PEROMYSCUS NEWSLETTER

NUMBER TWENTY-FOUR

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Cover: Deer mouse leading life on the edge.
(Photo by Clint Cook)

ISSUE # 24!

We are very pleased to announce that **Craig Stewart** of Indiana University has generously accepted the co-editorship of *PEROMYSCUS NEWSLETTER*. Craig has worked with *Peromyscus* in his research on thermal biology and has experience writing and editing. Welcome aboard!

Also, we want to thank the current and former members of the *Peromyscus* Genetic Stock Center Advisory Committee. The committee is in the process of reorganization under the direction of Dr. George Smith of UCLA, the current Chair. The reorganized committee, which is still in the selection process, will consist of five members. We especially want to thank **Muriel Davisson**, **John Gearhart**, **Rodney Honeycutt**, **Duke Rogers** and **Suellen Van Ooteghem** for their dedicated service on the Committee over the years, as well as **Oscar Ward** who served as *PN* co-editor until his retirement last year.

Please note that the URL for the Stock Center homepage has changed. The new URL is:

http://stkctr.biol.sc.edu/

We always encourage your input to *PEROMYSCUS NEWSLETTER* and welcome contributed entries concerning your research activites. Items for the "News and Comment" section also are invited. **Deadline for entries in Issue #25 is 20 Mar 1998.**

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C O N T E N T S

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NEWS, COMMENT and ANNOUNCEMENTS

The U.S. Fish and Wildlife Service has detailed descriptions of endangered subspecies of *Peromyscus polionotus* available online at http://www.fws.gov/ . Also included is information concerning management and protection efforts.

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The 4th International Conference on HFRS and Hantaviruses will meet Mar 5-7 1998 in Atlanta. Contact CDC in Atlanta *http://www.cdc.gov/* for more information.

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Fourteen papers and posters about Peromyscus were presented at the annual meeting of the American Society of Mammalogists held at Oklahoma State University in June.

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We have heard from **W. Newman Bradshaw**. He has retired from West Virginia University where he served on the faculty for many years. In 1970-71 he spent a sabbatical with T.C. Hsu at M.D. Anderson Center. With Hsu, Bradshaw published the first photos of G-banded deer mouse chromosomes (1972. Cytogenet. 11:436ff).

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PEROMYSCUS NEWSLETTER *was originally modelled on* MOUSE NEWS LETTER *which in recent years became* MOUSE GENOME. *This venerable publication is merging with* MAMMALIAN GENOME *beginning in 1998. MNL* was preceeded by an earlier newsletter, "Mouse Genetic News", edited by George Snell, first published (mimeographed) in November 1941. Until the early 1970s *MNL* included information on *Peromyscus*.

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BACK ISSUES. Unfortunately our supply of back issues of *PEROMYSCUS NEWSLETTER* is becoming depleted. The only issues we still have in adequate supply are Numbers 8, 13, 14, 17, 18, 19, 20, 21 and 23. For others there are either no available copies or fewer than 5 on hand. Our recent issue #22 (Sept 96) was undersupplied by the printer and we have no excess copies left. Photocopies of scarce back issues can be supplied for $ 5 each

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Brian Hjelle, University of New Mexico Health Science Center, was awarded a $ 1.35 million grant by NIH to investigate hantavirus - deer mouse association in the U.S. Southwest. There have been 30 confirmed cases and 14 deaths in New Mexico from hantaviral pulmonary syndrome since 1993, and about 162 cases with 76 deaths nationwide. Dr. Hjelle requests input from interested individuals concerning revision of the rodent collection guidelines initially issued by CDC after the 1993 outbreak.

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John L. VandeBerg, Scientific Director of the Southwest Foundation for Biomedical Research, reports that his organization breeds and sells laboratory opossums (*Mondelphis domestica*). He states that for the vast majority of research purposes they are superior to Virginia opossums (*Didelphis virginiana*). Anyone interested in obtaining opossums for research should contact Ms. **Ana Biediger**, Dept. Genetics, Southwest Foundation for Biomedical Research, P.O. Box 760549, San Antonio, TX 78245-0549; (210) 674-1410 Ext 223; FAX (210) 670-3316; e-mail *anab@darwin.sfbr.org*.

