

PEROMYSCUS NEWSLETTER

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Cover: Pinyon Mouse (*Peromyscus truei*)
Photo courtesy of B. Elizabeth Horner
(See page 4)

PEROMYSCUS NEWSLETTER is dedicated to sharing information among those interested in deer mice, white-footed mice and other peromyscine rodents whether that interest is professional or amateur. The primary purpose of *PN* is to serve as an informal means of communication among biologists using *Peromyscus* in research and education. Our list of "Recent Publications" is widely used as a quick overview of current research. We also encourage use of *PeroBase*, that includes the searchable Bruce Buttler Bibliography listing thousands of articles and other references to *Peromyscus*: <http://wotan.cse.sc.edu/perobase/> While there is a certain amount of redundancy between *PN* and *PeroBase*, one does not replace the other.

In this issue, we present information about the *Peromyscus* Genetic Stock Center in a revised format. Specifically, we have dedicated the first page of this section (p. 7) to explaining the "4-P's" (purposes, policies, procedures and prices). This is followed by a brief description of the live *Peromyscus* stocks and other materials available from the Center. **Note that there are changes in some of our pricing** at the behest of the National Science Foundation, one of our major sponsors.

How to submit an entry: Simply write one or more paragraphs (single spaced, 10-11 size font) describing your project and results. The entry is limited to two printed pages to include not more than one figure or graph. We always encourage grad students, if they are working with *Peromyscus*, to share their preliminary findings with our readers. Electronic submission to dawson@biol.sc.edu

We welcome and look forward to your research contributions to *PN* and your notifying us of any news, making relevant comments, correcting our mistakes, or providing anything else of interest. There is no charge to subscribe. **Deadline** for receipt of entries in the next issue is **15 Sept 02**.

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NEWS, COMMENT and ANNOUNCEMENTS

Dr. B. Elizabeth (Betty) Horner (Smith College) recently generously contributed her extensive collection of more than 600 35mm slides of various *Peromyscus* and related species, together with her detailed annotations in notebooks, and 22 frozen specimens of *P. truei* with documentation. Additionally, she gave three books of significance to peromyscologists: *Mans Nature and Nature's Man* and *The Biotic Provinces of North America*, both authored by Lee R. Dice, and *Report upon Natural History Collections Made in Alaska between the years 1877 and 1881*. As many of our readers are aware, from the 1920s into the 1960s Lee Dice was active in *Peromyscus* genetics, ecology and evolution. He was featured as one of our "Peromyscus Pioneers" in *PN #4*. Betty Horner conducted her Ph.D. studies under Dice's direction during the late 1940s, and was herself designated a "Peromyscus Pioneer" (*PN #13*). Betty has published in excess of 45 research articles during her long career, and continues to maintain an active role in *Peromyscus* research and mammalian biology. We are most pleased to receive these materials for our reference.

Speaking of *Peromyscus* Pioneers, we received a kind letter from our most recently designated "Pioneer", **Donald F. Hoffmeister**, emeritus Professor of Zoology at the University of Illinois. In his letter he pointed out two additional major papers pertaining to *Peromyscus* that we had not specifically mentioned: 1963. (with M.R. Lee) Status of the sibling species, *Peromyscus merriami* and *P. eremicus*. *J. Mamm.* 44:501-518, and 1973 (with V. Diersing) *Peromyscus goldmani* *Southwestern Naturalist* 18:354-357. Don also authored the *P. truei* account (#161) in the *MAMMALIAN SPECIES* series. Don says he enjoyed his work with *Peromyscus* and all mammals, as well as the opportunity to influence so many students to pursue careers in mammalogy. We wish Don the very best in his retirement.

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Dr. Suellen Van Ooteghem recently transferred a large number of pedigree records pertaining to the *Peromyscus* stocks that were maintained at the University of Michigan. Long before there was a "*Peromyscus* Genetic Stock Center" there was the U of M Laboratory of Vertebrate Biology (1935 – 1958), originally under the direction of Lee Dice (See above). This lab maintained a large number of wild-type and mutant stocks of *Peromyscus*, most of which were pedigreed to the founding wild ancestors. The LVB *Peromyscus* functions were later transferred to the U of M Laboratory of Mammalian Genetics. The U. of M. Museum of Zoology retained many skin and skull preparations and other records. Dr. VanOoteghem has for a number of years organized some of this information, particularly for the mutant Stocks. About 15 of the mutant and two of the wild-type deer mouse stocks in the *Peromyscus* Genetic Stock Center are derived from University of Michigan stocks. Dr. VanOoteghem has a longstanding interest in *Peromyscus* and is an established authority on neurological and behavioral genetics in *P. maniculatus*. We appreciate her contribution to the Stock Center.

