, Van worked two years at Johns Hopkins School of Hygiene and Public Health as a research associate and subsequently returned to Michigan for two years as a junior biologist in the Institute for Human Biology. In 1952 he became a research biologist with the U.S. Fish and Wildlife Service where he was stationed initially in Louisiana, and subsequently in Colorado, afterwhich he went to Washinton DC to become editor of U.S. F. & W. publications until his retirement from the Service in 1976.

Van married in 1950. He and his wife, Claire, have three children: a son, Tom, who received a Ph.D. in chemistry from Cornell and now resides in California; a daughter, Mary Clair Kennedy, who is a nurse and resides in Baltimore, and a second daughter, Carol Jean Appenzellar, now a historian in Martinsburg, WV. Following his retirement Van resided in Maryland and subsequenly in Pennsylvania.

Van Harris passed away 1 November 2000 at Clearville, PA.



VAN T. HARRIS

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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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DIFFERENCES BETWEEN THE DIGESTIVE TRACT OF *PEROMYSCUS GUATEMALENSIS* AND OTHER SMALL RODENTS IN THE MOUNTAINS OF SOUTHWESTERN GUATEMALA

It is assumed that when several species of similar size and belonging to the same taxon coexist in the same environment, they must have some differences in structure and habits that would reduce competition.

We studied this possibility in an abandoned agricultural field on the southeastern slopes of Mt. Santa María, an active volcano in southwestern Guatemala, Central America.

The objectives of our project were to 1) characterize the anatomy of the digestive tract of four species of small rodents captured in the slopes of Santa María volcano, 2) compare the internal and external morphology of the stomach, liver, intestines, and caecum of these same rodents, 3) determine, based on the anatomy of the intestinal tract, the differences on the feeding habits of these rodents that would allow them to share a common environment without excessive competition.

CHINCHILLA, MELGAR and HERNANDEZ (continued)

Twenty-five small rodents belonging to four different species were captured: 10 *Peromyscus guatemalensis*, 6 *Reithrodontomys sumichrasti*, 2 *Sigmodon hispidus*, and 7 *Heteromys desmarestianus*. After capture, they were euthanized using ether and their complete digestive tracts and liver were extracted. The external and internal morphology of these organs was observed and photographed. Each section of the digestive tract was measured separately in order to compare the size and shape of the segments between species. The differences were compared using the Kruskall-Wallis test.

Analyses indicated that there are no significant differences in the relative length of the segments of the small intestine and the caecum. However, there are differences in the shape and internal anatomy of the stomach and the caecum among the different species. The stomach of *P. guatemalensis* showed the specialized bilocular-discoglandular pattern, that reflects a varied, omnivorous diet. On the other hand, the stomach of *R. sumichrasti* is smaller and less complex, but suggests a similar pattern and diet. *Sigmodon hispidus* has a unilocular-hemiglandular pattern, reflecting an omnivorous diet but limited to soft foods. *Heteromys desmarestianus* has a simple, bag - shaped stomach, reflecting its largely herbivorous diet.

Considering our findings, we believe that *Peromyscus* and the other small rodents that share its habitat can coexist because their feeding habits are different.

* * *

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Comparative analysis of *Peromyscus* and *Chaetodipus* population density in two different habitats in Baja California Sur, México

Our objective was to compare the rodent populations from two different habitats of the Sierra de la Giganta in Baja California Sur, México. The field research was done during the dry season (March through May) and the rainy season (July through September) at two locations separated by 500 m. The research areas are at 24°08' north latitude and 11°40' west latitude, the elevation is 235 m, the climate is arid with an average temperature of 25.7° C, and the average rainfall per year is 22 centimeters. The two research areas have different habitats. Area I is a xerophytic scrub brush. Area II contains an oasis which provides a constant supply of water to the habitat, the vegetation in this areas is mainly mesophytic with herbaceous plants, shrubs, and trees.

We made four trap sessions every other month from March through September. Each session consisted of capturing rodents for three consecutive nights using the capture-recapture technique.

Four rodent species were captured in both research areas: *Peromyscus maniculatus, Peromyscus eva, Chaetodipus spinatus,* and *Chaetodipus arenarius*. *Chaetodipus* showed an increase in population density from March through September in both habitats. *Peromyscus* showed an increase in population density in Area I only during the same period. Area II had the highest number of rodents collected. *Chaetodipus* had the larger number of collected individuals during this study.