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Inbred white-footed mice (*Peromyscus leucopus*) are now available in limited numbers from the Peromyscus Stock Center. These are from lines recently developed at UCLA by Dr. George Smith. *P. leucopus* has been used as a model species in biomedical studies of aging and radiation resistance.

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Karen McBee, Okalhoma State University, reports that her former students, **Monte Thies** and **Michael Husby**, have moved on. Monte is an assistant professor in the Biological Sciences Department at Sam Houston State University, and Mike is working in Brazil. **Tim Graham** also has moved. He is now at the Biological Resources Division, U.S. Geological Survey, Moab UT.

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A white-footed mouse (*P. leucopus*) is featured as one of the **National Wildlife Federation**'s six Holiday Stamp designs. NWF has issued wildlife stamps since 1938. A white-footed mouse first appeared on a NWF 1951 stamp design.

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THOMAS BRYANT informs us that **BioCenotics**, 4880 Hudson Rd., Osseo MI 49266, provides research and testing services to the agricultural, animal health and pest control industries. BioCenotics maintains a number of small animal colonies of several species. These are maintained to meet the special needs of their clients. Information about species currently held or assistance in establishing colonies is available. Mr. Bryant may be contacted at phone (517) 523-3441; FAX (517) 523-3052; e-mail *biocenotics@dmci.net* .

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THE PEROMYSCUS STOCK CENTER WOULD LIKE TO KNOW OF ANY LABORATORY COLONIES OF *PEROMYSCUS* (*SENSU LATO*) AND *ONYCHOMYS*. IF YOU HAVE, OR ARE AWARE OF, EXISTING COLONIES, PLEASE ADVISE US.

The Peromyscus Stock Center has received an NSF Grant for the planning phase the **Peromyscus Database.** This project is directed by John Rose and W. Dawson of the University of South Carolina.
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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 Special Projects 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 **$17.50 per wild-type animal** and **$ 20 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 ten generations in captivity.
P. leucopus (LL Stock)	Derived from 38 wild ancestors captured between 1982 and 85 near Linville NC. Approximately 20 generations in captivity.
P. californicus insignis (IS Stock)	Derived from about 60 ancestors collected between 1979 and 87 in Santa Monica Mts. CA. Approximately twelve generations in captivity.
P. aztecus (AM Stock)	Derived from animals collected on Sierra Chincua, Michoacan, Mexico in 1986 Approximately ten 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. maniculatus X *P. polionotus* F_1 Hybrids	Sometimes available.

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:

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 and cDNA libraries and a variety of molecular probes are available. (See next page.)

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 or peromyscus@stkctr.biol.sc.edu

PLEASE CALL WITH INQUIRIES.

Peromyscus Genetic Stock Center
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Materials on Deposit in the *Peromyscus* Molecular Bank