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*We were please to see **Dr. David Gubernick** recently on the Discovery Health Channel. Dr. Gubernick described how the male *Peromyscus californicus* participates in rearing the young.*

The most recent version of **PeroBase** is on line through the Stock Center home page or at <http://wotan.cse.sc.edu/perobase/> Additional species accounts should soon be accessible. Stay posted.

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### ***PeroBase* Needs a Tree**

One objective of the **PeroBase** team from early on has been to present an easily understood consensus phylogenetic tree with all peromyscine species represented. Such a tree would incorporate molecular, cytogenetic and morphological data sets. Inasmuch as it would use data from various studies, some of which are not necessarily quantifiable, but utilize the best information available, the proposed tree might not be based entirely on statistical algorithms. Such a tree is envisioned as dynamic and would incorporate new information as it became available, hence would be frequently updated. The principal benefactors would be those biologists working with deer mice and allied species who are not primarily concerned with systematics or taxonomy, but who require an up-to-date systematic framework to interpret their findings. The consensus tree should be comprehensible to informed lay persons as well as biologists. **We welcome professional opinions and knowledgeable volunteers to help with this project.**

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New *Peromyscus* Sequences in GenBank

The following is a list of GenBank accessions for *Peromyscus* since our *PN 31* (Mar 2001) list. The following list gives inclusive successive accession numbers.

NUCLEAR GENES:

[MHCII] Major Histocompatibility Complex Class II beta chain
P. maniculatus (AF312748 – AF312761)
P. maniculatus, *P. eremicus*, *P. leucopus*, *P. polionotus* (AF300846 – AF300863)

[Cyp2] p450c 17alpha, complete cds. *P. leucopus* (AY054747)

[vwf] Partial cd for von Willebrand factor . *P. maniculatus* (AJ402697)

[Pth] Parathormone precursor exons 2 and 3 and partial cds. *P. maniculatus* and *P. polionotus*
(AF382952, AF382953)

[Bcl 2] B cell leukemia-lymphoma, partial cds alternatively spliced (AF389110, AF389111)
P. maniculatus, *P. polionotus*.

NUCLEAR ELEMENTS, MICROSATELLITES:

[PML12] Microsatellite sequences *P. maniculatus* clones. (AF251775 – AF 251786)

[msy-9] Retrotransposon and LTR 5' sequence. (AH010710 – AH010722) and (AY017275 – AY017293) *P. maniculatus*, *P. truei*, *P. difficilis*, *P. crinitus*, *P. leucopus*.

[PO3] Microsatellite sequence PO-3 (AF380232 – AF 380250) and (AY053424, AY053425)

MITOCHONDRIAL GENES:

[COIII] Cytochrome oxidase, subunit III partial cds. (AF343754 – AF343775) . *Peromyscus* sp.

[tRNA-gly,-ND3-ND4L-ND4] Mitochondrial genes for mitochondrial products. (AF374554 – AF374579) *P. maniculatus* isolates

[CytB] Cytochrome B gene, partial cds. (AY041198 – AY041200) *P. leucopus*, *P. nudipes*,
P. maniculatus

[16SrRNA] 16s r RNA mitochondrial gene, partial seq. (AF364506) *P. leucopus*

THE PEROMYSCUS GENETIC STOCK CENTER

General

The University of South Carolina has maintained a genetic stock center for *Peromyscus* (deer mice and congeneric species) since 1985. The center was established under a grant from the Living Stocks Collection Program of the National Science Foundation and continues to be supported by NSF and the NIH Biological Models and Materials Research Program. It also receives support from the University and from user fees.

The major function of the Stock Center is to provide genetically characterized types of *Peromyscus* in limited quantities to scientific investigators and educators. Continuation of the center is dependent upon significant external utilization, therefore potential **users are encouraged to take advantage of this resource.**

Policies and Procedures.

The Stock Center currently maintains several categories of stocks of living animals: 1.) Closed colony random-bred¹ "wild-type" stocks of seven species of *Peromyscus*. 2.) Two highly inbred² stocks of "wild-type" *P. leucopus*. 3.) Stocks of eighteen coat color mutations, mostly in *P. maniculatus*. 4.) Stocks of nine other monogenic traits. The Stock Center operates in strict compliance with the Animal Welfare Act and is located in an AAALAC approved facility. All animal care is performed by certified technicians. Stocks are monitored regularly for presence of disease and parasites and are free of hantavirus and 15 murine viruses.

