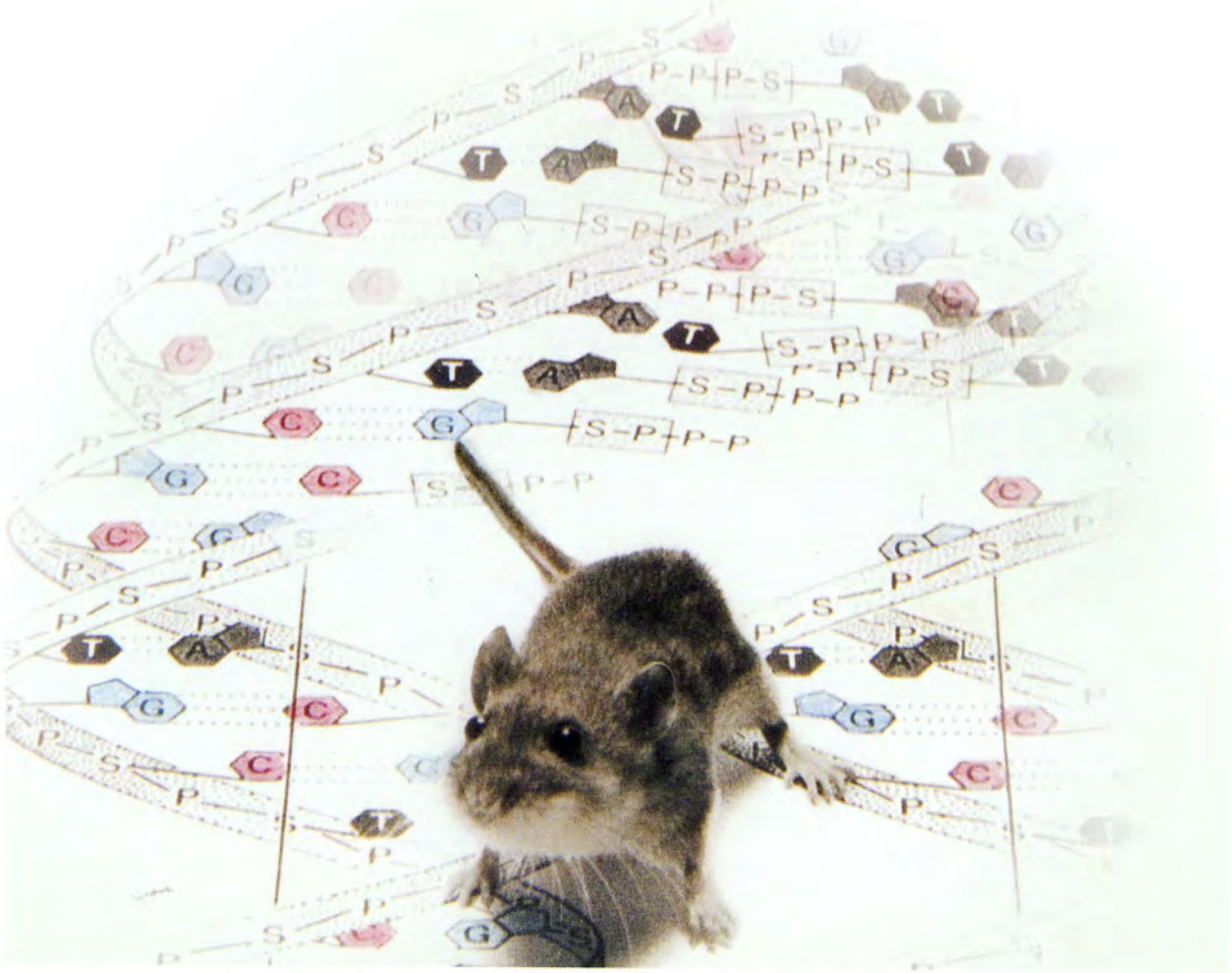
PEROMYSCUS NEWSLETTER

NUMBER THIRTY-SEVEN



GENOME ISSUE 2004

Cover: Peromyscus Genomics symbolized by immature *Peromyscus maniculatus bairdii* (BW stock) in DNA double helix. Composition by Michael Brown, Clint Cook and Janet Crossland.

ISSUE NUMBER 37.

About seven years ago, to limit redundancy and save printing costs, we decided to cease including annual detailed listings of ALL published peromyscine genomic sequences, genes, linkages and chromosomal linkage assignments, and to publish this content once every third year. The most recent such issue was March 2001 (*PN* #34). Therefore, the current issue is devoted to the genetics and genomics of *Peromyscus* and closely allied genera. The objective of this update is to direct the investigator to references concerning what is currently known about genes, DNA sequences, chromosomes and genetic linkage of these animals. We hope that those of you who work in this field will retain this issue of *Peromyscus Newsletter* as a ready reference to literature and GenBank accession numbers. Annual GenBank sequence updates appear regularly in the March issue of *PN*. In the future, lists of allozyme loci identified in natural populations will no longer appear in our updates, but will be posted in ***Pero*Base**. You may want to save this issue of *PN* for future reference.

In the September 2003 issue (*PN* #36), I undertook to recount my personal odyssey for a better understanding, at the intellectual level, of what is meant by "species" and how species come into being (speciation). I first became aware at a young age (~13), as I reported, that *Peromyscus* was a speciose genus, and, conveniently for me, centered in North America. By graduate school I had immersed myself in trying to answer this question: What makes a *Peromyscus* species a species? At various times I was convinced I knew the answer. Now, five decades later, I am less sure, but have developed a way of thinking about what constitutes a "species". I conclude this discussion on pages 10 -12.

PEROMYSCUS NEWSLETTER ALWAYS WELCOMES research results, comments, criticisms, news re peromyscines and *Peromyscus* investigators, matters of historical interest, etc. Let us hear from you.

Deadline for the next issue of *PN* is **25 October 04**

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The Stock Center sponsors ***Pero*Base**, a comprehensive database for peromyscine rodents.

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News, Comment and Announcements

Twenty-two papers and posters featuring peromyscines were presented at the 84th Annual Meeting of the **American Society of Mammalogists** held at Humboldt State University, Arcata CA 12-16 June 2004.

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We received a very welcome letter from **William Provine** of Cornell University. As many of you are aware, as a science historian, Will is the premier expert on the rise of neo-Darwinian thought during the Twentieth Century, and has published extensively in this field. Many of you may be aware of his biography of Sewell Wright, one of the founders of population genetics. Of more immediate interest to peromyscologists, Will Provine wrote his Ph.D. dissertation, later published (in W. Coleman and C. Limoges, eds. Studies in the History of Biology. 1979) on the career of Francis B. Sumner, the "Father of Peromyscus Evolutionary Genetics". (See PN #2 for a brief summary of Sumner's career). Will's letter was in response to the first of my two-part essay "Peromyscus Species and Speciation" that concludes in the present issue. Dr. Provine enclosed a draft of a provocative manuscript he is preparing in which he presents his thinking about species and speciation. Indeed, a challenging talk that Will presented at the meeting of the Society for the Study of Evolution at the University of Georgia in 1992 was the stimulus for a graduate course I offered in "Speciation" during my final years on the faculty of the University of South Carolina.

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Two recent papers with DNA sequence-based phylogenies are important additions to better understanding of the phylogenetic relationships among *Peromyscus* and other muroid rodents. In the 1 June 94 issue of *Journal of Mammalogy* **Robert Bradley** and co-investigators derived a phylogeny based on mitochondrial cytochrome-b gene sequence data that includes eight species of *Peromyscus* and twenty-eight other species from allied genera. A paper by **Scott Steppan, Ron Adkins and Joel Anderson** (*Systematic Biology* in press) gives a broader cladogram of muroid rodents based on multiple nuclear genes. *Peromyscus* falls into a clade with *Reithrodontomys* and *Neotoma.*

Jay Storz is lead author on two recent papers (Evolution 57:2628ff, 58:1342ff) dealing with population genetics of *Peromyscus* utilizing the information from the albumin locus.

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Efforts by the Peromyscus Stock Center to breed *Peromyscus boylii* in captivity (see *PN* #36) have not been promising. We are unable to supply this species at the present time.

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Where is the TREE?? Although we promised a version of the long-awaited "consensus" tree for peromyscine rodents for this issue of *PN*, we became aware of the recently published articles mentioned above that will, undoubtedly, influence the configuration of the tree. We are in the process of selecting a small group to help us with the tree project. We look forward to a preliminary Tree in *PN* #39 (Spring 2005). Anyone interested in participating in this project please contact Wally Dawson (*dawson@biol.sc.edu*) or Bill Kilpatrick (*C-William.Kilpatrick@uvm.edu*)

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THANKS! to **Suellen Van Ooteghem** for donating an extensive collection of *Peromyscus*-related reprints from the now defunct University of Michigan Laboratory of Vertebrate Biology. These will be added to our archives at the Stock Center. Individuals with interest in the materials in our archives may address inquiries to Wallace Dawson or Janet Crossland c/o Peromyscus Stock Ctr., Univ. South Carolina, Columbia SC 29209.

We welcome Julie Weston to our editorial staff. Julie is a Research Associate currently working on *Peromyscus* gene mapping in Mike Dewey's lab at the Peromyscus Stock Center. Julie will be challenged to correct my misspellings and other typos, plus providing advise on content and organization of subject matter . Julie is a graduate of Virginia Tech at Blacksburg, received an MS from Auburn University and a Ph.D. from the University of Georgia where she worked at the Savannah River Ecology Laboratory. Julie is one of the individuals seen on the cover of *PN* #36.

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-bred[1] "wild-type" stocks of seven species of *Peromyscus*. 2.) Two highly inbred[2] 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 ***Pero*Base**, 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. MOST USER CHARGES WILL INCREASE January 1, 2005**. User assumes the cost of all 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**
P. maniculatus bairdii (BW Stock) Deer Mouse	Closed colony bred in captivity since 1948. Descended from 40 ancestors wild-caught near Ann Arbor MI.
P. maniculatus sonoriensis (SM2 Stock) Sonoran Deer Mouse	Derived from about 50 animals wild-caught by Jack Hayes in 1995 near White Mountain Research Station , CA
P. polionotus subgriseus (PO Stock) Oldfield Mouse	Closed colony since 1952. Derived from 21 ancestors wild-caught in Ocala Nat'l. Forest FL. High inbreeding coefficient.
P. polionotus leucocephalus (LS Stock) Beach Mouse	Derived from beach mice wild-caught on Santa Rosa Island FL and bred by R. Lacy.
P. leucopus (LL Stock) White-footed Mouse	Derived from 38 wild ancestors captured between 1982 and 1985 near Linville, NC.
P. californicus insignis (IS Stock) California Mouse	Derived from about 60 ancestors collected between 1979 and 1987 in Santa Monica Mts. CA.
P. aztecus (AM Stock) Aztec Mouse	Derived from animals collected on Sierra Chincua Michoacan, Mexico in 1986.
P. melanophrys (XZ Stock) Plateau Mouse	Derived from animals collected between 1970 and 1978 from Zacatecas, Mexico and bred by R. Hill.
P. eremicus (EP Stock) Cactus Mouse	Originated from 10-12 animals collected at Tucson, AZ in 1993.
INTERSPECIFIC HYBRIDS	
P. maniculatus X P. polionotus F_1 Hybrids	Bred by special order.
P. leucopus X P. gossypinus F_1 Hybrids	Sometimes available by request.

COAT COLORS	ORGINAL SOURCE
Blonde *bln/bln*	Mich. State U. colony (Pratt and Robbins, 1982)
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)
[4]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}	Wild caught *P. leucopus* (Horner and Dawson, 1993)
Ivory *i/i*	Wild caught in Oregon (Huestis, 1938)
[5]Pink-eyed dilution *p/p*	Sumner's "pallid" deer mice (Sumner, 1917)
Platinum *plt/plt*	Barto stock at U. Mich. (Dodson et al., 1987)
[4]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)

OTHER MUTATIONS AND VARIANTS		
Alcohol dehydrogenase negative	Adh^0/Adh^0	South Carolina BW stock (Felder, 1975)
Alcohol dehydrogenase positive	Adh^f/Adh^f	South Carolina BW stock (Felder, 1975)
Boggler *bgl/bgl*		Blair's *P. m. blandus* stock (Barto, 1955)
Cataract-webbed *cwb/cwb*		From Huestis stocks (Anderson and Burns, 1979)
Epilepsy *epl/epl*		U. Michigan *P. m. artemisiae* stock (Dice, 1935)
[5]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 provide a reservoir (Dawson, 1983)

[1] "Random bred" without deliberate selection, sib-sib matings avoided. [2] Inbred lines bred by sib-sib and/or parent-offspring mating for 21 generations or more. [3] Unless otherwise noted, mutations are in *P. maniculatus*. [4] Available only as silver/brown double recessive. [5] Available only as pink-eye dilution/flexed tail double recessive.

Other Resources of the *Peromyscus* Stock Center

Highly inbred *P. leucopus* (I_{30+}) 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 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 not more than 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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Peromyscus Species and Speciation: A Commentary. II.

In the previous issue of *PN* I initiated an informal essay concerning my changing views on the nature of species and speciation with particular reference to my experience with *Peromyscus*. I am concluding my discussion here and will attempt to present a non-quantitative, more-or-less subjective view of "species" and "speciation".

In the formal legalistic sense, a species is any group of organisms of the same kind that has been identified as such by an acceptable, authoritative person or persons, described in an appropriate publication and documented with one or more representative voucher specimens to be retained for reference. This traditional approach is sometimes called the Taxonomic Species Concept and is generally most useful with respect to morphology. In some sense the "species" becomes synonymous with the museum or herbarium specimens. In certain instances all that is known about the "species" is based on the representative specimens and the original description. This is particularly true of species that are extinct. Hence humans "create" species in the process of naming them, presuming only to identify what already exists in nature. For legal purposes, *e.g.* for the Endangered Species Act, a formal description is essential. Fifty-three living species currently are formally recognized in the genus *Peromyscus* (*sensu stricto*).