Habitat	Species	Density (individuals/ha)			
		March	May	July	September
Area I	*Peromyscus*	5	5	5	7
	Chaetodipus	9	17	20	23
Area II	*Peromyscus*	11	13	9	8
	Chaetodipus	37	49	54	58

In arid lands, small mammals, like rodents, depend on vegetation, seeds, and invertebrates for their survival (Vaughan, 1988). In our work, a higher population density of rodents was found in the more complex and diverse habitat.

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* * *

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Use of chromosomal markers for distinguishing *Peromyscus maniculatus* and *P. leucopus* on the U.S. Air Force Academy reservation

Trapping activities and anecdotal information from the last ten years indicate that both deer mice and white-footed mice occur on the U.S. Air Force Academy (USAFA) reservation. Unfortunately, distinguishing these two species in the field can be rather difficult, as they are very similar in appearance. Such species identifications are typically made by objective (or subjective.....) assessments of tail length, tail coloration, rostral shape, ear size, and/or habitat. However, species-identification criteria that work well for these mice in one region are not necessarily applicable in another. Definitive identification of deer mice and white-footed mice from the same area often requires detailed analysis of morphological characters, electrophoretic identification of allozymes, and/or microscopic analysis of chromosomal characters.

In the first stage of this project, chromosomal markers will be employed to determine whether both species do actually occur on the USAFA. For species identifications, we will utilize previously described chromosomal characters that definitively distinguish *P. leucopus* and *P. maniculatus* (Baker et al., 1983). If white-footed mice and deer mice are both present, cytogenetic data will be compared with standard-morphological and ecological data to identify one or more characters that will facilitate identification of each species in the field. The efficacy of correlating species-specific chromosomal markers with quantitative morphological characters has been demonstrated by Gunn and Greenbaum (1986), who identified a tail-length difference that readily distinguished *P. maniculatus* and *P. keeni* of the Pacific Northwest mainland.

Additionally, our trapping experience at other Colorado Front Range localities indicates that *P. maniculatus nebrascensis* inhabits lower elevations (≤ 6800 feet), while *P. maniculatus rufinus* is typical of higher foothills and mountains. Both subspecies potentially occur within the USAFA reservation proper, as elevation ranges from 6360 feet to nearly 8000 feet. Previously identified chromosomal characters (D. W. Hale and I. F. Greenbaum, unpublished data) will allow us to ascertain whether both of these deer-mouse subspecies exist on the USAFA.

Hopefully, the results of this project will provide a simple method for field-identification of white-footed mice and deer mice (two subspecies?) on the USAFA. Such a tool will be useful for future monitoring of the distributions and relative abundances of these mice on the USAFA reservation. As expected, we have already identified several individuals as *P. maniculatus*; we are trapping a diversity of habitats to confirm or refute the presence of *P. leucopus*.

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Sick agouti *Peromyscus maniculatus* have increased instance of tumor growth

The agouti gene is primarily involved in coat-color in deermice (*Peromyscus maniculatus*) and other mammals. It is connected with certain types of diabetes in humans; as well as diabetes and obesity in lab mice (*Mus*) (Siracusa, 1994). A dominant coat-color mutation at the agouti gene produces increased tumor growth in *Mus* (yellow) (Siracusa, 1994). This study was undertaken to determine if the agouti gene is also involved in tumorogenesis in deermice. Specifically, does the recessive coat-color mutation (nonagouti) decrease or increase the instance of tumor growth in *Peromyscus maniculatus*?

Forty-four captive-bred deermice over the age of one year from the Smith College Colony were dissected for this study. Due to overcrowding, 7 of the deermice were culled for space. This included 5 nonagouti deermice and 2 agouti deermice. No tumors were found in these deermice. Of the remaining 37 deermice, 21 were agouti, 16 were nonagouti. These mice had been saved and frozen after being euthanized due to sickness or found dead in their cages.

Tumors were found in 11 deermice (Figure 1). Of these 11, 9 were agouti and 2 were nonagouti. Both the nonagouti mice that had tumors had ovarian tumors. No reproductive tumors were found in the agouti deermice (Figure 2). Tumors in the agouti deermice were found on the face, limbs, liver, abdomen, kidneys, and lungs. One male agouti mouse had 31 tumors ranging in weight from 0.006 grams to 3 grams. Twenty-nine of these were in his abdomen and two were found in his pericardial cavity. Of the sick agouti mice, 43% contained tumors compared to only 12.5% of the sick nonagouti mice (see Figure 2). Thus tumors are more frequent in the sick wild type than the nonagouti deermice (Pearson chi-square, $p = 0.045$)

This study was performed with a small sample size, however, important trends were found. It appears that the agouti protein may be related to tumorogenesis.