Accession Number	Item	Description	Species	Donor	Location[1]
Probes and Clones:					
Pr-01	LINE1	pDK62	*P. maniculatus*	D. Kass	C
Pr-02	LINE1	pDK55	*P. maniculatus*	D. Kass	C
Pr-03	ADH1	pADH F72	*P. maniculatus*	M. Felder	B
Pr-04[2]	Mys		*P. leucopus*	(Requested)	
Pr-05[2]	SAT		*P. leucopus*	(Requested)	
Pr-06	6PGD	pB5 clones	*P. californicus*	S. Hoffman	A
Pr-07	MHC *Pele*I	38dp2	*P. leucopus*	M. Crew	A
Pr-08	MHC *Pele*I	52ap6	*P. leucopus*	M. Crew	A
Pr-09	MHC *Pele*I	40Bgl	*P. leucopus*	M. Crew	A
Pr-10	MHC *Pele*I	53Pv1	*P. leucopus*	M. Crew	A
Pr-11	MHC *Pele*I	37B2	*P. leucopus*	M. Crew	A
Pr-12	MHC *Pele*I	37B4	*P. leucopus*	M. Crew	A
Pr-13	MHC *Pele*II	α3E23	*P. leucopus*	M. Crew	A
Pr-14	MHC *Pele*III	17E2	*P. leucopus*	M. Crew	A
Pr-15	MHC *Pema*I	pr44	*P. maniculatus*	M. Crew	A
Libraries:					
Lb-01	lambda genomic	liver (ADH+)	*P. maniculatus*	M. Felder	B
Lb-02	lambda cDNA	liver	*P. maniculatus*	M. Felder	B
Lb-03	lambda genomic	testis	*P. leucopus*	M. Crew	A
Lb-04	cosmid genomic	testis	*P. leucopus*	R. Baker	A
Lb-05	lambda genomic	liver	*P. californicus*	S. Hoffman	A
Frozen Tissue for DNA:					
S-01	bairdii (BW)	liver, tail, other[3]	*P. maniculatus*	Stk. Ctr.	A
S-02	subgriseus (PO)	liver, tail, other	*P. polionotus*	Stk. Ctr.	A
S-03	leucopus (LL)	liver, tail, other	*P. leucopus*	Stk. Ctr.	A
S-04	wild-caught SC	liver, other	*P. gossypinus*		A
S-05	aztecus (AM)	liver, tail, other	*P. aztecus*	J. Glendinning	A
S-06	insignis (IS)	liver, tail, other	*P. californicus*	S. Hoffman	A
S-07	inbred PmH1A	liver, other	*P. maniculatus*	Jackson Lab	A
S-08	inbred PmH8	liver, other	*P. maniculatus*	Jackson Lab	A

[1]Location code: **A** = USoCar SAI 01; **B** = USoCar CLS 603; **C** = USoCar CLS 707

[2]Not currently available.

[3]kidney, spleen, testis, carcass.

VARIANT GENETIC LOCI IN NATURAL POPULATIONS OF PEROMYSCUS

Numerous electrophoretic studies of allozymes and other proteins in natural populations of *Peromyscus* have been conducted since the 1960's (See *PN* #18 and #20). These studies revealed numerous polymorphisms within populations and species, as well as variation among potentially interbreeding species, *e.g. P. maniculatus* and *P. polionotus*. Variants of a protein are generally presumed to identify a genetic "locus", although formal Mendelian analysis might not have been accomplished.

PEROMYSCUS NEWSLETTER periodically lists in tabular form the known genetic loci in peromyscine species or species groups. We distinguish between loci which have been formally **demonstrated** and **presumptive** loci. The latter are usually protein variants from natural populations identified by electrophoresis. Separate listings for the two categories are published in *PN*. Presumptive loci are not listed in the *Peromyscus* Gene Catalog.

In this issue Tables 1. through 4. summarize presumptive variant loci identified in the *P. californicus, P. eremicus, P.(Podomys) floridanus* and *P.(Megadontomys) thomasi* respecitively. Similar tables in *PN* #21 and #23 list variant presumptive loci reported in other *Peromyscus* species and species groups. These tables are updated at three year intervals.

Since limited interbreeding in captivity is frequently possible among different species within a species group, we treat a species group as a single gene pool. Thus, while two species may each be monomorphic for alternate alleles, by hybridization heterozygotes might be produced and genetic analysis conducted. Linkage analysis and gene regulation potentially can be investigated using species hybrids. Such systems are currently used in both *Mus* and *Peromyscus*. Therefore, the tables serve as a reference to locate reported variants at given loci. **Completely monomorphic loci, *i.e.* loci for which no variation within the species or species group has been reported, are not listed.**

Only variants reported in refereed research publications, abstracts excluded, are listed in the tables. References are listed at the foot of each table. Please call our attention to omissions, corrections or newly published additions.