In the 1930s, '40s and '50s emphasis changed from formal taxonomy to the concept that species are entities in nature consisting of populations of organisms that are reproductively isolated from other populations, and, hence, are closed genetic systems. Individuals of a given species are potentially interfertile with other members of the same species, but are not able to intercross with those of a different species. There is genetic continuity within a species, but not between species. Geographic isolation usually precedes reproductive isolation. This concept, often called the Biological Species Concept (BSC), was widely accepted among most biologists, particularly evolutionists and ecologists, but for many botanists and microbiologists was often not applicable.

While intellectually satisfying, the Biological Species Concept proved difficult to apply in practice, particularly since the reproductive compatibilities among natural populations were often ascertained only by experimentation. Numerous examples of partial infertility were known in hybrids produced in captivity or under cultivation. In particular, the Biological Concept was difficult to apply to many groups of hybrid plants where allopolyploidy presented difficulties. It also had no application to organisms that reproduced exclusively by asexual means and to forms known only as fossils. During the 1970s, '80s and '90s numerous proposals were made to modify the BSC. Often proposals were made to expand or constrict species criteria to include ecological or niche compatibility, *i.e.* exchangeability of populations between sites where each occupies the niche successfully (Templeton, 1987). These and others based on mate recognition, habitat specificity, host preference, *etc.*, I tend to lump as BSC-Ecology Appended concepts.

During these same decades, as protein electrophoresis and nucleic acid sequencing became practical, some molecular systematists attempted to quantify the degree of genetic divergence using allozyme electrophoretic variants or, subsequently, DNA sequence divergence based on various criteria depending on whether the DNA is mitochondrial, chloroplast or nuclear, and whether the sequence is coding or not. Some of these proponents attempted to make a species definable by some mean "distance" or divergence value, generally considered 1 – 5 % depending on the system utilized. I refer to any definition of species based solely on molecular or biochemical statistical analysis or mathematic algorithm as a Quantitative Species Concept.

Which approach to species definition is best? Or are any of these valid? Or, for that matter, is there any real distinction between "species" and all of the other hierarchal categories of systematics from kingdoms down to varieties. Are they arbitrary constructs? Do the definitions apply to both cultivated/domesticated forms and their natural forbearers? Is the toy poodle simply a variety of wolf (*Canis lupus*)? A large number of plant species have been produced by hybridization between allopolyploids. Is there "something special" about the species category, or is the notion that the taxon we designate a "species" exceptional simply a philosophic carry-over from creationist thinking?

My conclusions were reached after many years of consideration, reading the literature (sample references appended), teaching advanced courses in "Evolutionary Genetics" and "Speciation", collecting rodents in the wild, coupled with many hours and years in the lab breeding, handling young and adult, male and female, *Peromyscus leucopus, P. gossypinus, P. maniculatus, P. polionotus, P. californicus, P. eremicus, P. aztecus, P. melanophrys* and occasionally other *Peromyscus*. My research experience also extends to traditional laboratory rodents, native *Drosophila* species and sunfishes (*Lepomis*). Osgood (1909) and the others who described and arranged the systematics of *Peromyscus* basically had it right. Additional species have been described, and a few removed from Osgood's "*Peromyscus*". Only the golden mouse (*Ochrotomys*) and two species of *Baiomys* are no longer considered "peromyscus" in the sense of Hooper (1968) as modified by Carleton (1989) as "peromyscines". Within the genus there are levels of differentiation, *e.g. P. maniculatus* and *P. polionotus* are allopatric in distribution, but laboratory hybrids can be produced, although sometimes with anomalous development; *P. leucopus* and *P. gossypinus* will rather easily hybridize in captivity, but rarely do so in nature even when sympatric. Several other species of *Peromyscus* can be hybridized although with poor success. What we see in these cases is speciation in progress. Consistent with neo-Darwinian principles, new species usually arise as the consequence of geographic isolation of subpopulations for extended (thousands of years) periods of time, amply illustrated in the genus *Peromyscus*. Yes, species are "real" in the sense that they represent the stage in evolution at which reproductive isolation of two or more populations is completed or essentially completed and is irreversible. It may require fixation of only a very few alleles or minor chromosomal rearrangements to accomplish this end.

Another way to consider species is to think in terms of the genetic program, *in toto*, in each nucleated cell of each individual. When gametes are formed and syngamy has occurred the haplo-genomes of the gamete must be compatible and capable of producing a viable, fertile diploid organism. or spore. The genomic information from each parent must be able to integrate and function to produce a viable fertile organism, and the same for each successive generation. On the other hand, if the gametic genomes are not compatible, syngamy will not occur or there will be a breakdown in embryonic or later development. The breakdown may be as late as subsequent gametogensis, *e.g.* hybrid sterility. In any case, the hybrid becomes genetically irrelevant. The viable program directs the anatomical development, physiology and behavior of other individuals with more or less compatible genomes, and so on to the following generations. **A species, then, whether plant, animal or microorganism, is a population of organisms that share a closed, mutually compatible genomic program.** Genes that induce hybrid infertility or inviability I characterize as *speciation genes*. Fixation of one or a few key mutations, *e.g.* imprinting genes in *Peromyscus,* may be sufficient to "create" a new species. If this is common among various taxa of organisms, quantitative distance models of genetic divergence may have little relevance to genetic isolation and, hence, to speciation. Utilization of fluctuating asymmetry (FA) is one way to measure the stability of the genome within a species. Typically FA increases in highly inbred organisms and in wide (interspecific) outcrosses and might be a useful measure of compatibility of genomes within a taxon. A corollary of the Genomic Program model of speciation, is that the term "species" in the strict neo-Darwinian sense of reproductive isolation has no meaning in obligate asexual organisms.

In practice, however, none of the various species concepts apply universally, and some cases, *e.g.* species swarms of chiclid fishes, syngameons (*e.g.* in oaks and sunflowers), "compilospecies" of grasses, Rassenkreise (*e.g.* circumpolar Herring gulls and *Ensatina* salamanders in California) are not easily reconciled with any of the major species concepts in their more conservative interpretation. The *P. maniculatus* species group contains one widespread species, *P. maniculatus,* that, like *Homo sapiens,* has many genetically and phenotypically distinct races. When these races are brought together in captivity, they are interfertile and produce viable, fertile young, hence they have "compatible genomes". Other members of the *P. maniculatus* group (*P. melanotis, P. polionotus, P. keeni*) in each case have been known to produce live-born progeny when crossed with *P. maniculatus,* but the hybrids have growth anomalies and, except in the case of *P. polionotus,* have not survived to reproduce. In the *P. maniculatus* X *P. polionotus* cross genomic imprinting is disrupted to produce either larger or smaller than normal F_1 progeny (Vrana *et al.* 2000). These interspecific hybrids may have lower fitness when mated among themselves or in backcrosses due to imprinting mismatches and hybridized mating and nesting behaviors. In the *P. truei* species group, crosses between *P. truei* and *P. difficilis* are possible, but although hybrid females produce viable gametes, hybrid males are sterile and mature sperm do not form. These laboratory observations of partial interfertility reflect speciation in progress.

In summary, there are natural, biological entities at any point in time we call a "species". Yes, for many, perhaps most, eukaryotic organisms species are "real", existing as closed populations of genetically compatible individuals. Species are a natural consequence of sexual reproduction, but there exists a whole spectrum of genetic systems from selfing and close inbreeding to wide out crossing and polyploidy that muddles the definitions. The species concept we choose to apply in a given situation is dependent upon the context of the relevant discussion.

W. Dawson, Editor

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PEROMYSCINE GENETICS AND GENOMICS
2004 UPDATE

As with many research organisms, *Peromyscus* genetic and genomic information is increasing dramatically as the result of developments in technology. A major function of *PEROMYSCUS NEWSLETTER* is to keep abreast of these advances. While deer mice and allied species have been studied in captivity for nearly a century, they never were bred as standard laboratory rodent models, *e.g. Mus musculus* and *Rattus norvegicus*. Most research with peromyscines has pertained to systematics, evolution, parasitology, virology, behavior, physiology, and ecology with emphasis on wild populations. Despite longstanding study under laboratory conditions, peromyscines have traditionally been viewed as "wild", and hence have received less attention than "standard" models. Nevertheless, the underlying importance of genetics to all aspects of an organism's biology is recognized.

Formal genetic analysis is expensive and difficult to conduct in outbred animals and in the case of *Peromyscus* very little has been accomplished compared with traditional laboratory and domesticated species. To date fewer than sixty genetic loci have been defined in the deer mouse by formal genetic analysis and a mere handful for all other peromyscine species combined. Formally analyzed genetic traits in *Peromyscus* are listed in Tables 1-3 pp 14.

Beginning in the 1960s, with the application of electrophoresis to detect protein polymorphisms, a substantially greater number of genetic traits were identified. The formal genetics of some of this variation was analyzed and contributed about half of the loci that have been formally described in *Peromyscus*. In most instances the polymorphisms were presumed to be genetically based, and the possibility of post-translational modification was ignored. Numerous population surveys of "biochemical"= protein polymorphisms were conducted, usually to identify variation within species and to address population genetic questions. Tables 1-10 pp 30.

By the mid 1980s DNA technology had developed to the point that restriction enzyme polymorphisms (RFLPs) were efficiently detectible on Southern blots and provided the basis for additional analysis of genomic variability. In *Peromyscus* this technology was applied primarily to identify differentiation of populations within a species.

Advances in DNA sequencing methodology, particularly automation, by the 1990s made possible determination of nucleic acid sequences of specific genes, and the accession of this information into GenBank, has revolutionized genome mapping. At this time more than 2000 *Peromyscus* sequences have been entered in GenBank. About 30 nuclear genes have been sequenced, at least partially, for *Peromyscus*. A great number of mitochondrial gene sequences are available for a few informative loci used in systematics. (See pp 45)

At the level of cytogenetics there have also been advances. In *Peromyscus*, historically there have been several stages. The earliest studies were simple chromosome counts. Subsequent improvements included hypotonic pre-treatment of cells and Giemsa staining for differentiating bands. This permitted reliable chromosome identification and detection of polymorphisms involving chromosome arm number and inversions. Translocations have not been observed in *Peromyscus*. More recently *in situ* hybridization with gene or whole chromosome probes have advanced chromosome mapping and helped resolve homology questions. The normal diploid chromosome number for all peromyscine rodents (*sensu* Carleton 1989) is 48. The *Peromyscus* standard ideogram is given on page 28. The *Peromyscus* Linkage Map, as developed to date, from all sources is shown on pages 24 – 26.

GENETIC LOCI IN *PEROMYSCUS*

(Deer mice and allied species)

Table I. lists recognized genetic loci described in *Peromyscus maniculatus* or other species of the *maniculatus*-group. Table II. lists loci formally described in the *P. leucopus* species group and Table III. those of other species of *Peromyscus*. These lists are limited to loci for which formal Mendelian analysis has been conducted and appropriately reported in the published scientific literature, and/or for functional genes for which nucleic acid sequences have been published. Additional genetic traits are known, some of which have been cited in abstracts, casual reports, newsletters, grant proposals, papers presented at meetings *etc*. The latter are not included, since the descriptions and genetics are generally insufficient to formally define the loci. Presumptive loci described from natural polymorphisms in the absence of formal genetic analysis are not listed here. Protein electrophoretic and other biochemical or immunological variants known in natural populations are listed elsewhere. This list is limited to nuclear genes.

Standardization of genetic nomenclature for *Peromyscus* is a function of the Genetic Advisory Committee for the genus. The following guidelines currently are applied:

1. To the maximum extent feasible, *Peromyscus* genetic nomenclature and conventions will be consistent with those used for other mammalian species, particularly mouse (*Mus*). Where homology is evident or very likely, the same locus name and symbol is employed. Because homology among alleles is more difficult to ascertain, allelic symbols (superscripts) do not necessarily correspond to those of other species.

2. Dominant and incompletely dominant variant or mutant genes are designated with the first letter of the symbol capitalized. Recessive variant or mutant genes are indicated in lower case letters. The wild-type (normal or standard) allele for morphological, pelage color and behavioral traits, when recognized, is symbolized with a "+" sign. Electrophoretic allelic variants of proteins or subunits are indicated by superscripts in alphabetical sequence, except for null alleles which are designated, with an "o" superscript; or, in some cases, by relative mobility with reference to a standard mobility "100". Restriction fragment length variant alleles are designated by a numerical sequence or size in kilobases. Distinct loci with similar phenotypic effects may be indicated in a hyphenated numerical or alphabetical series.

3. Symbols published by the original investigator are given priority, unless there is clear homology with *Mus* loci, except for certain loci for which the original symbol was retained under the "grandfather" principle and because of prior use in the literature. If an original symbol is in conflict with an established one for *Mus*, the equivalent *Mus* symbol is given preference. In cases where the original symbols have been superseded by subsequent common usage, the latter has been adopted. If a variant is shown to be allelic with a previously reported gene, the locus symbol is reduced to an allelic symbol. Where two authors have used the identical symbol for different loci in *Peromyscus*, priority is given to the first reported, and an alternate designation is devised for the other. (In Table 1 previously published obsolete names and symbols are listed in parentheses.)

4. Presumed loci described solely on the basis of variation observed among individuals in the absence of convincing Mendelian or molecular analysis are not considered to be formally established and are not included in these tables, but may be listed as polymorphisms in natural populations.