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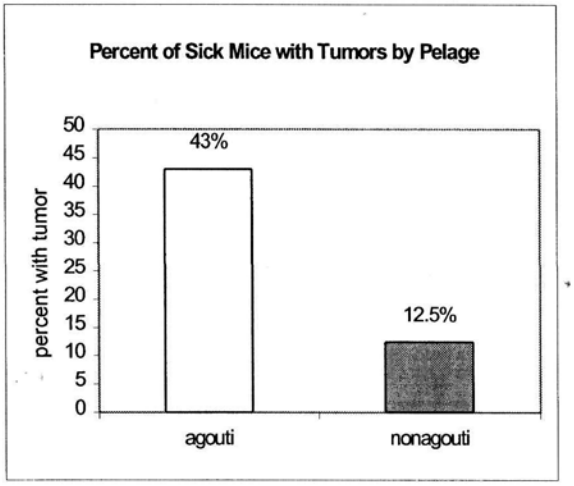

Figure 1: Of the 21 sick agouti mice, 9, or 43%, had tumors. Of the 16 nonagouti mice, 2, or 12.5%, had tumors (p = 0.045).

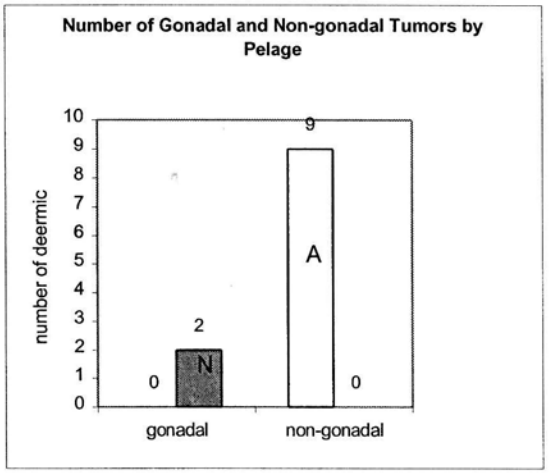

Figure 2: Both nonagouti (N) deermice with tumors had ovarian tumors, whereas none of the agouti (A) mice with tumors had gonadal tumors.

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Small murid avian-nest predators as determined by dye-injected eggs

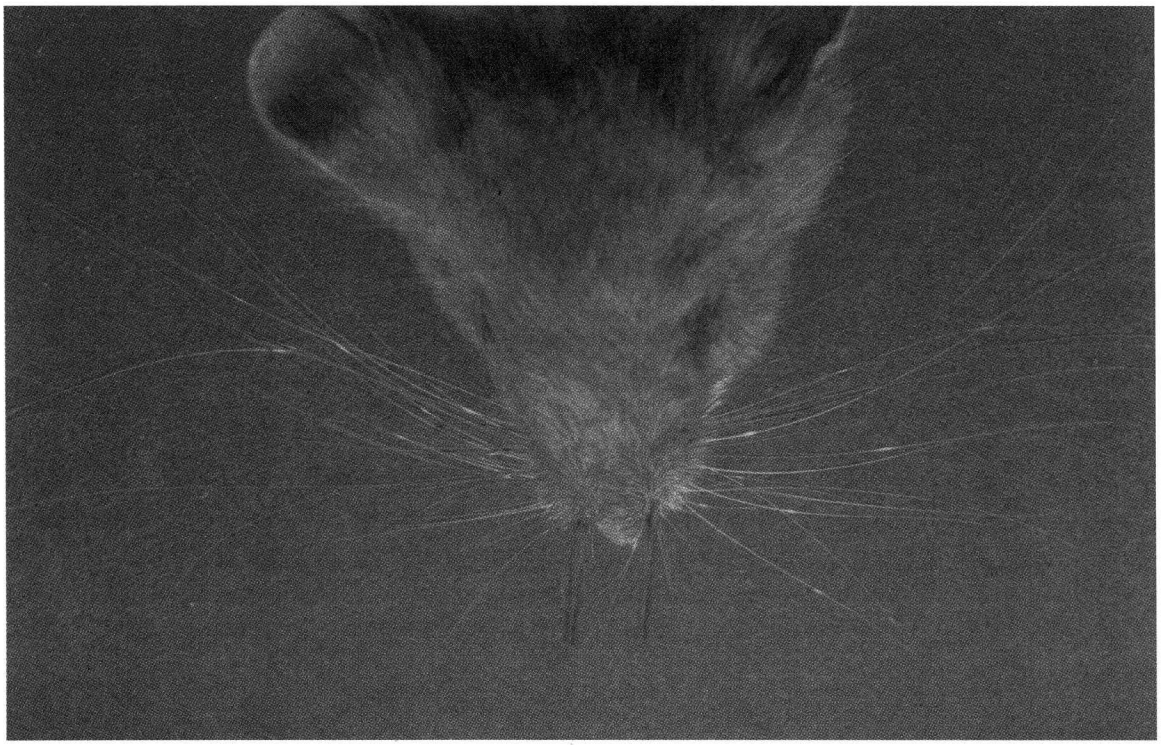
Mice and voles have together been implicated as major passerine-egg predators by field studies using soft, plasticine-clay egg simulacra or small Zebra Finch (*Taeniopygia guttata*) eggs, yet these murids have seldom been photographed or otherwise documented actually depredating avian nests.