Table 1. VARIANT PROTEIN LOCI REPORTED FROM NATURAL POPULATIONS OF *PEROMYSCUS CALIFORNICUS*

Protein	Locus	References
Albumin	*Alb*	Avise *et al.* (1974)
Esterase	*Es-3* *Es-4* *Es-4+* *Es-5*	Smith (1979)
α-glycerophosphate dehydrogenase	*Gpd-1*	Avise *et al.* (1974) Smith (1979)
Isocitrate dehydrogenase	*Idh-1* *Idh-2*	Avise *et al.* (1974) Smith (1979)
Malate dehydrogenase	*Mdh-1*	Avise *et al.* (1974) Smith (1979)
Malic enzyme	*Me-1* *Me-2*	Smith (1979)
Post-albumin	*Palb*	Smith (1979)
Peptidase	*Pep-1*	Smith (1979)
6-Phosphogluconate dehydrogenase	*Pgd-1*	Avise *et al.* (1974) Smith (1979)
Phosphoglucoisomerase	*Pgi-1*	Smith (1979)
Phosphoglucomutase	*Pgm-1* *Pgm-3*	Avise *et al.* (1974) Smith (1979)
Sorbitol dehydrogenase	*Sdh-1*	Avise *et al.* (1974) Smith (1979)
Transferrin	*Trf*	Avise *et al.* (1974)

References:

Avise, J.C., M.H. Smith, R.K. Selander, T.E. Lawlor and P.R. Ramsey. 1974. Syst. Zool. 23:226-238.
Smith, M.F. 1979. J. Mamm. 60:705-722.

Table 2. VARIANT PROTEIN LOCI REPORTED FROM NATURAL POPULATIONS OF *PEROMYSCUS EREMICUS* AND RELATED SPECIES

Protein	Locus	Species	References
Alcohol dehydrogenase	*Adh-1*	*P. eremicus*	Avise *et al.* (1974)
Amylase	*Amy-1*	*P. eremicus*	Werbitsky and Kilpatrick (1987)
Esterase	*Es-1*	*P. eremicus*	Rasmussen and Jensen (1971) Avise *et al.* (1974)
Glutamate oxaloacetate transaminanse	*Got-1*	*P. eremicus*	Avise *et al.* (1974)
α-Glycerophosphate dehydrogenase	*Gpd-1*	*P. eremicus*	Avise *et al.* (1974)
Isocitrate dehydrogenase	*Idh-1* *Idh-2*	*P. eremicus* *P. guardia* *P. interparietalis*	Avise *et al.* (1974)
Lactate dehydrogenase	*Ldh-1*	*P. eremicus* *P. caniceps*	Avise *et al.* (1974)
Phosphogluconate dehydrogenase	*Pgd-1*	*P. eremicus* *P. caniceps*	Avise *et al.* (1974)
Phosphoglucomutase	*Pgm-1*	*P. eremicus*	Avise *et al.* (1974)
Plasma protein B (Macroglobulin)	*Ppb*	*P. eremicus* *P. caniceps*	Avise *et al.* (1974)
Transferrin	*Trf*	*P. eremicus* *P. merriami* *P. caniceps*	Rasmussen and Koehn (1966) Avise *et al.* (1974)

References:

Avise, J.C., M.H. Smith, R.K. Selander, T.E. Lawlor and P.R. Ramsey. 1974. Syst. Zool. 23:226-238.
Rasmussen, D.I. and J.N. Jensen. 1971. Comp. Biochem. Physiol. 39B:19-24.
Rasmussen, D.I. and R.K. Koehn. 1966. Genetics 54:1353-1357.
Werbitsky, D. and C.W. Kilpatrick. 1987. J. Mamm. 68:305-312.