5. Linkage assignments are subject to updates of the *Peromyscus* linkage map.

Table 1

Genetic Loci Formally Described[1] in the *Peromyscus maniculatus* Species Group:

A. Coat and Eye Pigmentation and pattern variants.

Name of Locus and allelic variants	Symbol	Mode of inheritance[1]	Linkage group/ chromosome	Definitive description and analysis	Collateral descriptions, interactions and recurrences	Recombination reported
AGOUTI			III			
Wide-band agouti	A^{Wb}	dominant		McIntosh 1956a	Blair (1947) as "buff"	Clark (1938) as "buff"
White-belly non-agouti	a^{w}	recessive		Egoscue (1971)		
Non-agouti	*a*	recessive		Horner *et al.* (1980)		
ASHINESS (Ashy)	*ahy*	recessive		Teed *et al.* (1990)		
BROWN	*b*	recessive	II	Huestis and Barto (1934)	Blair (1947), McIntosh (1956a), Dawson *et al.* (1969)	Huestis and Barto (1934), Blair (1947), Barto (1955, 1956) McIntosh (1956a)
Orange-tan	b^{ot}	recessive		Egoscue and Day (1958)		
BLONDE[3]	*bln*	recessive		Pratt and Robbins (1982)		
ALBINO	*c*	recessive	I (Chm 1)	Sumner (1922)	Clark (1938)	Sumner (1922), Clark (1936, 1938), Feldman (1937), Barto (1942a), Huestis and Lindstedt (1946), Huestis (1946)
CALIFORNIA BLONDE	*cfb*	recessive		Roth and Dawson (1996)		Roth and Dawson (1996)
COLORLESS HAIRTIP	*ctp*	recessive		Bowen and Dawson (1969)	Bowen (1968)	
DILUTE*	*d=dlt*	recessive	II	Dice (1933)		Clark (1938), Barto (1942a, 1950), McIntosh (1956a)
GRAY	*g*	recessive		Dice (1933)	Clark (1938), Blair (1947), McIntosh (1956a)	Blair (1944, 1947)
IVORY	*i*	recessive		Huestis (1938)	Clark (1938),	Barto (1942a, 1956), McIntosh (1956a)
PINK-EYED DILUTION	*p*	recessive	I (Chm 1)	Sumner (1917) as "pallid"	Clark (1938) Barto (1942b)	Sumner (1922), Clark (1936, 1938), Feldman (1937), Snyder (1980a)
PLATINUM[2]	*plt*	recessive		Dodson *et al.* (1987)		Dodson *et al.* (1987)
RED EYE[2] (Heterochromia)	*rde* (*r*)	recessive		Huestis and Willoughby (1950)		
DOMINANT SPOT (Whiteface)	*S*	dominant		Feldman (1936)		Feldman (1937)
SILVER	*sil* (*si,sl*)	recessive	I(Chm1)	Huestis and Barto (1934)		Huestis and Barto (1934), Huestis and Piestrak (1942), Huestis and Lindstadt (1946), Barto (1956)
TAN STREAK	*tns*	recessive		Wang *et al.* (1993)		
VARIABLE WHITE	*Vw*	semi-dominant lethal		Cowling *et al.* (1994)		
WHITE CHEEK[2]	Wck (*Wc*)	dominant		Blair (1944)	Bowen and Dawson (1977)	Blair (1944)

Name of Locus and allelic variants	Symbol	Mode of inheritance[1]	Linkage group/ chromosome	Definitive description and analysis	Collateral descriptions, interactions and recurrences	Recombination reported
WHITESIDE[2]	*ws* (*wh*)	recessive		McIntosh (1956b)		
YELLOWING[3] (Yellow)	*y* = *yel*	recessive		Sumner (1917)	Sumner and Collins (1922), Clark (1938), McIntosh (1956a)	Sumner (1922), Feldman (1937), Barto (1956)[3] McIntosh (1956a)
COMPLEXLY INHERITED COAT PATTERN TRAITS:						
Minor white spotting (Star, splash)	*p-1*, *p-2*	recessive incompletely penetrant		Feldman (1936)	Sumner (1932), Barto and Huestis (1933)	
Grizzled[2]	*"Gr"*	"complex dominant"		Sumner (1928, 1932)		
Coat pattern in *P. polionotus*				Bowen and Dawson (1977)	Bowen (1968)	Bowen and Dawson (1977)
Pointed A[2]	*Pt-A* (p_A)	dominant	VII			
Pointed B[2]	*Pt-B* (p_B)	dominant	VII			
Tapered	*Tpt* (*Tp*)	dominant				
Coat pattern modifiers				Bowen and Dawson (1977)		
Squared modifier[2]	*Msq* (*Rs*)	incompletely dominant				
Tapered modifier[2]	*Mtp* (*Rt*)	dominant				

[1] Autosomal unless otherwise stated.

[2] Symbol or name changed to avoid confusion with designations in *Mus*. Obsolete published names and symbols in parentheses.

[3] No longer known to be in existence.

B. Integumentary, Skeletal and Pathological Variants.

Name of Locus and allelic variants	Symbol	Mode of inheritance[1]	Linkage group/ chromosome	Definitive description and analysis	Collateral descriptions, interactions and recurrences	Recombination reported
CATARACT-WEBBED[2] (Syndactyly)	*cwb* (*cw*)	recessive		Anderson and Burns (1979)	Burns and Feeney (1975)	
FLEXED TAIL	*f*	recessive	I(Chm1)	Huestis and Barto (1936a)		Huestis and Barto (1936a), Huestis and Piestrak (1942), Huestis and Lindstedt (1946), Huestis *et al.* (1956), Barto (1956)
HAIRLESS-1	*hr-1*	recessive		Sumner (1924)		Sumner (1924, 1932), Feldman (1937), Clark (1938), Barto (1942a, 1955, 1956), McIntosh (1956a)
HAIRLESS-2	*hr-2*	recessive		Egoscue (1962)	Knapp and Dawson (1991)	
NUDE*[2] (Post-juvenile nude)	*nd* (*n*)	recessive		Clark (1938)	Barto (1942a)	
SPHEROCYTOSIS (Inherited jaundice)	*sph*	recessive		Huestis and Anderson (1954)	Huestis *et al.* (1956), Motulsky *et al.* (1956)	Huestis *et al.* (1956)

C. Behavior and Neurological Variants.

Name of Locus and allelic variants	Symbol	Mode of inheritance[1]	Linkage group/ chromosome	Definitive description and analysis	Collateral descriptions, interactions and recurrences	Recombination reported
BOGGLER[2]	*bgl* (*bg*)	recessive		Barto (1955)	Vandemeer and Barto (1969)	Barto (1955)
EPILEPSY[2] (EP, Waltzing in *artemisiae*)	*epl* (*"e", ep, v_2*)	recessive		Dice (1935)	Clark (1938), Watson (1939), Chance and Yaxley (1950), Barto (1954,1956)	Watson (1939), Barto (1956)
JUVENILE ATAXIA[2]	*jtx* (*ja*)	recessive		Van Ooteghem (1983)		
SPINNER*[2] (Waltzing in *rhoadsi*)	*spn* (*sp, v_3*)	recessive		Watson (1939)	Barto (1954)	
TREMOR*	*tr*	recessive		Huestis and Barto (1936b)		
WALTZER* (Waltzing in *bairdii*)	*v* (*w*)	recessive	III	Dice (1935)	Clark (1938), Watson (1939), Dice *et al.* (1963)	Barto (1942a, 1954, 1956), McIntosh (1956a)

[1] Autosomal unless otherwise stated.

[2] Symbol or name changed to avoid confusion with designations in *Mus*. Obsolete published names and symbols in parentheses.

* No longer known to be in existence.

D. Biochemical and Immunological Genetic[1] Variants.

Name of locus	Allelic designation	Linkage group/ chromosome	Definitive description and formal analysis	Recombination reported	Nucleic acid sequence[4]
ALCOHOL DEHYDROGENASE-1 (liver)	*Adh-1*^{f} *Adh-1*^{s} *Adh-1*^{0}	**VI(Chm2)**	Felder (1975), Burnett and Felder (1978a, 1978b)	Dawson *et al.* (1983), Cowling *et al.* (1994)	GB **L15703**
ALCOHOL DEHYDROGENASE-2	*Adh-2*		Zheng *et al.* (1983), Haseba *et al.* (1995)		GB **L15704**
ALBUMIN (serum)	*Alb*^{100} *Alb*^{96} *Alb*^{86}	**VI(Chm2)**	Brown and Welser (1968), Jensen and Rasmussen (1971)	Dawson (1982), Dawson *et al.* (1983), Cowling *et al.* (1994), Roth and Dawson (1996)	
AMYLASE (salivary)	*Amy-1*^{a} *Amy-1*^{b} *Amy-1*^{c}	**VI(Chm2)**	Evans *et al.* (1977)	Dawson *et al.* (1983)	
ERITHROCYTIC ANTIGEN	*Ea*^{A} = (*Pm*^{A}) *Ea*^{B} = (*Pm*^{B}) *Ea*^{C} = (*Pm*^{C})	**IV**	Rasmussen (1961), Savage and Cameron (1971)	Randerson (1973)	
ESTERASE (erythrocytic)[2]	*Es-3*^{0} (*Es-1*) *Es-3*^{a} *Es-3*^{b} *etc.*	**IV**	Randerson (1965), Van Duesem and Kaufman (1978)	Randerson (1973)	
ESTERASES (tissue and serum)	*Es-1* --- *Es-7* (Symbols not standardized)	**VIII**	Rasmussen and Jensen (1971), Dawson (1982), Gill (1976), Baccus *et al.* (1980)	Dawson (1982)	
GLYCEROL-3-PHOSPHATE DEHYDROGENASE[2] (tissue)	*Gdc-1*^{a} (*Gdp-1*) *Gdc-1*^{b}		Gill (1978)		
GLUTAMATE OXALOACETATE TRANSAMINASE (soluble) (ASPARTATE AMINO TRANSFERASE)	*Got-1*^{a} (*Aat-1*) *Got-1*^{b} *Got-1*^{c}		Gill (1976)	Dawson *et al.* (1983)	
GLUCOSE-6-PHOSPHATE (Autosomal Hexose-6-P) DEHYDROGENASE (tissue)	*Gpd-1*^{a} (*G6pd-1*) *Gpd-1*^{b}		Shaw and Barto (1965), Shaw (1966)		
HEMOGLOBIN – ALPHA TYPE GLOBINS (duplicated locus)	*Hba* =(*Hb*^{t})=(*Hbl*^{a}) *Hba*^{2} *Hbc*^{0}=(*Hb*^{0})=(*Hbl*^{c}) *Hbc*^{1} *Hbc*^{2}=(*Hb*^{f})		Thompson *et al.* (1966), Rasmussen *et al.* (1968), Jensen *et al.* (1976), Maybank and Dawson (1976), Snyder (1978, 1980b)		
HEMOGLOBIN – BETA TYPE GLOBINS (triplicated locus)	*Hbb*^{1} *Hbd*^{0} or *Hbb-b1* *Hbd*^{1} or *Hbb-b2* *Hbe*^{0} or *Hbb-b3* *Hbe*^{1}	**I(Chm1)**	Snyder (1978, 1980b), Padget et al. (1987)	Snyder (1980a)	GB **M15289 - M15299**
HAPTOGLOBIN (serum)[3]	*Hp*^{1} (*Hpf*) *Hp*^{2}		Rasmussen (1968), Griswold and Dawson (1971)		
IMMUNOGLOBIN(7Sy.. $_{CK1}$)	*Ig*^{f} *Ig*^{s}		Coe (1972)		
LEUCINE AMINOPEPTIDASE (serum)	*Lap-1*^{a} *Lap-1*^{b}	**V(Chm7)**	Dawson (1982)	Dawson (1982), Dawson *et al.* (1983)	
LACTATE DEHYDROGENASE[2] A SUBUNIT (tissue)	*Ldh-1*^{a} (*Ldh-A*) *Ldh-1*^{b}		Cattanach and Perz (1969)		

LACTATE DEHYDROGENASE[2] B SUBUNIT (tissue)	*Ldh-2*^{f} (*Ldh-B*) *Ldh-2*^{s}		Shaw and Barto (1963)	
6-PHOSPHOGLUCONATE DEHYDROGENASE (tissue)	*Pgd-1*^{a} *Pgd-1*^{b}		Gill (1976)	
PHOSPHOGLUCOMUTASE-1 (tissue)	*Pgm-1*^{a} *Pgm-1*^{b}		Gill (1976)	
PHOSPHOGLUCOMUTASE-4 (tissue)	*Pgm-4*^{a} *Pgm-4*^{b} *Pgm-4*^{c}		Gill (1976)	
SUPEROXIDE DISMUTASE	*Sod-1*^{J} = (*Ng*) *Sod-1*^{P} *Sod-1*^{M}		Birdsall *et al.* (1970)	
TRANSFERRIN (serum)	*Trf*^{a} = (*Trf*^{f}) *Trf*^{b} *Trf*^{c} *Trf*^{e} *Trf*^{m} = (*Trf*^{M})	**V(Chm7)**	Rasmussen and Koehn (1966) Biggers and Dawson (1971) Griswold and Dawson (1971) Canham *et al.* (1970)	Dawson (1982) Dawson *et al.* (1963) Roth and Dawson (1996)

Footnotes Table 1 (D)

[1] Demonstrated or inferred by recombination genetic analysis.
[2] Autosomal unless otherwise specified.
[3] Symbol and/or name changed from original publication to avoid confusion with non-homologous designations.
[4] GenBank accession numbers.

Table 2

Genetic Loci Formally Described in the *Peromyscus leucopus* Species Group.