The Stock Center also provides blood, organs, tissues, fetuses, skins and other biological materials from *Peromyscus*. The Stock Center operates a Molecular Bank where selected genomic libraries and probes are available. Other resources include a reference collection of more than 2,500 reprints of articles on peromyscine rodents copies of which may be provided. The Stock Center is the primary sponsor of **PeroBase**, an on-line database dedicated to information regarding *Peromyscus* and closely related species.

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.

Orders and Pricing.

A user fee of **\$17.50 is charged per wild-type stock animal. (\$22.50 for corporate users). Coat color and other mutants, as well as special stock animals are currently available for \$25 per animal.** User assumes the cost of air shipment. Animals lost in transit are replaced without charge. Tissues, blood, skins, *etc.* are supplied at a modest fee that includes technician time. Arrangements for special orders will be negotiated. Billing will be submitted upon satisfactory delivery. **Write or call for details.**

Stocks Available

WILD TYPE STOCKS

ORIGIN

<i>P. maniculatus bairdii</i> (BW Stock) Deer Mouse	Closed colony bred in captivity since 1948. Descended from 40 ancestors wild-caught near Ann Arbor MI.
<i>P. maniculatus sonoriensis</i> (SM2 Stock) Sonoran Deer Mouse	Derived from about 50 animals wild-caught by Jack Hayes in 1995 near White Mountain Research Station, CA
<i>P. polionotus subgriseus</i> (PO Stock) Oldfield Mouse	Closed colony since 1952. Derived from 21 ancestors wild-caught in Ocala Nat'l. Forest FL. High inbreeding coefficient.
<i>P. polionotus leucocephalus</i> (LS Stock) Beach Mouse	Derived from beach mice wild-caught on Santa Rosa Island FL and bred by R. Lacy.
<i>P. leucopus</i> (LL Stock) White-footed Mouse	Derived from 38 wild ancestors captured between 1982 and 1985 near Linville NC
<i>P. californicus insignis</i> (IS Stock) California Mouse	Derived from about 60 ancestors collected between 1979 and 1987 in Santa Monica Mts. CA
<i>P. aztecus</i> (AM Stock) Aztec Mouse	Derived from animals collected on Sierra Chincua Michoacan, Mexico in 1986.
<i>P. melanophrys</i> (XZ Stock) Plateau Mouse	Derived from animals collected between 1970 and 1978 from Zacatecas, Mexico and bred by R. Hill.
<i>P. eremicus</i> (EP Stock) Cactus Mouse	Originated from 10-12 animals collected at Tucson, AZ in 1993.

INTERSPECIFIC HYBRIDS

<i>P. maniculatus</i> X <i>P. polionotus</i> F ₁ Hybrids	Bred by special order.
<i>P. leucopus</i> X <i>P. gossypinus</i> F ₁ Hybrids	Sometimes available by request.

MUTATIONS AVAILABLE FROM THE STOCK CENTER³

COAT COLORS	ORIGINAL SOURCE
Albino <i>c/c</i>	Sumner's albino deer mice (Sumner, 1922)
Ashy <i>ahy/ahy</i>	Wild-caught in Oregon ~ 1960 (Teed et al., 1990)
Black (Non-agouti) <i>a/a</i>	Horner's black mutant (Horner et al., 1980)
Blonde <i>bln/bln</i>	Mich. State U. colony (Pratt and Robbins, 1982)
⁴ Brown <i>b/b</i>	Huestis stocks (Huestis and Barto, 1934)
California blonde <i>cfb/cfb</i>	Santa Cruz I., Calif., stock (Roth and Dawson, 1996)
Dominant spotting <i>S/+</i>	Wild caught in Illinois (Feldman, 1936)
Golden nugget <i>b^{gn}/b^{gn}</i> [in <i>P. leucopus</i>]	Wild caught in Mass. (Horner and Dawson, 1993)
Gray <i>g/g</i>	Natural polymorphism. From Dice stocks (Dice, 1933)
Ivory <i>i/i</i>	Wild caught in Oregon (Huestis, 1938)
⁵ Pink-eyed dilution <i>p/p</i>	Sumner's "pallid" deer mice (Sumner, 1917)
Platinum <i>plt/plt</i>	Barto stock at U. Mich. (Dodson et al., 1987)
⁴ Silver <i>sil/sil</i>	Huestis stock (Huestis and Barto, 1934)
Tan streak <i>tns/tns</i>	Clemson U. stock from N.C. (Wang et al., 1993)
Variable white <i>Vw/+</i>	Michigan State U. colony (Cowling et al., 1994)
White-belly non-agouti <i>a^w/a^w</i>	Egoscue's "non-agouti" (Egoscue, 1971)
Wide-band agouti <i>A^{Nb}/a</i>	Natural polymorphism. U. Mich. (McIntosh, 1954)
Yellowish <i>y/y</i>	Sumner's original mutant (Sumner, 1917)