Table 3. VARIANT PROTEIN LOCI REPORTED FROM NATURAL POPULATIONS OF *PEROMYSCUS (PODOMYS) FLORIDANUS*

Protein	Locus	Reference
Esterase	*Es-1* *Es-2* *Es-4*	Smith *et al.* (1973)
Glutamate oxaloacetate transaminase	*Got-1*	Smith *et al.* (1973)
Hexose-6-phospahte dehydrogenase	*Gpd-1*	Smith *et al.* (1973)
Hemoglobin	*Hb-1*	Smith *et al.* (1973)
Isocitrate dehydrogenase	*Idh-1* (*Icd-1*)	Smith *et al.* (1973) Rogers and Engstrom (1992)
Lactate dehydrogenase	*Ldh-1* *Ldh-2* *Ldh-3*	Smith *et al.* (1973) Rogers and Engstrom (1992)
Malic enzyme	*Mod-1*	Smith *et al.* (1973)
Phosphoglucomutase	*Pgm-1* *Pgm-3*	Smith *et al.* (1973)
Pre-albumin	*Pra*	Smith *et al.* (1973)
Transferrin	*Trf*	Smith *et al.* (1973)

Reference:

Rogers, D.S. and M.D. Engstrom. 1992. J. Mamm. 73:55-69.
Smith, M.H., R.K. Selander and W.E. Johnson. 1973. J. Mamm. 54:1-13.

Table 4. VARIANT PROTEIN LOCI REPORTED FROM NATURAL POPULATIONS OF *PEROMYSCUS (MEGADONTOMYS) THOMASI*

Protein	Locus	References
Alcohol dehydrogenase	*Adh-1*	Werbitsky and Kilpatrick (1987)
Albumin	*Alb*	Werbitsky and Kilpatrick (1987)
Amylase	*Amy-1*	Werbitsky and Kilpatrick (1987)
Carbonic anhydrase	*Car-1*	Werbitsky and Kilpatrick (1987)
Cholinesterase	*E-2*	Werbitsky and Kilpatrick (1987)
Glutamate oxaloacetate transaminase	*Got-1*	Werbitsky and Kilpatrick (1987)
Hemoglobin	*Hba-1*	Werbitsky and Kilpatrick (1987)
Phosphoglucoisomerase	*Pgi-1*	Werbitsky and Kilpatrick (1987)
Peptidase	*Pep-1* (*Pep-A*) *Pep-4* (*Pep-D*) *Pep-B1*	Werbitsky and Kilpatrick (1987) Rogers and Engstrom (1992)
Transferrin	*Trf*	Werbitsky and Kilpatrick (1987)

Reference:

Rogers, D.S. and M.D. Engstrom. 1992. J. Mamm. 73:55-69.
Werbitsky, D. and C.W. Kilpatrick. 1987. J. Mamm. 68:305-312.

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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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CONTRIBUTIONS

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RECOLLECTIONS OF EARLY DEER MOUSE HEMOGLOBIN RESEARCH

I would like to make a modest contribution to the history of hemoglobin research with *Peromyscus maniculatus*:

I graduated from Centenary College of Louisiana in May 1961. Within a week of graduation, I was in a biology field camp (University of Wyoming) near Centennial, Wyoming. As an experienced mountain hiker, I was in good shape and expected no problems related to the physically demanding field work. Within a week I was losing part or all of every meal I ate. Not wanting anyone to know there was something wrong, I kept quiet and tried to work harder, ignoring the annoying symptoms as much as possible. Writing a paper at the end of the session, I finally diagnosed my problem: altitude sickness. Science Camp was at an elevation of 10,500 feet. We routinely worked as high as 11,500 feet above sea level. At the end of the course, moving to Laramie (7,500 ft.) was easy. Nausea, etc., disappeared.