Name of Locus and allelic variants	Symbol	Mode of inheritance[1]	Definitive description and analysis
GOLDEN NUGGET	*b*^{GN}	recessive	Horner and Dawson (1993)
ALBINO	*c*	recessive	Castle (1912)
CARBONIC ANHYDRASE	*Ca*^{f} *Ca*^{s}	co-dominant	Wilmot and Underhill (1972)
CATALASE	*Ca*^{a}	co-dominant	Jensen (1969)
ESTERASE-3 (Esterase-1)[2] (erythrocytic)	*Es-3*^{0} (*Es-1*^{a}) *Es-3*^{b}	semi-dominant	Wilmot and Underhill (1973)
ESTERASE-2	*Es-2*^{0} (*Es-2*^{a}) *Es-2*^{b}	semi-dominant	Wilmot and Underhill (1973)
HEMOGLOBIN	*Hb*^{A} (in *P. gossypinus*) *Hb*^{B} (in *P. gossypinus*) *Hb*^{C} (in *P. gossypinus*) *Hb*^{D} (in *p. leucopus*)	co-dominant co-dominant	Foreman (1966)

[1] All are autosomal.
[2] Name and symbol changed to correspond to *Mus*. Obsolete names and symbols in parentheses.

Table 3

Formally Described[1] Genetic Loci in Miscellaneous *Peromyscus* Species

Species	Locus	Symbol and alleles	Mode of inheritance	References
P. truei	ESTERASE-1	$Es\text{-}1^{100}$ $Es\text{-}1^{93}$	co-dominant	Zimmerman and Kilpatrick (1975)
P. eremicus	PECTORAL SPOT	*psp*	recessive	Huestis (1925) Clark (1938)
P. californicus	HAIRLESSNESS	*hm*	recessive (unconfirmed)	Packchanian and Louis (1984)

[1]All are autosomal.
[2]Name and symbol changed to correspond to *Mus*. Obsolete names and symbols in parentheses.

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PEROMYSCUS GENETIC LINKAGE 2004

Most genetic linkage data for *Peromyscus* to date have been generated by formal recombination genetics. However, additional approaches to gene mapping utilizing recently developed technologies are now being employed at the *Peromyscus* Genetic Stock Center. These approaches promise greater efficiency and a more extensively developed gene map in the near future. Among these approaches are fluorescence *in situ* hybridization (FISH), microsatellites in UTRs with known homologs in other rodent species, and screening radiation hybrid panels. Some initial results have been obtained with these methodologies. An understanding of genetic organization in the *Peromyscus* genome also is advanced by apparently homologous Giemsa stain banding patterns in other rodents, particularly *Rattus,* that have been more extensively mapped. Partial banding homology between Chromosome 1 of *Rattus* and Chromosome 1 of *Peromyscus* (14) suggests that Linkage Group (LG) I is probably located on Chromosome 1 in deer mouse, as is the homologous group in rat (7). Two loci, *Tk-1* and *Tp53*, have been assigned to Chromosome 13 by flourescence *in situ* hybridization (FISH) (21). Several additional loci have been assigned presumptively to *Peromyscus* Chromosome 11 (Ramsdell pers. com.).

The diploid chromosome number of all *Peromyscus* species is 2N = 48 (6). The standard karyotype was most recently revised in 1994 (11). Species of *Peromyscus* differ in several diagnostic euchromatic inversions, but translocations have not been reported in the genus. Heterochromatic arm polymorphism occurs within species and populations of peromyscines. Virtually all of the genetic mapping studies have employed *P. maniculatus* and/or *P. polionotus*. Polymorphisms for protein-coding genes are known within many species of *Peromyscus*). Naturally occurring protein (allozyme and serum protein) polymorphism has been used extensively to explore population genetics and, to a lesser extent, phylogeny (See "Variant Genetic Loci in Natural Populations" pp. 30 - 44).

Linkage data for the deer mouse (*P. maniculatus*) collected prior to 1972 are summarized by Robinson (17,18). The system of assigning linkage groups (LGs) on the basis of a single marker, as employed in the 1940s and 50s (2,15), is no longer used. "Group IV" in the earlier system is now Group II and former Groups "II" and "III" have been abandoned. In the interim since Robinson's review several additional linkages have been described (3,8,10,19) based on recombination genetics. The current status of the linkage map for the deer mouse and its sibling species, *P. polionotus*, is shown in the figure. Eight linkage groups are now established by formal genetics and another is tentative. Additional linkage associations are presumed based on fluorescence *in situ* hybridization (see page 24 - 26).

The order of loci in LG I, reported informally by R.R. Huestis and K. Silliman in an unpublished communication and previously published (17,9), was revised based on unpublished data of W.B McIntosh and K. Dodson. Linkage of *Trf* and *Lap* is tentative (8), but is homologous with a similar linkage in *Mus*. The *Pep-2* locus is provisionally assigned to LG VI proximal to *Alb*, but has not been mapped further (10).

Positive, but not significant, lod scores suggesting possible linkage between gene pairs *Adh - Pgd, Adh-Got-1, Adh - Idh, Alb - Pept-1, Alb - Sdh* and *Est-4 - Sdh,* respectively, were reported by Baccus *et al.*(1). Subsequent information indicates that *Adh-1* and *Got-1*are independednt, as are the *Alb* and *Sdh-1* loci (10).

The *Hbe* locus is part of the triplicated beta globin site (*Hbb*), according to Snyder (19). Unpublished data from Snyder maps the position of the *Gpi-1* and *Hbe* loci relative to the albino (*c*) and pink-eyed dilution (*p*) loci. Silliman (unpub) proposed that there is a duplication, *f*, closely linked to the *f* locus. The Pm blood group, formerly designated "*Pm*", is redesignated Ea_{Pm}. Linkage of the agouti (*a*) to waltzing (*v*) was tested using the dominant wide-band agouti allele, A^{Nh} (15).

Two significant markers on the *Peromyscus* linkage map, *d* and *v*, are now extinct in laboratory stocks of deer mice. The "flexed tail" trait that occurs in a laboratory stock may not be identical by descent with the original trait used in early linkage studies, but it maps to the same location in LG I.

The *c, p, a,* and *b* coat color loci are phenotypically essentially identical to their counterparts in *Mus* and *Rattus* human and other mammals. Specific homologies between esterases and peptidases are not firm, but two clusters of common esterases in *Peromyscus* LG VIII are probably homologous to the esterase clusters on *Mus* Chromosome 8 and *Rattus* LG V. Erythrocytic esterase (*Es-3,* formerly "*Es-1*") of *Peromyscus* is very likely homologous with *Es-3* of *Mus* and is now known to be independent of the esterase loci in LG 8 (D.L. Covington *et al.*, unpub.)

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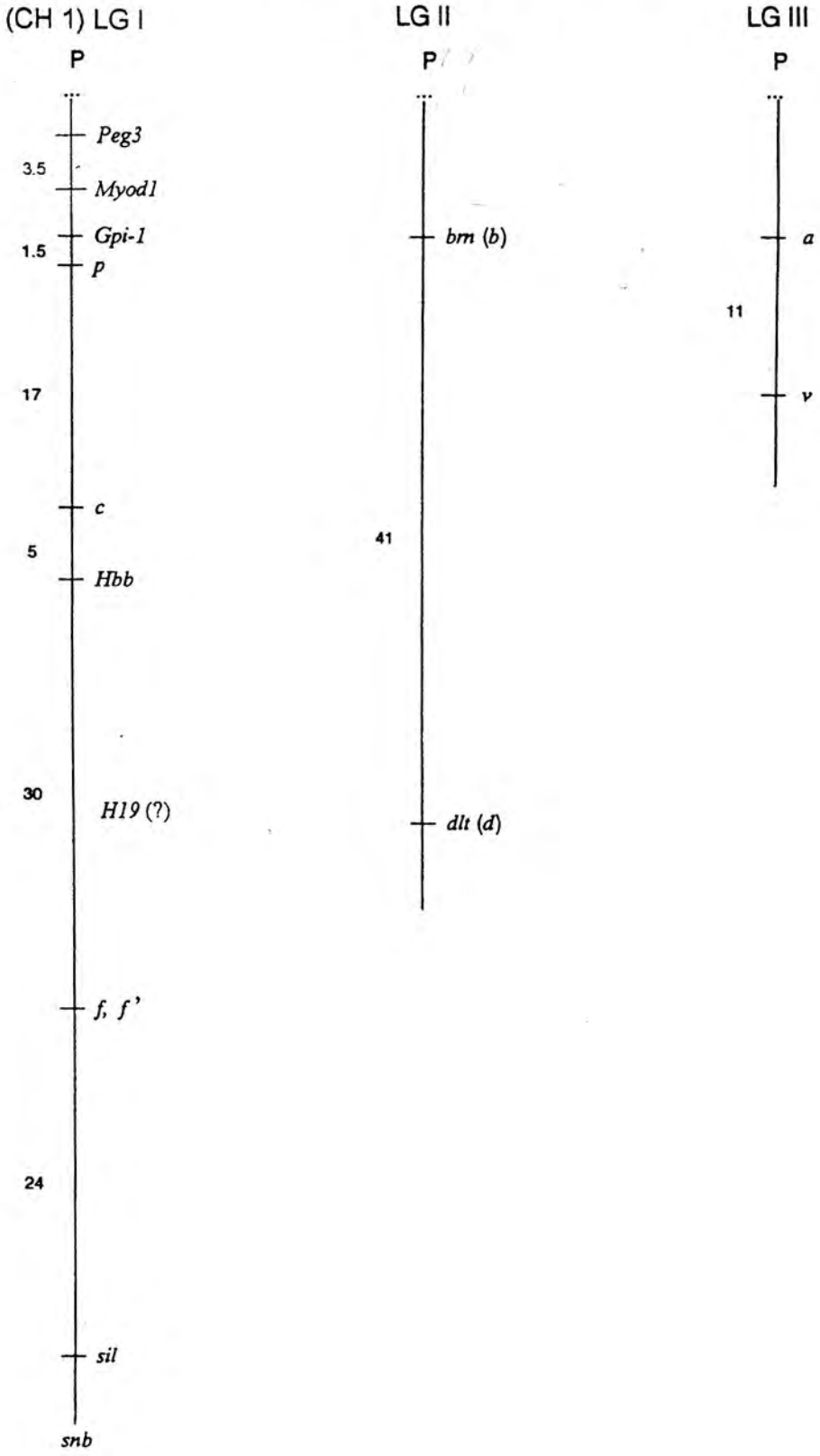
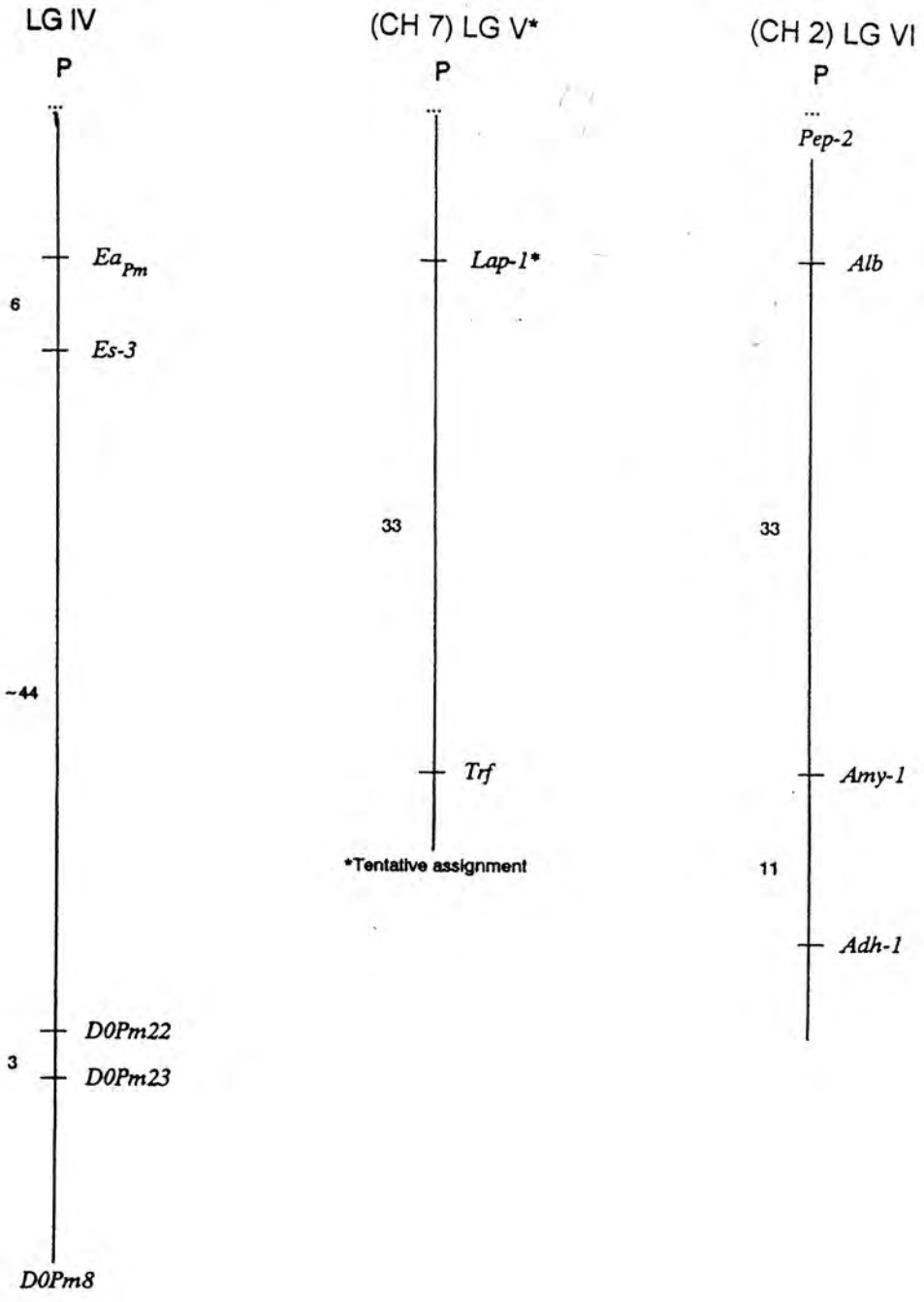
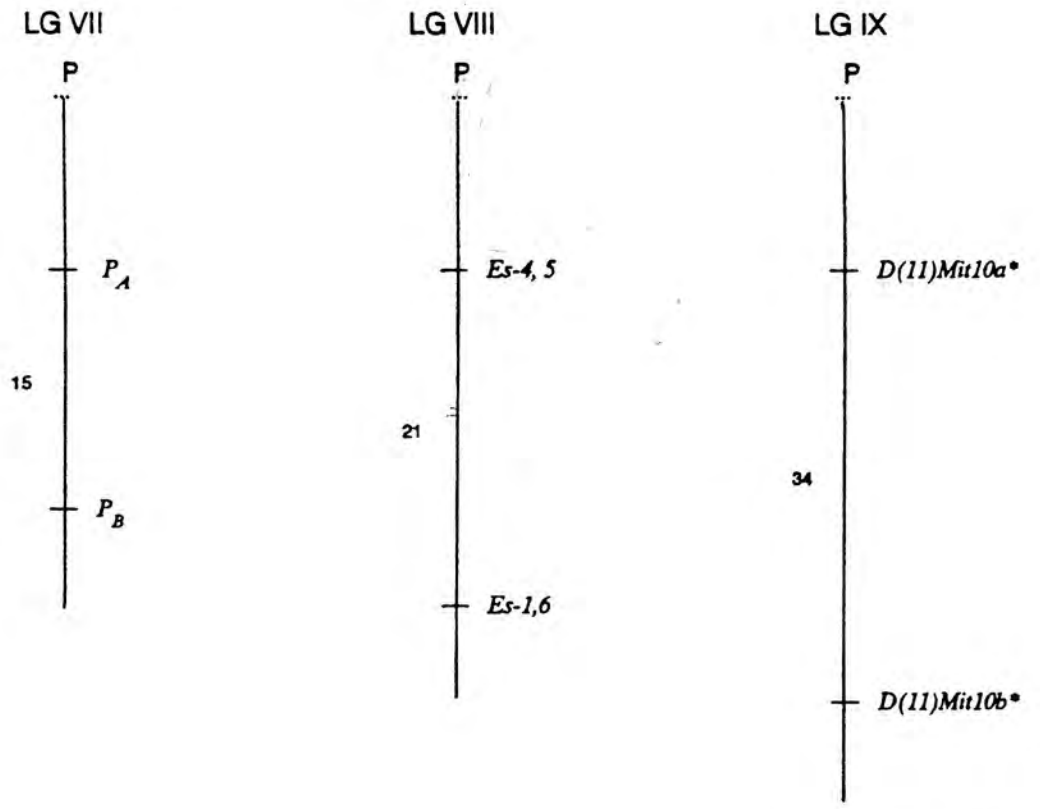
PEROMYSCUS LINKAGE MAP