OTHER MUTATIONS AND VARIANTS

Alcohol dehydrogenase negative <i>Adh^o/Adh^o</i>	South Carolina BW stock (Felder, 1975)
Alcohol dehydrogenase positive <i>Adh^f/Adh^f</i>	South Carolina BW stock (Felder, 1975)
Boggler <i>bg/bg</i>	Blair's <i>P. m. blandus</i> stock (Barto, 1955)
Cataract-webbed <i>cwb/cwb</i> 1979)	From Huestis stocks (Anderson and Burns,
Epilepsy <i>ep/ep</i>	U. Michigan <i>artemisiae</i> stock (Dice, 1935)
⁵ Flexed-tail <i>ff/ff</i>	Probably derived from Huestis flexed-tail (Huestis and Barto, 1936)
Hairless-1 <i>hr-1/hr-1</i>	Sumner's hairless mutant (Sumner, 1924)
Hairless-2 <i>hr-2/hr-2</i>	Egoscue's hairless mutant (Egoscue, 1962)
Juvenile ataxia <i>ja/ja</i>	U. Michigan stock (Van Ooteghem, 1983)
Enzyme variants	Wild type stocks given above provide a reservoir for several enzyme and other protein variants. (Dawson <i>et al.</i> , 1983)

¹"Random-bred" stocks are mated without deliberate selection, and sib-sib mating is avoided.

²Inbred lines are bred by sib-sib (or parent-offspring equivalent) mating for 21 generations or more.

³Unless otherwise noted, mutations are in *P. maniculatus*

⁴Available only as silver/brown double recessive

⁵Available only as pink-eye dilution/flexed-tail double recessive

Other Resources of the Peromyscus Stock Center

Highly inbred *P. leucopus* (I₃₀₊) are available as live animals or as frozen tissues.

Two lines developed by George Smith (UCLA) are currently maintained by the Stock Center.

Limited numbers of other stocks are on hand, but not currently available. Inquire.

Preserved or frozen specimens of types given in the above tables.

Flat skins of mutant or wild-type coat colors or wild-types of any of the stocks listed above.

Reference library of more than 2500 reprints of research papers, articles and reports on *Peromyscus*. Single copies of individual articles can be photocopied and mailed. Please limit requests to five articles at any given time. There will be a charge of 10 cents per photocopied page after the initial 20 pages.

Photocopies of back issues of *Peromyscus* Newsletter (\$5 ea.) or original back copies, when still available, without charge.

Materials are available through the *Peromyscus* Molecular Bank of the Stock Center. Allow two weeks for delivery. Included is purified DNA or frozen tissues of 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, e-mail crosslan@biol.sc.edu

PLEASE CALL WITH INQUIRIES

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NOTICE

PEROMYSCUS NEWSLETTER IS NOT A FORMAL SCIENTIFIC PUBLICATION.

Therefore ...

**INFORMATION AND DATA IN THE CONTRIBUTIONS SECTION SHOULD NOT BE
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THANK YOU!



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Examining the energetic cost of immunocompetence in *Peromyscus leucopus*

The amount of energy required to maintain a functioning immune system and mount an immune response was studied in wild white-footed mouse, *Peromyscus leucopus*. We tested the null hypotheses 1) the energy cost of maintaining a functioning immune system is not a significant energy demanding process, 2) there is no significant energetic cost of mounting an immune response, and 3) other systems of the body are not affected by changes in the immune system. To determine the amounts of energy used, daily metabolic rate (DMR), resting metabolic rate (RMR), and the masses of vital and reproductive organs (i.e., heart, lungs, kidneys, liver, spleen, thymus, small intestines, and testés) were measured.

The energy required to maintain an immune system was studied by comparing a control group to a group that was immunosuppressed. Animals were immunosuppressed through injections of cyclophosphamide during a 10-day period. White blood cell (WBC) counts showed an 80% decrease in the immunosupressed animals compared with control animals. There were no significant differences in the DMR, RMR, or organ masses between control and experimental mice.

To measure the energetic cost of mounting an immune response, control mice were tested against mice injected with sheep red blood cells (SRBC) and phytohemagglutinin (PHA) to stimulate the humoral and cell-mediated components of the immune system, respectively. There were no significant differences in DMR or RMR between groups; however, both the wet and dry masses of the small intestine and testes were significantly lower in the SRBC-PHA treated mice. Our findings suggested that maintaining a functioning immune system was not a significant energy demanding process. Mounting an immune response, however, was a significant energy demanding process that may have involved trade-offs in allocation of energy within the organism. Specifically, increased allocation of energy to immune function may occur at the expense of energy allocation to reproduction and digestive functions.