During the summer in field camp, however, one course, "Terrestrial Ecology," caught my imagination. We studied terrestrial environments by trapping at a number of designated stations, recording the trapline contents, and along with other methods, estimated population sizes for rodents in each of the study areas. Most of the mice we found were *Peromyscus maniculatus* (*Pm*). We found them at 5,000 ft. and 11,500 feet, and in between as well. *Pm*, we learned in class, were near ubiquitous in the U.S. I marveled at the success they enjoyed at all altitudes; no nausea for them! For my Master's degree I began to focus on how these *Pm* had adapted to such high altitudes.

The summer of 1962 found me trapping mice from 3,000 feet to 11,000 feet above sea level. My studies included some typical hematological parameters such as hematocrit, red blood cell count, and total hemoglobin. I expected to find difference in these between the low and high altitude populations. By midsummer I began using paper electrophoresis to study the hemoglobin in these mice. At 3,000, 5,000, and 7,000 feet, all mice showed a single discrete spot on the electrophorogram. At 9,000 feet, a variant hemoglobin appeared and it was found even greater proportion of the mice from 11,000 feet. This high altitude variant was called "diffuse" as that described its smudgy appearance, and because a hemoglobin from *Mus musculus* had been similarly described. My conclusion was that the hemoglobin variant found only in the higher altitude populations was somehow related to altitude adaptation.

Several of my professors were uncomfortable with the conclusion. After all, work done at the University of California, Berkeley, did not show altitude variation in *Pm* hemoglobins (later revised). No one suggested I publish; so I didn't. My M.S. was awarded in January 1963.

The summer of 1963 I spent at Jackson Laboratory, Bar Harbor, ME with Dr. Elizabeth (Tibby) Russell. On learning of my M.S. work, she suggested I look at hemoglobin from *Pm* from Michigan, Maine, and several places in between. Dr. Basil Eleftheriou was using the colony of *Pm* for hormone and behavioral studies, but I was welcome to have blood from each animal. At the end of the summer I had hundreds of starch gels showing only single spots, similar in migration to the single spots I had found with paper electrophoresis in Wyoming.

Dr. Russell urged me to publish, but there were no incentives and I was anxious to get on with my doctoral work. My doctoral dissertation focussed on blood proteins, including more work on hemoglobin electrophoresis. By the fall of 1966, I had finished my dissertation, too weary to want to publish. My curiosity had been satisfied and there seemed no reason to do more. However, it turned out that UW required a $50 deposit from each doctoral student as an incentive to publish. Once you published all or part of the dissertation, a student could reclaim the deposit. In 1966-67, $50 was an enormous amount for a graduate student. Setting to work, I got the paper ready, had it accepted for publication by spring 1967. The paper came out in 1968 in *Comparative Biochemistry and Physiology*, volume 24, pages 427-435 ("Electrophoretic examination of hemoglobin and plasma proteins from 3 altitudinal groups of *Peromyscus maniculatus nebracensis*").

After 20 years on faculty at Michigan State University, I resigned to pursue veterinary public health work in the Federal government (received the DVM in 1987). That led me ultimately into the evolving field of biological risk assessment. As a relatively new field, it is vigorous and exciting. The associated lifestyle is far removed from trapping deer mice on the mountains and prairies of Wyoming. I still have a picture of *Peromyscus maniculatus* on the wall of my office. People have learned not to ask about the significance of the mouse picture because I so quickly (and sometimes lengthily) oblige!

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FECAL CORTICOSTERONE IN *PEROMYSCUS MANICULATUS*

During the 1950Us biologists began to hypothesize that stress, characterized by elevated glucocorticoid (=GC) levels, and its physiological consequences (e.g. impaired immunity, reproductive suppression) may play an important role in determining the dynamics of vertebrate populations. However, the gap between theories about the potential ecological impact of stress and an empirical understanding of its role in population regulation is still enormous. While radioimmunoassay (RIA) and ELISA techniques have allowed stress to be measured in the field through plasma or serum GC concentrations, these methods do have some drawbacks. First, since they are inherently point measurements they only represent stress as experienced in a narrow window of time. Second, point measurements from free-living animals are likely to be influenced by uncontrollable or unknown events (e.g. social interactions) that occur near the time of measurement. And finally, due to the rapidity of the stress response the capture, handling, and restraint necessary to collect a blood sample significantly elevates GC levels within several minutes. Therefore, most if not all field measures of circulating GCUs are actually measures of the stress involved in obtaining the sample.