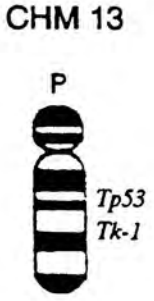
Peromyscus Linkage Map (Continued).



Peromyscus Linkage Map (Continued).



******Mus* Chm 11 primers



PEROMYSCUS CYTOGENETICS

The study of chromosomes of peromyscine rodents has advanced through several stages, beginning in the 1930s with simple drawings of metaphase configurations accompanied by counts (Cross, 1938). By the 1960s improved methods employing induced cell division of bone marrow or other tissues using colchicine, followed by hypotonic treatment and Giemsa staining gave reliable counts of individual chromosome arm numbers, and revealed extensive polymorphism in arm number within and among species of *Peromyscus,* and also demonstrated that chromosome number was remarkably conserved within the genus, all having a normal diploid number = 48 (Hsu and Arrighi, 1966; 1968). Furthermore, much of the variation within species in arm number, as revealed by C-banding, was due to heterochromatic additions, rather than to inversions, whereas euchromatic changes were attributable to inversions.

Further advances in Giemsa-band methodology permitted recognition of individual chromosome bands within arms. Based on banding patterns, evolutionary changes in *Peromyscus* chromosome morphology were amenable to analysis and a phylogenetic model was constructed (Greenbaum and Baker, 1978). G-banding technology also made possible comparisons of the *Peromyscus* karyotype with those of other rodent genera (Koop *et al.*1984). Stangl and Baker (1984) and Rogers *et al.* (1984) demonstrated that phylogenies derived from karyotypes were consistent with those based on allozymes and morphology. The cytogenetic nomenclature and the karyotype for *Peromyscus* was standardized by Greenbaum *et al.* (1994)[1]. The ideogram on the facing page is based on this standard. Translocation polymorphism has not been observed within or among *Peromyscus* species.

More recently fluorescence *in situ* hybridization (FISH) of specific gene probes or whole chromosome probes to specific chromosomes allows assignment of genes or groups of genes to specific chromosomes or chromosome arms (Wang *et al.* 1995; Dawson *et al.* 1999). FISH has the potential to demonstrate homologous chromosome regions among species of different taxa, *e.g.* house mouse (*Mus*) and *Peromyscus.* Based on FISH methodology all loci on *Mus* Chr 7 are located on the *ad*-centromeric two thirds of *Peromyscus* Chr 1q. About 90% of *Mus* Chr 3 genes are located in two disjunct regions of *Peromyscus* Chr 2q. All *Mus* Chr 9 genes are located on *Peromyscus* Chr 7.

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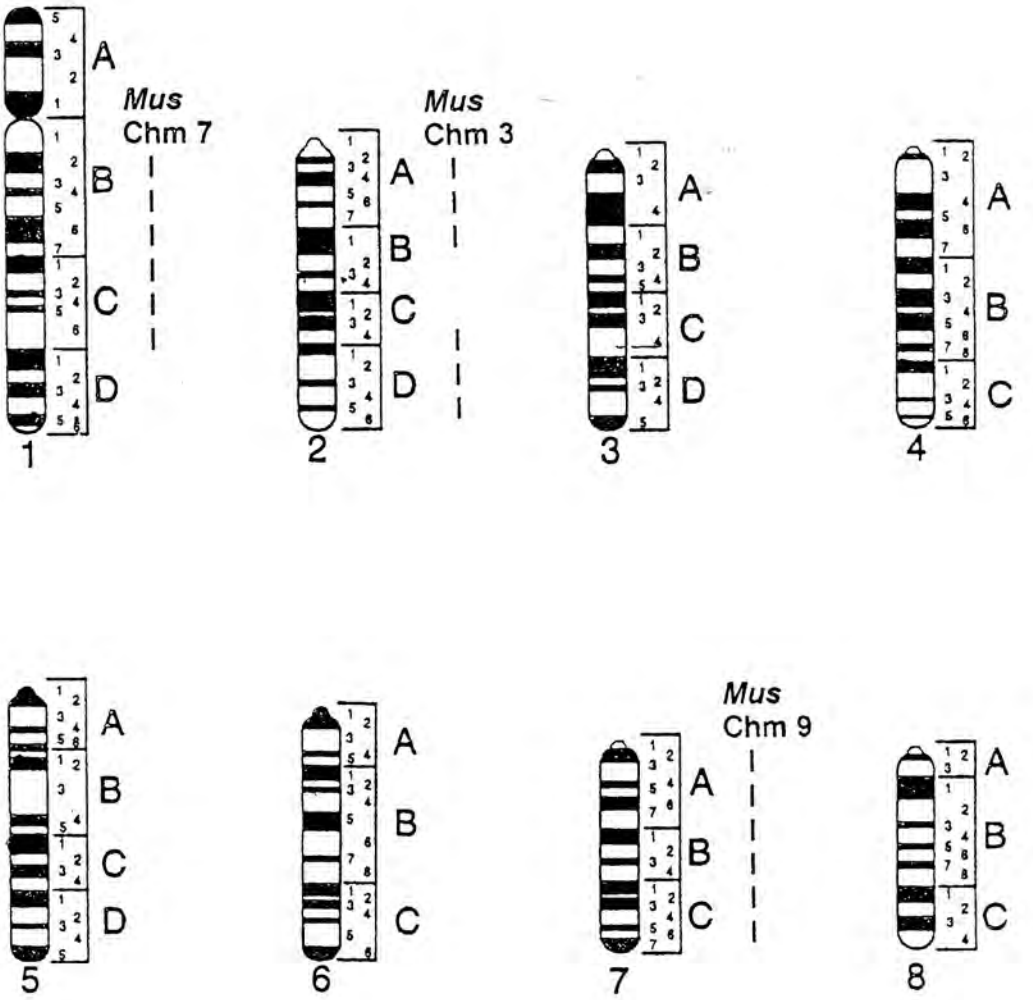
[1]Available in limited number, upon request, from the *Peromyscus* Genetic Stock Center.

PEROMYSCUS STANDARD IDEOGRAM



Peromyscus Ideogram* showing regions of homology with *Mus* chromosomes as demonstrated with FISH. (Wang *et al.* 1995; Dawson *et al.* 1999). A substantial portion of *Mus* whole Chr 11 probe hybridizes to *Peromyscus* Chr 13, consistent with Wang *et al.* 1995. (Jane Scalzi. Unpublished). The ideogram is based on the presumed "primitive" *Peromyscus* karyotype as exhibited in *P. boylii*. Other peromyscine species typically show inversion variation from the standard, changing the centromeric position and/or the number of acrocentric vs. bi-armed autosomes.

*Modified from Greenbaum et al. (1994). Cytogenet. Cell Genet. p.184

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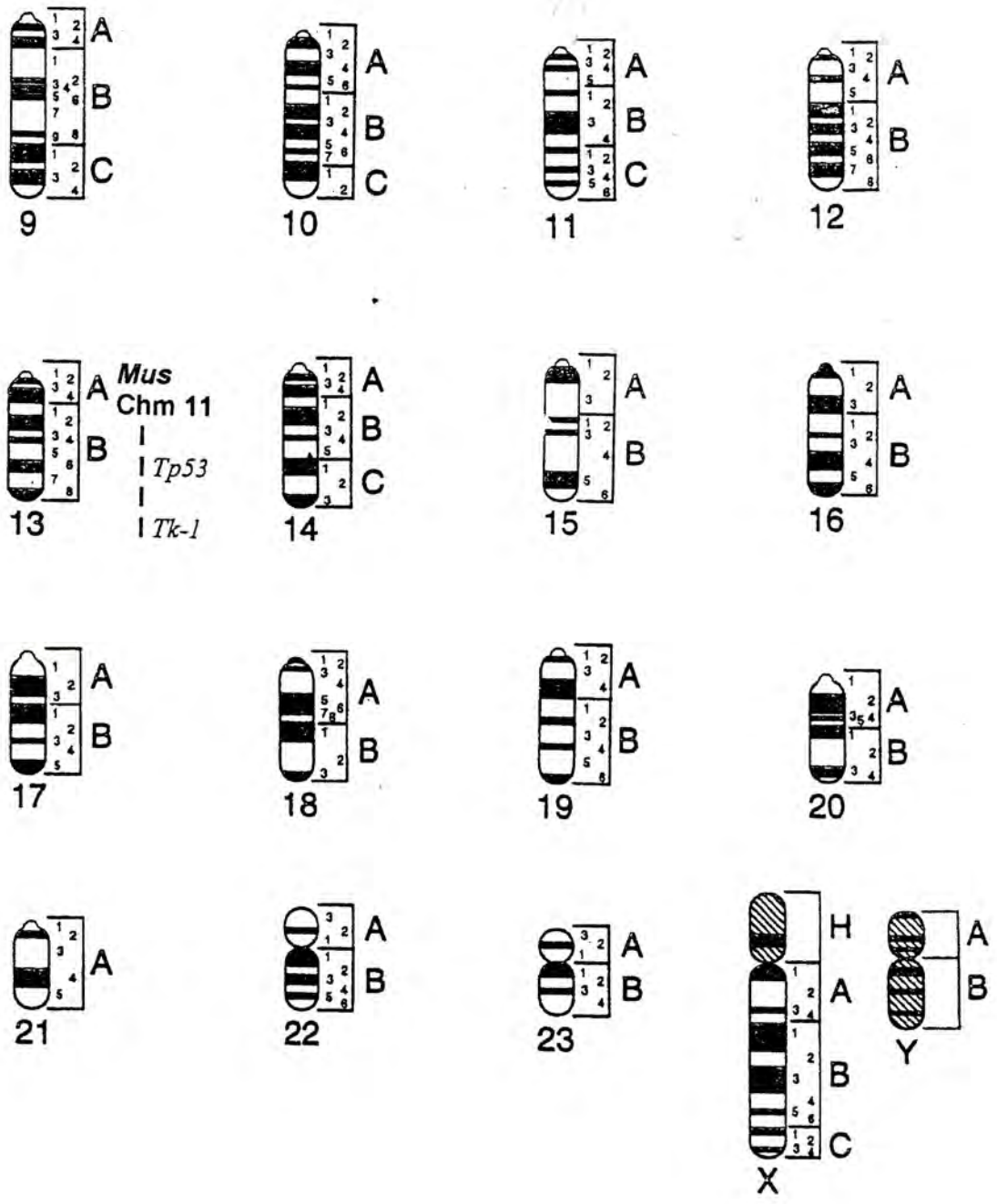

Peromyscus Ideogram showing regions of homology with *Mus* chromosomes. (Continued)

VARIANT GENETIC LOCI IN NATURAL POPULATIONS OF PEROMYSCUS

Numerous electrophoretic studies of allozymes and other proteins in natural populations of *Peromyscus* have been conducted beginning in the late 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 *Peromyscus* 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 the Tables summarize presumptive variant loci identified in the *Peromyscus* species groups to date. Similar tables in PN #16 list variant presumptive loci reported in other *Peromyscus* species and species groups.