To elucidate the predatory proclivity of white-footed mice (*Peromyscus leucopus*) and red-backed voles (*Clethrionomys gapperi*) towards small eggs similar to those of many forest passerines, we conducted a field study that exposed Rhodamine B dye-injected House Sparrow (*Passer domesticus*) eggs in camera-monitored ground nests within central Massachusetts mixed-hardwood forests, June-July 1997 and 1998. This dye, when consumed by these murid species, produced characteristic fluorescent bands in vibrissae (Fig. 1).

Although numerous mice (n = 1,066) and voles (n = 271) were trapped at 144 nest sites following egg exposure, examination of specimens with UV-A light revealed that dye-positive white-footed mice (larger than most other mice [$P < 0.001$] and often female [$P = 0.13$]) accounted for only 8-12% of all depredations (n = 59 each year) and that red-backed voles accounted for none. No voles were photographed, whereas mice were the most commonly photographed species at nests (usually as initial visitors). Only one mouse, however, was actually photo-documented depredating an egg; thus, we identified more murid predators using dye-injected eggs (n = 12) than by use of still-cameras.

Although the low incidence of mouse predation relative to their abundance, the lack of predation by voles, and the opportunity for predation (i.e., no avian parental defense) suggests that these murids likely play a smaller role in the depredation of forest passerine eggs than that implied by studies using soft clay or very small finch eggs, larger *Peromyscus* mice, given their ubiquity and arboreal activity, may play at least an omnipresent role as egg predators of smaller passerines.

Figure 1. Rhodamine B dye* produces numerous fluorescent marks in vibrissae when consumed by white-footed mice and red-backed voles. (Specimen displayed is an adult white-footed mouse.)



*The Rhodamine B dye/ethyl alcohol mixture injected into House Sparrow eggs provided a 1.5 mg dose of this systemic dye. After consumption, the fluorescent dye was incorporated in keratinous tissue and was the most visible as 1 mm fluorescent bands within mystacial vibrissae, approximately 6-12 days after growing beyond the muzzle (depending on animal's activity level). These bands glow brightly when sufficiently irradiated by a 365 nm ultraviolet lamp in a darkroom.

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Peromyscus Genome Mapping Project

In an effort to create a medium density linkage map for *Peromyscus maniculatus*, PCR based genetic markers for known genes have been developed that show single nucleotide polymorphisms (SNPs) between *P. maniculatus* and *P. polionotus*. These markers are used to screen a panel of backcross animals generated from *P. maniculatus/P.polionotus* hybrids back crossed to *P. maniculatus*. The polymorphisms were uncovered using sequences generated using the ABI Prism 377 but then are more easily detected in the backcross animals using other molecular techniques such as RFLP, denaturing HPLC, and primer termination analysis. After allele detection is complete, the data is analyzed for linkage using Mapmanager software.

The markers developed thus far, were chosen based on their locations already identified on *Mus* chromosome 11 and on human chromsome 17. Currently, all these markers are hypothesized to be on *Peromyscus* chromosome 13 based on previously published and unpublished FISH (fluorescence in-situ hybridization) data. The current list of genes under investigation is *Evi2*, *Mpo*, *Myl4*, *Sparc*, *Adra1a*, *HoxB*, *Myh2*, *Igfbp1*, *Tp53*, and *Tk1*. The latter two are the anchor loci as they have been confirmed to be on chromsome 13 via the before mentioned FISH data. The first four markers have already been found to have RFLP's.

As the project progresses, more markers will be created for particular genes of interest on this and other chromosomes. Other markers that will be used extensively are the highly polymorphic microsatellites. Some micosatellites have already been developed by other members of our lab. These will be used to screen the backcross panel but will also be used to screen a radiation hybrid panel which is currently being developed by other members of the lab.

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