Recently, it has been discovered that many of the problems associated with measuring stress in free-living animals can be avoided by measuring GCUs in urine and feces. The chief advantage of this technique is that fecal measurements integrate GC levels over a substantial period of time, and due to its metabolic clearance time will indicate stress levels prior to capture and handling. Thus, the objective of this research was to validate an RIA originally developed for measuring plasma or serum corticosterone (=CORT, the primary GC in most rodents) in laboratory mice as a reliable measure of plasma and fecal CORT levels in *P. maniculatus*.

To validate the assay, both fecal and plasma samples were collected from individuals maintained in the lab, in addition to fecal samples collected directly from the field. Assay validity was determined via: 1) the demonstration of parallelism between serial dilutions of each medium and the standard curve (a measure of specificity), 2) the quantitative recovery of exogenous CORT from each medium (a measure of accuracy) and 3) by running a series of control samples at least 21 times across 7 different assays (a measure of precision). Finally, changes in both the circulating plasma levels of CORT associated with circadian patterns of secretion, and the artificial elevation of circulating CORT levels via intraperitoneal injections of CORT, were detected in fecal samples collected consecutively over a period of 9 days.

We are interested in collaborating with any investigators working with populations of *P. maniculatus* under a variety of conditions. The data indicates that fecal CORT levels remain relatively unchanged with regards to plasma levels for at least twelve hours and that fecal material collected from individuals confined overnight in a live-trap should be indicative of their normal circulating CORT levels. Any interested investigators should contact J.M. Harper for information.

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THE ROLE OF EARLY EXPERIENCE IN SHAPING PARENTAL BEHAVIOR IN *PEROMYSCUS POLIONOTUS*

We have begun a pilot study to examine whether oldfield mice (*Peromyscus polionotus rhoadsi*) that remain with their parents through the birth and rearing of a subsequent litter show improved parental behavior and/or litter survival when they themselves reach sexual maturity and breed. Because *P. polionotus* is monogamous, and pups are believed to remain with their parents beyond the age of nutritional weaning, pups may, under natural conditions, be present during the birth and rearing of one or more litters of siblings. This early experience may be significant in shaping (qualitatively and/or quantitatively) the parental behavior shown by animals as adults. Because this is a preliminary study, and because earlier studies have shown that maternal behavior is more important to litter survival than is paternal behavior (Margulis, 1996; in press), we chose to compare experienced and inexperienced females. We may, however, continue the study using experienced and inexperienced males.

To date, we have established 48 pairs. Twenty-four pairs have an "experienced" female. The remaining 24 pairs have an inexperienced female that is the full sister of one of the experienced females. All males are inexperienced. We are observing parental behavior in these pairs and evaluating litter survival. We will collect data through the rearing of up to three litters per pair. Data collection should be completed by December, 1997.

We would be interested in learning of similar studies conducted on this, or other, biparental care species.

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PEROMYSCUS LEUCOPUS AND ASSOCIATED SMALL MAMMAL SPECIES IN PREVIOUSLY CUT FOREST PATCHES IN ILLINOIS

Structural changes in forested habitats impact animal abundance and/or occurrence in species-specific ways. Such spatial dynamics warrant special consideration in multiple use areas, where various management objectives (e.g., wildlife conservation, timber harvest, ...) have to be met simultaneously at large spatial and temporal scales. Several factors impact dynamics of small forest mammal communities at the landscape level (e.g., Foreman 1995). At a regional level, however, vegetational and environmental characteristics are more effective predictors of species' occurrence due to differences in habitat preferences among small mammal species.