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 THE *Peromyscus leucopus* SPECIES GROUP

Protein	Locus	Species	Referencess
Acid phosphatase	*Acp-1*	*P. leucopus*	Nelson *et al.* (1987)
Aconitase	*Acon*	*P. leucopus*	Schnake-Greene *et al.* (1990)
Adenosine deaminase	*Ada-1*	*P. leucopus*	Krone and Baccus (1985)
Albumin	*Alb*	*P. leucopus* *P. gossypinus*	Brown and Welser (1968) Jensen and Rasmussem (1971) Browne (1977) Price and Kennedy (1984) Robbins *et al.* (1985)
Alcohol dehydrogenase	*Adh-1*	*P. leucopus*	Robbins *et al.* (1985) Nelson *et al.* (1987) Toliver *et al.* (1987)
Adenylate kinase	*Ak-1*	*P. leucopus*	Nelson *et al.* (1987)
Amylase	*Amy-1*	*P. leucopus*	Aquadro and Patton (1980) Merriam *et al.* (1989) Palas *et al.* (1992)
Carbonic anhydrase	*Ca-1*	*P. leucopus*	Wilmot and Underhill (1972) Krohne and Baccus (1985)
Creatine kinase	*Ck-1*	*P. leucopus*	Schnakke-Greene *et al.* (1990)
NADH diphorase	*Dia-1*	*P. leucopus*	Nelson *et al.* (1987)
Esterase	*Es-1* *Es-2* *Es-3* *Es-4* *Es-5* *Es-9*	*P. leucopus* *P. gossypinus*	Price and Kennedy (1980) Wilmot and Underhill (1973)
Fumarate hydratase	*Fh-2*	*P. leucopus*	Nelson *et al.* (1987)
L-glutamate dehydrogenase	*Gld-1*	*P. leucopus*	Nelson *et al.* (1987)
Glutamate oxaloacetate transaminase	*Got-1* *Got-2*	*P.leucopus*	Price and Kennedy (1980) Nelson *et al.* (1987)
α -glycerophosphate dehydrogenase	*Gdp-1* *Gdp-2*	*P. leucopus* *P. gossypinus*	Mascarello and Shaw (1973) Browne (1977) Robbins *et al.* (1985)
Glucose-6-phosophate dehydrogenase	*G6pd-1*	*P. leucopus*	Nelson *et al.* (1987)
Glucose phosphate isomerase	*Gpi-1* *(Pgi-1)*	*P. leucopus* *P. gossypinus*	Price and Kennedy (1980) Robbins *et al.* (1985) Nelson *et al* (1987) Rogers and Engstrom (1982)
Hemoglobin	*Hb*	*P. leucopus* *P. gossypinus*	Foreman (1960) Foremen (1966) Price and Kennedy (1980)

(Table continued)

Table 1. Continued.

Isocitrate dehydrogenase	*Icd-1* *(Idh-1)* *Icd-2*	*P. gossypinus*	Robbins *et al.* (1985) Nelson *et al.* (1987) Schnake-Greene *et al.* (1990)
Lactate dehydrogenase	*Ldh-1*	*P. leucopus*	Robbins *et al.* (1980) Nelson *et al.* (1980)
Malate dehydrogenase-2	*Mdh-2*	*P. leucopus*	Schnake-Greene *et al.* (1990)
Malic enzyme	*Me-1*	*P. leucopus*	Nelson et al. (1987) Schnake-Greene *et al.* (1990)
Mannose phosphoisomerase	*Mpi-1*	*P. leucopus*	Rogers and Engstrom (1992)
Major urinary protein	*Mup-1*	*P. leucopus* *P. gossypinus*	Cain *et al.* (1992)
Nucleoside phosphorylase	*Np-1*	*P. gossypinus*	Smith *et al.* (1984) Nelson *et al.* (1987) Schnake-Greene *et al.* (1990)
Peptidase	*Pep-2* *(Pep-1)*	*P. leucopus*	Nelson *et al.* (1987) Schnake-Greene *et al.* (1990)
Phosphogluconate dehydrogenase	*Pgd-1*	*P. leucopus*	Robbins *et al.* (1985) Nelson *et al.* (1987)
Phosphoglucose mutase	*Pgm-1* *Pgm-3*	*P. leucopus* *P. gossypinus*	Mascarello and Shaw (1973) Browne (1977) Price and Kennedy (1980) Robbins *et al.* (1985) Nelson *et al.* (1987)
Sorbitol dehydrogenase	*Sdh-1*	*P. leucopus*	Nelson *et al.* (1987)
Superoxide dismutase	*Sod-1* *(Ipo-1, Tetra-1)* *Sod-2*	*P. leucopus* *P. gossypinus*	Mascarello and Shaw (1973) Browne (1977) Price and Kennedy (1980) Robbins *et al.* (1985) Tolliver *et al.* (1987) Nelson *et al.* (1987)
Transferrin	*Trf*	*P. leucopus* *P. gossypinus*	Price and Kennedy (1980) Robbins *et al.* (1985) Krohne and Baccus (1985)
Xanthine dehydrogenase	*Xdh-1*	*P. leucopus*	Nelson *et al.* (1987)
Non-specific proteins:			
Plasma protein	*Pprt-1*	*P. leucopus*	Khrone and Baccus (1985)
General protein	*Gp*		Schnake-Greene *et al.* (1990)

TABLE 2. VARIANT PROTEIN LOCI REPORTED FROM NATURAL POPULATIONS OF THE *Peromyscus maniculaus* SPECIES GROUP

Protein	Locus	Species	References
Aconitase	*Acon-1*	*P. maniculatus*	Meagher (1999)
Acid phosphatase	*Acp-1*	*P. maniculatus*	Baccus and Wolff (1989)
Adenosine deaminase	*Ada-1*	*P. manicualtus*	Baccus and Wolff (1989)
Alcohol dehydrogenase	*Adh-1*	*P. maniculatus* *P. polionotus*	Avise *et al.* (1979) Baccus *et al.* (1980) Massey and Joule (1981) Calhoun *et al.* (1988) Baccus and Wolf (1989) Meagher (1999)
Albumin	*Alb*	*P. maniculatus* *P. polionotus*	Rasmussen (1970) Jensen and Rasmussen (1971) Selander *et al.* (1971) Avise *et al.* (1974) Biggers and Dawson (1971) Loudenslager (1978) Baccus *et al.* (1980) Meagher (1999)
Aldolase	*Aldo-1*	*P. maniculatus*	Baccus and Wolff (1989)
Alkaline phosphatase	*Ak-2*	*P. maniculatus*	Meagher (1999)
Amylase	*Amy-1*	*P. maniculatus*	Aquadro and Patton (1980) Palas *et al.* (1992)
Carbonic anhydrase	*Ca-1*	*P. maniculatus*	Baccus and Wolff (1989)
Catalase	*Cat-1*	*P. maniculatus*	Baccus and Wolff (1989)
Esterase	*Es-1* *Es-2* *Es-3* *Es-4* *Es-5* *Es-6* *Es-7* *Es-8*	*P. maniculatus* *P. polionotus*	Rasmussen and Jensen (1971) Selander *et.al.* (1971) Peck and Biggers (1975) Gill (1976) Loudenslager (1978) Massey and Joule (1981) Foltz (1981) Aquadro and Kilpatrick (1981) Medwaldt and Jenkins (1986)
Glucose dehydrogenase	*Gdh-1*	*P. maniculatus*	Mewaldt and Jenkins (1986) Baccus and Wolff (1989)
Glutamate oxaloacetate transaminase (Aspartase aminotransferase)	*Got-1* *Got-2* *(Aat)*	*P. maniculatus* *P. polionotus* *P. melanotis*	Selander *et al.* (1971) Gill (1976) Loudenslager (1978) Avise *et al.* (1979) Baccus *et al.* (1980) Massey and Joule (1981) Aquadro and Kilpatrick (1981) Calhoun *et al.* (1988) Baccus and Wolf (1989) Medwaldt and Jenkins (1968) Meagher (1999)

(Continued)

Table 2. Continued.

Glucose-6-phosphate dehydrogenase	*G6pd-1* (*H6pd-1*)	*P. maniculatus*	Shaw and Barto (1965) Loudenslager (1978) Aquadro and Kilpatrick (1981)
α -grlycerophosphate dehydrogenase	*Gpd-1*	*P. maniculatus* *P. polionotus* *P. keeni* (*oreas*)	Selander *et al.*. (1971) Mascarello and Shaw (1973) Gill (1976) Avise *et al.* (1979) Calhoun *et al.* (1988) Baccus and Wolf (1989)
Glucose phosphate isomerase	*Gpi-1*	*P. polionotus* *P. melanotis* *P. maniculatus*	Selander *et al.* (1971) Avise *et al.* (1974) Avise iet al. (1979) Massey and Joule (1981) Foltz (1981) Baccus and Wolff (1989)
Glutamate pyruvate transaminase	*Gpt-1*	*P. maniculatus*	Baccus and Wolff (1989)
Hemoglobin	*Hba* *Hbb*	*P. maniculatus* *P. polionotus* *P. melanotis*	Thompson *et al.*(1966) Ahl (1968) Foreman (1968) Rasmussen *et al.* (1968) Rasmussen (1970) Sealander *et al.* (1971) Snyder (1978, 1980) Loudenslager (1978) Avise *et al.* (1979) Massey and Joule (1981) Aquadro and Kilpatrick (1981) Chappell and Snyder (1984)
Haptoglobin	*Hpt*	*P. polionotus*	Peck and Biggers (1975)
Immunoglobin (7sγ)	*IgG*	*P. maniculatus*	Coe (1972)
Isocitrate dehydrogenase	*Idh-1* (*Icd-1*)	*P. maniculatus* *P. keeni* (*oreas*)	Mascarello and Shaw (1973) Baccus *et al.* (1980 Avise *et al.* (1979) Massey and Joule (1981) Aquadro and Kilpatrick (1981) Calhoun *et al.* (1988) Baccus and Wolff (1989) Meagher (1999)
Lactate dehydrogenase	*Ldh-1* *Ldh-2*	*P. maniculatus* *P. polionotus* *P. melanotis*	Selander *et al.* (1971) Avise *et al.* (1979) Massey and Joule (1981) Mewaldt and Jenkins (1986) Calhoun *et al.* (1988)
Malate dehyrdogenase	*Mdh-1* *Mdh-2*	*P. maniculatus* *P. polionotus*	Selander *et al.* (1971) Massey and Joule (1981)
Malic enzyme	*Me-1*	*P. maniculatus*	Baccus and Wolff (1989)
Nucleoside phosphorylase	*Np-1*	*P. maniculatus*	Baccus and Wolff (1989) Meagher (1999)

(Continued)

Table 2. Continued.

Peptidase	*Pep-1* *(Pep-B)* *Pep-2*	*P. maniculatus* *P. melanotis*	Avise *et al.* (1979) Baccus *et al.* (1980) Massey and Joule (1981) Calhoun *et al.* (1988) Baccus and Wolff (1989)
6-Phosphogluconate dehydrogenase	*Pgd-1*	*P. maniculatus* *P. polionotus* *P. keeni (oreas)*	Selander *et al.* (1971) Mascarello and Shaw (1973) Gill (1976) Avise *et al.* (1979) Baccus *et al.* (1980) Massey and Joule (1981) Foltz (1981) Mewaldt and Jenkins (1986) Baccus and Wolff (1989)
Phosphoglucomutase	*Pgm-1* *Pgm-2* *Pgm-3* *Pgm-4*	*P. maniculatus* *P. polionotus* *P. melanotis*	Selander *et al.*. (1971) Mascarello and Shaw (1973) Gill (1976) Avise *et al.* (1979) Massey and Joule (1981) Aquadro and Kilpatrick (1981) Baccus and Wolff (1989)
Sorbitol dehydrogenase	*Sdh-1*	*P. maniculatus*	Baccus *et al.* (1980) Massey and Joule (1981)
Superoxide dismutase	*Sod-1*	*P. maniculatus*	Baccus and Wolff (1989) Meagher (1999)
Transferrin	*Trf*	*P. maniculatus* *P. polionotus*	Rasmussen (1970) Biggers and Dawson (1971) Selander *et al.* (1971) Avise *et al.* (1974) Gill (1976) Redfield (1976) Loudenslager (1978) Avise *et al.* (1979 Baccus *et al.* (1980) Massey and Joule (1981) Foltz (1981)
Urinary proteins		*P. polionotus*	Cain *et al.* (1992)
Miscellaneous non-specific proteins (*e.g.* pre- and post albimins *etc.*)		*P. maniculatus*	Mascarello and Shaw (1973) Gill (1976) Baccus and Wolff (1989)