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The Complications of Taxonomy for Biological Databases: A Solution

The *PeroBase* project aims to develop an encyclopedic on-line database of information about *Peromyscus* biology. One of the goals of the project has been to develop an effective method for searching the database using taxonomic names. The common approach is to use taxonomic names as simple keywords. The problem with this approach is that the correct taxonomic name for a particular organism depends on the classification used. Many databases use simple lists of synonyms to relate previously-used names to valid names, but such databases cannot distinguish among different uses of the same name. Information previously published under a currently valid name may not pertain to the taxon known by that name today.

To illustrate, consider the simplified taxonomic history of a few species from the *truei* species group (figure 1). This complex web of lumping and splitting must be taken into account when interpreting information published under these species names. For example, measurements attributed to *P. difficilis* in a 1962 paper may in fact have been taken from individuals that would now be considered *P. nasutus*. Similarly, some mice that are now called *P. gratus* were classified as *P. truei*, *P. difficilis*, *P. nasutus*, and *P. comanche* at different times in the past.

To deal with this complexity we need to accommodate multiple classifications in the database simultaneously so that information can be correctly retrieved using the names from any taxonomic point of view. This enables a more powerful, flexible, and robust framework for taxonomic queries than most existing biological databases use. Users can get complete taxonomic query results without having to know detailed taxonomic histories. Also, the database can easily adapt to future changes in classifications without excessive editing and data loss. Information that cannot be reliably attributed to current taxa can be retained in its original context and returned to users with a warning of the ambiguity.

We are aware of only four publicly available designs for databases that can accommodate multiple classifications (ASC, 1993; Beach et al., 1993; Berendsohn, 1997; Pullan et al., 2000). None was entirely satisfactory for the purposes of *PeroBase*, but all were useful in our efforts to develop a more appropriate design. We have presented a preliminary design (Yoon and Rose, 2001) that we are currently testing and refining. More detailed and current information is available from the *PeroBase* website: wotan.cse.sc.edu/perobase.

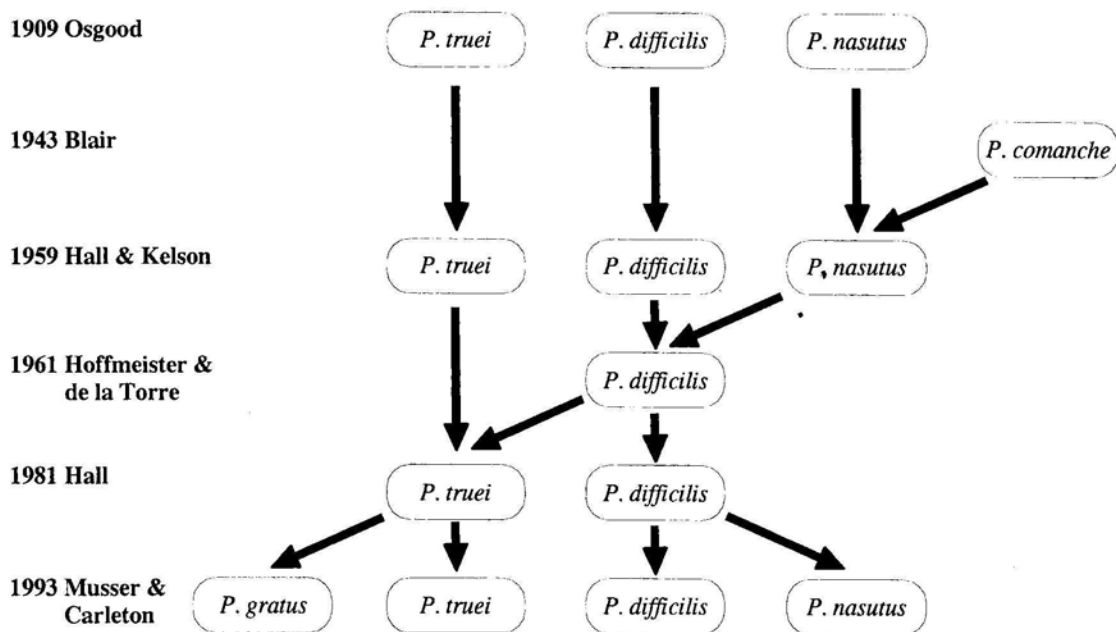


Fig. 1. Abbreviated taxonomic history of some species in the *truei* species group.

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