During May-September 1996 we surveyed 40 previously cut forest patches in the Shawnee National Forest in southern Illinois. (An additional 40 plots surveyed during May-September 1997 will be included in later analyzes). Plots were categorized according to time since timber harvest, method of cutting (clear-cut vs. thinning), and forest type (hardwood vs. pine). We live-trapped each plot once for a three-day period (i.e., 300 trapnights per plot), and measured several vegetational characteristics. The vegetational characteristics were subsequently related to small mammal captures via canonical correspondence analysis (Jongman et al. 1987).

We captured a total of 580 *Peromyscus leucopus*, 28 *Ochrotomys nuttalli*, 25 *Blarina carolinensis*, 19 *Microtus pinetorum* and 15 *Tamias striatus*. Overall, most recently cut ($\leq$5 years) forest patches yielded highest numbers of *P. leucopus*, highest small mammal densities, and diversities. Clear-cut patches harbored more individuals than thinned patches, and more individuals of *P. leucopus*, as well as of all species combined, were caught in hardwood than in pine forest. Pine forest patches, however, showed highest small mammal diversity. Surveyed pine forests are non-native to southern Illinois (first planted in the 1930s), and might thus represent ecologically younger systems, that are utilized by transient individuals of various species.

Analyses of vegetational characteristics revealed that tree species basal area accounted for most of the variance in small mammal captures among plots, while tree species densities, and the combined environmental characteristics (such as logs, shrubs, canopy height, etc.) were weak predictors for small mammal occurrence across plots. *P. leucopus*, as habitat generalist, was not particularly responsive to any one tree species, but in general showed an association with oak-hickory communities characteristic for this region. *T. striatus* and *M. pinetorum* exhibited similar habitat preferences, while *B. carolinensis* appeared intermediate in its habitat association in Illinois, occurring in pine as well as in hardwood forest. *O. nuttallii* responded most readily to the occurrence of pine trees. These results suggest that *P. leucopus* restricts *O. nuttallii* (here at the northern edge of its range) to pine forest patches in southern Illinois, that represent sub-optimal habitat in this area.

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BREEDER DEATHS IN A *PEROMYSCUS LEUCOPUS* COLONY

A very peculiar phenomenon occurred among the *Peromyscus leucopus* in my colony. During the past few months I saw more than a dozen nursing mothers die between about seven and 15 days post partum. The litters seem to live 24 to 48 hours longer and probably die of starvation. I was successful in fostering one of the older litters. Most mothers were substantially autolyzed when found in cage checking every few days. Gross and microscopic exam of a couple has not yet been informative. Males in the cages appear normal and deaths among non-breeders and inactive breeders have not increased. Breeding cages adjacent to each other are not necessarily affected, and two separate inbred lines are both affected although housed in separate rooms. When I realized what was happening, record review suggested that the occurrence of nursing mother deaths may have started gradually over perhaps two months.

To me this seems to be a picture of something toxic in which nursing mothers in the nesting and care of young are accumulating in amounts which would otherwise not be toxic. The toxic substance would appear to NOT be transmitted via placenta or milk(?), since the babies are not dying till a day or two after the mother.

The only change which can be identified during that period has been a change in bedding. The supply processes for Aspen shavings broke down and a growing mixture of Aspen shaving and Aspen Sani-Chips occurred to a point of use of all Sani-Chips about June 15th. I have reviewed the formal chemical analysis reports from the two companies regarding these two products with my colleague, a clinical toxicologist, who has also discussed the situation with the Sani-Chip analyst. The two products have similar analyses and contain no detected unusual levels of known toxins or heavy metals. Whether or not molds could do this is unknown, although molds or other organisms could increase during storage, shipping and handling. My animals were changed back to only Aspen Shavings on June 30. A couple more deaths were seen in the following two weeks, however there have been none since. It should be noted that the colony size has been cut about 90%, thus the at risk animal population is at now small.

I am assured that there has been no evidence of problems with other rodent colonies at UCLA using these bedding products. No unusual human problems have been apparent.

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