TABLE 3. VARIANT PROTEIN LOCI REPORTED FROM NATURAL POPULATIONS OF THE *Peromyscus boylii* SPECIES GROUP

Protein	Locus	Species	Reference
Alcohol dehydrogenase	*Adh*	*P. attwateri*	Sugg *etal.* (1990)
Albumin	*Alb*	*P. boylii* *P. pectoralis*	Jensen and Rasmussen (1971) Avise *et al.* (1974) Kilpatrick and Zimmerman (1975 Zimmerman *et al.* (1975) Kilpatricek and Zimmerman (1976a) Kilpatrick (1984) Rennert and Kilpatrick (1986) Werbitsky and Kilpatrick (1987)
Amylase	*Amy*	*P. boylii*	Rennert and Kilpatrick (1986) Rennert and Kilpatrick (1987)
Carbonic anhydrase	*Car-1* *Car-2*	*P. boylii*	Rennert and Kilpatrick (1986) Rennert and Kilpatrick (1987) Sullivan and Kilpatrick (1991)
Catalase	*Cas-1*	*P attwateri*	Sugg *et al.* (1990)
Creatine kinase	*Ck-1*	*P. attwatei*	Schnake-Greene *et al.* (1990)
Esterase	*Es-1* *Es-3* *Es-4* *Es-5* *Es-6* *Es-7*	*P. boylii* *P. attwateri* *P. pectoralis* *P. polius* *P. beatae*	Rasmussen and Jensen (1971) Avise *et al.* (1974) Kilpatrick and Zimmerman (1975) Zimmerman *et al.* (1975) Kilpatrick and Zimmerman (1976a) Kilpatrick (1984) Rennert and Kilpatrick (1986) Rennert and Kilpatrick (1987) Sugg *et al.* (1990) Sullivan and Kilpatrick (1991)
Glucose dehydrogenase	*Gdh-1*	*P. attwateri*	Sullivan *et al.* (1991)
Glutamate dehydrogenase	*Gtdh-1*	*P. attwateri*	Sugg *et al.* (1990)
Glutamate oxaloacetate transaminase	*Got-1*	*P. boylii* *P. pectoralis* *P. attwateri* *P. simulans*	Avise *et al.* (1974) Kilpatrice and Zimmerman (1975) Zimmerman *et al.* (1975) Kilpatrick and Zimmerman (1976a) Kilpatrick (1984) Rennert and Kilpatrick (1986) Rennert and Kilpatrick (1987) Sullivan *et al.* (1991)
α -glycerophosphate dehydrogenase	*Gdp-1*	*P. boylii*	Mascarello and Shaw (19973) Avise *et al.* (1974) Janecek (1990)
Glucose-6-phosphate dehydrogenase	*G6pd-1* *(H6pd-1)*	*P. pectoralis* *P. boylii*	Avise *et al.* (1974) Kilpatrick (1984) Rennert and Kilpatrick (1986) Rennert and Kilpatrick (1987) Sulllivan *et al.* (1991) Rogers and Engstrom (1992)

(Continued)

Table 3. Continued.

Hemoglobinin	*Hb-1* *Hb-2*	*P. boylii* *P. pectoralis* *P. attwateri* *P. simulus*	Rasmussen *et al.* (1968) Avise *et al.* (1974) Kilpatrick and Zimmerman (1975) Zimmerman *et al.* (1975) Kilpatrick and Zimmerman (1976a) Kilpatrick and Zimmerman (1976b) Kilpatrick (1984) Sullilvan *et al.* (1991)
Hexose-6-phosphate isomerase	*H6pd-1*	*P. boylii*	Rennert and Kilpatrick (1986) Rennert and Kilpatrick (1987)
Isocitrate dehydrogenase	*Idh-1* *(Icd-1)* *Icd-2*	*P. boylii* *P. pectoralis* *P. attwateri* *P. simulus*	Mascarello and Shaw (1973) Avise *et al.* (1974) Kilpatrick and Zimmerman ((1976a) Kilpatrick (19984) Rennert and Kilpatrick (1986) Rennert and Kilpatrick (1987) Schnake-Greene *et al.* (1990) Sugg *et al.* (1990) Janecek (1990) Sullivan *et al.* (1991)
Lactate dehydrogenase	*Ldh-1* *Ldh-2* *Ldh-3*	*P. boylii* *P. pectoralis* *P. polius* *P. attwateri*	Mascarello and Shaw (1973) Avise *et al.* (1974) Kilpatrick and Zimmerman (1975) Kilpatrick and Zimmerman (1976a) Kilpatrick (1984) Schnake-Greene *et al.* (1990) Sugg *et al.* (1990) Janecek (1990)
Leucine aminopeptidase	*Lap-1*	*P. boylii* *P. attwateri*	Kilpatrick (1984) Janecek (1990)
Malate dehydrogenase	*Mdh-1* *Mdh-2*	*P. boylii* *P. pectoralis* *P. attwateri*	Avise *et al.* (1974) Kilpatrick and Zimmerman (1976a) Schnake-Greene *et al.* (1990) Sugg *et al.* (1990) Janecek (1990)
Mannose phosphate isomerase	*Mpi-1*	*P. attwateri*	Sugg *et al.* (1990)
Nucleoside phosphorylase	*Np*	*P. attwateri* ??	Schnake-Green *et al.* (1990) Sugg *et al.* (1990) Rogers and Enstrom (1992)
Peptidase	*Pep-1* *Pep-2*	*P. attwateri* ??	Schnake-Greene *et al.* (1990) Sugg *et al.* (1990) Janecek (1990)
Phosphogluconate dehydrogenase	*Pgd-1*	*P. boylii* *P. pectoralis* *P. attwateri*	Avise *et al.* (1974) Kilpatrick and Zimmerman (1975) Zimmerman *et al.* (1975) Kilpatrick and Zimmerman (1976a) Sugg *et al.* (1990) Janecek (1990)

(Continued)

Table 3. Continued

Phosphoglucose isomerase	*Pgi-1*	*P. boylii* *P. pectoralis* *P. attwateri* *P. simuluss*	Avise *et al.* (1974) Kilpatrick (1984) Rennert and Kilpatrick (1986) Rennert and Kilpatrick (1987) Sullivan *et al.* (1991) Rogers and Engstrom (1992)
Phosphoglucomutase	*Pgm-1*	*P. boylii* *P. pectoralis* *P. attwateri*	Mascarello and Shaw (1973) Avise *et al.* (1974) Kilpatrick and Zimmerman (1976a) Rennert and Kilpatrick (1986) Rennert and Kilpatrick (1987) Sugg *et al.* (1990) Janecek (1990)
Sorbitol dehydrogenase	*Sdh-1*	*P. boylii*	Janecek (1990)
Superoxide dismutase	*Sod-2*	*P. boylii*	Janecek (1990)
Transferrin	*Trf*	*P. boylii* *P. pectoralis* *P. attwateri* *P. polius*	Rasmussen and Koehn (1966) Avise *et al.* (1974) Kilpatric and Zimmerman (1975) Zimmerman *et al.* (1975) Kilpatrick and Zimmerman (1976a) Kilpatrick (1984) Rennert and Kilpatrick (1986) Rennert and Kilpatrick (19987) Werbitsky and Kilpatrick (1987) Sullivan *et al.* (1991)
Xanthine dehydrogenase	*Xdh-1*	*P. boylii* *P. attwateri*	Kilpatrick (1984)
Unspecified protein	*"Gp"*	*P. boylii*	Janecek (1990)

TABLE 4. VARIANT PROTEIN LOCI REPORTED FROM NATURAL POPULATIONS OF THE *Peromyscus truei* SPECIES GROUP

Protein	Locus	Species	References
Albumin	*Alb*	*P. truei* *P. difficilis*	Brown and Welser (1968) Jenson and Rasmussen (1971) Johnson and Packard (1974) Zimmerman *et al.* (1975) Avise *et al.* (1979)
Esterase	*Es-1* *Es-2* *Es-3* *Es-4* *Es-5* *Es-6*	*P. truei* *P. difficilis*	Rasmussen and Jensen (1971) Johnson and Packard (1974) Zimmerman *et al.* (1975)
Glutamate oxaloacetate transaminase	*Got-1* *(Aat-1)* *Got-2*	*P. truei* *P. difficilis* *P. gratus*	Zimmerman *et al.* (1975) Avise *et al.* (1979) Janecek (1990) Sullivan *et al.* (1991)
α -glycerophosphate dehydrogenase	*Gpd-1* *Gpd-2*	*P. truei* *P. difficilis*	Mascarello and Shaw (1973) Johnson and Packard (1974) Avise *et al.* (1979) Jancek (1990)
Isocitrate dehydrogenase	*Icd-1* *(Idh-1)* *Icd-2*	*P. truei* *P. difficilis* *P. gratus*	Mascarello and Shaw (1973) Johnson and Packard (1974 Avise *et al.* (1979) Rogers and Engstrom (1992) Janecek (1990)
Lactate dehydrogenase	*Ldh-1* *Ldh-2*	*P. truei* *P. gratus*	Mascarello and Shaw (1973) Janecek (1990)
Malate dehydrogenase	*Mdh-2*	*P. difficilis* *P. gratus*	Janecek (1990)
Nucleoside phosphorylase	*Np-1*	*P. truei* *P. difficilis* *P. gratus*	Janecek (1990)
Peptidase	*Pep-1* *Pep-2* *Pep-3*	*P. difficilis* *P. gratus* *P. truei*	Janecek (1990)
6-phosphogluconate dehydrogenase	*Pgd-1*	*P. truei* *P. difficilis* *P. gratus*	Mascarello and Shaw (1973) Johnson and Packard (1974) Zimmerman *et al.* (1975) Avise *et al.* (1979) Janecek (1990) Sullivan *et al.* (1991)
Phosphoglucomutase	*Pgm-1* *Pgm-2* *Pgm-3*	*P. truei* *P. difficilis* *P. gratus*	Mascarello and Shaw (1973) Johnson and Packard (1974) Janecek (1990)
Sorbitol dehydrogenase	*Sdh-1*	*P. difficilis*	Janecek (1990)
Transferrin	*Trf*	*P. truei* *P. difficilis*	Avise *et al.* (1979) Johnson and Packard (1974) Sullivan *et al.* (1991)

TABLE 5. VARIANT PROTEIN LOCI REPORTED FROM NATURAL POPULATIONS OF *Peromyscus eremicus* AND ALLIED SPECIES

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

TABLE 6. VARIANT PROTEIN LOCI REPORTED FROM NATURAL POPULATIONS OF THE *Peromyscus mexicanus* SPECIES GROUP[1]

Protein	Locus	Species	References
Esterase (NADA)	*Es-3*	*P. mexicanus* *P. gymnotiis*	Rogers and Engstrom (1992)
Glutamate oxaloacetate transaminase	*Got-1*	*P. mexicanus*	Rogers and Engstrom (1992)
6-glycerophosphate dehydrogenase	*Gpd-1*	*P. mexicanus*	Rogers and Engstrom (1992)
Glucose phosphate isomerase	*Gpi-1*	*P. mexicanus* *P. gymnotis*	Rogers and Engstrom (1992)
Isocitrate dehydrogenase	*Icd-2*	*P. mexicanus*	Rogers and Engstrom (1992)
	(*Idh-2*)		
Malate dehydrogenase	*Mdh-1*	*P. yucatanicus*	Rogers and Engstrom (1992)
	Mdh-2	*P. mexicanus*	
Malic enzyme	*Me*	*P. mexicanus* *P. gymnotis*	Rogers and Engstrom (1992)
Mannose phosphoisomerase	*Mpi-1*	*P. mexicanus*	Rogers and Engstrom (1992)
		P. zarhynchus	
Nucleoside phosphorylase	*Np-1*	*P. zarhynchus*	Rogers and Engstrom (1992)
Peptidase	*Pep-1* (B) *Pep-2* (D)	*P. mexicanus*	Rogers and Engstrom (1992)
Phosphoglucomutase	*Pgm-1* *Pgm-2*	*P. mexicanus* *P. zarhynchus*	Rogers and Engstrom (1992)

[1] *sensu* Carleton (1989)

TABLE 7. VARIANT PROTEIN LOCI REPORTED FROM NATURAL POPULATIONS OF THE *Peromyscus aztecus* SPECIES GROUP

Protein	Locus	Species	References
Amylase	Amy-1	*P. aztecus* *P. spicilegus* *P. winkelmanni*	Sullivan and Kilpatrick (1991)
Carbonic anhydrase	*Car-3*	*P. aztecus* *P. specilegus* *P. winkelmanni*	Sullivan and Kilpatrick (1991)
Esterase	*Es-1* *Es-2* *Es-3*	*P. aztecus* *P. specilegus* *P. specilegus*	Sullivan and Kilpatrick (1991)
Glutamate oxaloacetate transaminase	*Got-1*	*P. aztecus* *P. winkelmanni*	Sullivan and Kilpatrick (1991)
Hemoglobin	*Hba*	*P. aztecus*	Sullivan and Kilpatrick (1991)
Isocitrate dehydrogenase	*Idh-1* *(Icd-1)* *Icd-2*	*P. aztecus* *P. spicilegus* *P. winkelmanni*	Sullivan and Kilpatrick (1991)
Lactate dehydrogenase	*Ldh-2*	*P. spicilegus*	Sullivan and Kilpatrick (1991)
Malate dehydrogenase	*Mdh-1*	*P. winkelmanni*	Sullivan and Kilpatrick (1991)
Malic enzyme	*Me-1* *(Mod-1)*	*P. winkelmanni*	Sullivan and Kilpatrick (1991)
Peptidase	*Pep-1* (A) *Pep-4* (D)	*P. aztecus* *P. winkelmanni*	Sullivan and Kilpatrick (1991)
Phosphogluconate dehydrogenase	*Pgd-1*	*P. spicilegus* *P. winkelmanni*	Sullivan and Kilpatrick (1991)
Phosphoglucomutase	*Pgm-2* *Pgm-3*	*P. aztecus* *P. spicilegus* *P. winkelmanni*	Sullivan and Kilpatrick (1991)
Sorbitol dehydrogenase	*Sdh-1*	*P .aztecus* *P. winkelmanni*	Sullivan and Kilpatrick (1991)
Transferrin	*Trf*	*P. aztecus* *P. winkelmanni*	Sullivan and Kilpatrick (1991)

TABLE 8. VARIANT PROTEIN LOCI REPORTED FROM NATURAL POPULATIONS OF *Peromyscus furvus*

Protein	Locus	Reference
Acid phosphatase	*Acp*	Harris and Rogers (1999)
Adenosine deaminase	*Ada*	Harris and Rogers (1999)
Alopine dehydrogenase	*Aldph*	Harris and Rogers (1999)
Albumin	*Alb*	Harris and Rogers (1999)
Arabinofuranosidase	*Arab*	Harris and Rogers (1999)
Glucose phosphate isomerase	*Gpi*	Harris and Rogers (1999)
Glyceraldehyde-3-phosphate dehydrogenase	*Gpdh*	Harris and Rogers (1999)
Iditol dehydrogenase	*Iddh*	Harris and Rogers (1999)
Isocitrate dwhydrogenase	*IdhM* *IdhS*	Harris and Rogers (1999)
Lactate dehydrogenase	*LdhA*	Harris and Rogers (1999)
Malate dehydrogenase	*MdhM* *MdhS* *MdhP*	Harris and Rogers (1999)
Mannose phosphate isomerase	*Mpi*	Harris and Rogers (1999)
Peptidase	*PepA* *PepB* *PepC* *PepF*	Harris and Rogers (1999)
Phosphoglucomutase	*Pgm*	Harris and Rogers (1999)
Purine-nucleoside phosphorylase	*Pnp*	Harris and Rogers (1999)
Sorbitol dehydrogenase	*Sod*	Harris and Rogers (1999)
Thiosulphate-sulfur transferase	*Tst*	Harris and Rogers (1999)

TABLE 9. VARIANT PROTEIN LOCI REPORTED FROM NATURAL POPULATIONS OF *Peromyscus* (*Podomys*) *floridanus*

Protein	Locus	References
Esterase	*Es-1* *Es-2* *Es-3*	Smith *et al.* (1973)
Glutamate oxaloacetate transaminase	*Got-1*	Smith *et al.* (1973)
Hexose-6-phosphate 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-2*	Smith *et al.* (1973)
Pre-albumin	*Pra*	Smith *et al.* (1973)
Transferrin	*Trf*	Smith *et al.* (1973)

TABLE 10. 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)

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Peromyscus Nucleic Acid Sequences

Numerous nucleic acid sequences from *Peromyscus* are registered in GenBank. The sequences are periodically indexed in *PEROMYSCUS* NEWSLETTER. Sequences in this index are listed under major categories: (1) Nuclear genes, (2) Nuclear elements, introns, microsatellites and repeats, and (3) Mitochondrial genes. Formal locus designations are abbreviated, *e.g. Adh1* (alcohol dehydrogenase-1). Sequences are arranged alphabetically within these categories by (a) gene, (b) species and (c) alphabetic/numeric successive GenBank accession numbers, in that order. An appended index lists GenBank entries for non-*Peromyscus* peromyscine genera (*sensu* Carleton 1989).

Section 1. NUCLEAR GENES

Alcohol dehydrogenase (*Adh1, Adh2)*

[ADH1B] *P. maniculatus* alcohol dehydrogenase 1 (*Adh1)* mRNA, complete cds. **(L15703)**

[ADH2A] *P. maniculatus* alcohol dehydrogenase 2 (*Adh2)* mRNA, complete cds. **(L15704)**

Aryl hydrocarbon receptor (*Ahr*)

[AHRnt] *P. maniculatus* aryl hydrocarbon receptor nuclear translocator protein (*Ahr1f*) mRNA complete cds **(AF542079)**

[AHR] *P. maniculatus* aryl hydrocarbon receptor mRNA (*Ahr*) complete cds. **(AF542078)**

B-cell leukemia 2 (*Bcl2*)

[BCL2] *P. maniculatus* B-cell leukemia/lymphoma (*Bcl2*) gene, partial cds, alternatively spliced **(AF389110)**

[BCL2] *P. polionotus* B-cell leukemia/lymphoma (*Bcl2*) gene, partial cds . alternatively spliced **(AF389111)**

Breast cancer protein (*BRCA1*)

[BRCA1] *P. leucopus* breast cancer protein 1 gene, exon11 and partial cds. **(AY294927)**

Chemokine ligands (*Ccl2*)

[Ccl2] *P. manicualtus* CC chemokine ligand 2 (*Ccl2*) mRNA, partial cds. **(AY271904, AY271905)**

[Ccl3] *P. maniculatus* CC chemokine ligand 3 (*Ccl3*) mRNA, partial cds. **(AY247759)**

[Ccl4] *P. maniculatus* CC chemokine ligand 4 (*Ccl4*) mRNA, partial cds. **(AY247758)**

c-myc protein (*c-myc*)

[c-myc] *P. leucopus* c-myc gene (*c-myc*) exon 3 and partial cds. **(AY294987)**

Cytochrome P450

[Cyp2] *P. leucopus* p450c17alpha (*Cyp17*) gene, complete cds. **(AY054747)**

Delta-like homolog Drosophila (*Dlk1*)

[DLK1] *P. maniculatus* delta-like Drosophila homolog protein (*Dlk1*) mRNA, partial cds. **(AF272850)**

Dentin matrix protein 1 (*Dmp*)

[DMP1] *P. mexicanus* dentin matrix protein 1 exon 6 and partial cds. **(AY269981)**

[DMP1] *P. difficilis* dentin matrix protein 1 exon 6 and partial cds. **(AY269980)**

[DMP1] *P. boylii* dentin matrix protein 1 exon 6 and partial cds. **(AY269979)**

[DMP1] *P. attwateri* dentin matrix protein 1 exon 6 and partial cds. **(AY269978)**

Endothelin-B receptor (*ENDRB*)

[EDNRB] *P. maniculatus* endothelin-B receptor (*EDNRB*) gene, partial cds. **(AF212999)**

[EDNRB] *P. polionotus* endothelin-B receptor (*EDNRB*) gene, partial cds. **(AF213000)**

Fetal liver mRNA (*H19*)

[H19] *P. maniculatus* fetal liver mRNA (*H19*) complete cds. **(AF214115)**

Granulocyte macrophage stimulating factor (*Gmcsf*)

[GMCSF] *P. maniculatus* granulocyte macrophage stimulating factor **(AY247762, AY247763)**

Growth hormone receptor (*GHR*)

[GHR] *P. leucopus* growth hormone receptor (*GHR*) gene, exon 10 and partial cds. **(AY294927)**

Hemoglobin beta chain (*Hbb*)

[HBB1BB] *P. maniculatus* (deer mouse) beta-1-globin (*Hbb-b1*) DNA, 5' region **(M15289)**

[HBB2BB] *P. maniculatus* (deer mouse) beta-2-globin (*Hbb-b2*) DNA, 5' region **(M15290)**

[HBB3BA] *P. maniculatus* (deer mouse) beta-3-globin (*Hbb-b3*) DNA, 5' region **(M15291)**

[HBB1BA] *P. maniculatus* (deer mouse) beta-1-globin (*Hbb-b1*) DNA, 5' region **(M15292)**

[HBB2BA] *P. maniculatus* (deer mouse) beta-2-globin (*Hbb-b2*) DNA, 5' region **(M15293)**

[HBB1BC] *P. maniculatus* (deer mouse) beta-1-globin (*Hbb-b1*) DNA, second coding-block region, partial cds. **(M15294)**

[HBB2BC] *P. maniculatus* (deer mouse) beta-2-globin (*Hbb-b2*) DNA, second coding-block region, partial cds. **(M15295)**

[HBB3BB] *P. maniculatus* (deer mouse) beta-3-globin (*Hbb-b3*) DNA, second coding-block region, partial cds. **(M15296)**

[HBB1BD] *P. maniculatus* (deer mouse) beta-1-globin (*Hbb-b1*) DNA, 3' region **(M15297)**

[HBB2BD] *P. maniculatus* (deer mouse) beta-2-globin (*Hbb-b2*) DNA, 3' region **(M15298)**

[HBB3BC] *P. maniculatus* (deer mouse) beta-3-globin (*Hbb-b3*) DNA, 3' region **(M15299)**

Histocompatibility 19 (*H19*)

[H19] *P. maniculatus (bairdii)* H19 mRNA, complete cds. **(AF214115)**

Hypoxia-inducible factor (*Hyp1*)

[HYP1] *P. leucopus* Factor 1. Alpha subunit 1 mRNA, partial cds. **(AY591916)**

[BFIBR, intrn 7] *P. difficilis* beta fibrinogen gene, intron 7. **(AY274209)**

Immunoglobin M (*IghM*)

[IGHM] *P. maniculatus* immunoglobin M (*Ighm*) mRNA, partial cds. **(AY455974)**

Interferon alpha (*IFA*)

[IFA] *P. maniculatus* interferon alpha 12 (*Ifna12*) mRNA, partial cds. **(AY311482)**

[IFA] *P. maniculatus* interferon alpha-1 (*Ifna1*) mRNA, partial cds. **(AY311481)**

Interferon gamma (*IFG*)

[IFG] *P. maniculatus* interferon gamma (*InfG*) mRNA, partial cds. **(AF307011)**

[IFG] *P. maniculatus* interferon gamma precursor (*INFG*) mRNA, complete cds. **(AY289494)**

Interleukins (*IL*)

[IL2] *P. maniculatus* Interleukin-2 (*Il2*) mRNA, partial cds. **(AY247760)**

[IL6] *P. maniculatus* Interleukin-6 (*Il6*) mRNA, partial cds. **(AY256518)**

[IL10] *P. maniculatus* Interleukin-10 (*Il10*) mRNA, partial cds. **(AF307012)**

[IL10] *P. maniculatus* Interleukin-10 (*Il10*) gene, complete cds. **(AY251293)**

[IL12] *P. maniculatus* Interleukin-12 p35 subunit (*Il12a*) mRNA **(AY247763)**

[IL13] *P. maniculatus* Interleukin-13 (*Il 13*) mRNA partial cds. **(AY311480)**

[IL17] *P. maniculatus* Interleukin 17 (*Il 17*) mRNA, partial cds. **(AY426970)**

[IL21] *P. maniculatus* Interleukin-21 (*Il* 21) mRNA partial cds. **(AY247761 – AY247762)**

[IL23] *P. maniculatus* Interleukin-23a (Il23 subunit p19 mRNA, partial cds. **(AY247629)**

Interphotoreceptor retinoid-binding protein (*IRBP*)

[IRBP] *P. maniculatus* interphotoreceptor retinoid binding protein , partial cds. (*Irbp*) gene **(AY326102)**

[IRBP] *P. maniculatus* interphotoreceptor retinoid binding protein (*Rbp3*) gene, exon 1 and partial cds. **(AY163630)**

[IRBP] *P. truei* (MVZ 157329) interphotoreceptor reinoid binding protein (*IRBP*)

Lecithin cholesterol acyl transferase (*LCAT*)

[PMLCAT] *P. maniculatus* lecithin:cholesterol acyl transferase (*LCAT*) gene **(AH005250)**

[PMLCAT01] *P. maniculatus* lecithin:cholesterol acyl transferase (*LCAT*) exons 2 – 5 and partial cds. **(U72307)**

[PMLCAT02] *P. maniculatus* lecithin:cholesterol acyl transferase (*LCAT*) exon 6 and partial cds. **(U72308)**

Leptin (*ob*)

[OB] *P. maniculatus* leptin (*ob*) gene, partial cds. **(AF213001)**

[OB] *P. polionotus* leptin (*ob*) gene, partial cds. **(AF213002)**

Lymphotoxin alpha (*Lta*)

[LTA] *P. maniculatus* lymphotoxin alpha (*Lta*) mRNA, partial cds. **(AF348259)**

[LTA] *P. maniculatus* lymphotoxin alpha (*Lta*) gene, complete cds. **(AY251294)**

Lymphotoxin beta (*Ltb*)

[LTB] *P. maniculatus* lymphotoxin beta (*Ltb*) gene, complete cds. **(AY282503)**

Major Histocompatibility Complex – CLASS I (*MHCI*)

[MHCIBM4] *P. leucopus* MHV+C class Ib precursor (*PeleM4*), partial cds. **(AF006618)**

[MHCIA11B] (*P. leucopus* group) Mouse MHC class I antigen (*Pele-A11b*) gene, exon 5. **(M59218)**

[MHCIA6B] *P. leucopus* group) Mouse MHC class I antigen (*Pele-A6b*) gene, exon 5. **(M59219)**

[MHCIA24A] (*P. leucopus* group) Mouse MHC class I antigen (*Pele-A24a*) gene, exon 5. **(M59220)**

[MHCIA34C] (*P. leucopus* group) Mouse MHC class I antigen (*Pele-A34c*) gene, exon 5. **(M59221)**

MHCIA37A] (*P. leucopus* group) Mouse MHC class I antigen (*Pele-A37a*) gene, exon 5. **(M59222)**

[MHCIA38B] (*P. leucopus* group) Mouse MHC class I antigen (*Pele-A38b*) gene, exon 5. **(M59223)**

[MHCIA42B] (*P. leucopus* group) Mouse MHC class I antigen (*Pele-A42b*) gene, exon 5. **(M59224)**

MHCIA42C] (*P. leucopus* group) Mouse MHC class I antigen (*Pele-A42c*) gene, exon 5. **(M59225)**

[MHCIA48C] (*P. leucopus* group) Mouse MHC class I antigen (*Pele-A48c*) gene, exon 5. **(M59226)**

[MHCIA5] *P. leucopus* MHC class I gene, exon 5. **(M60611 = M33983)**

[MHCIA4] *P. leucopus* MHC class I gene, exon 5. **(M60612 = M33984)**

[MHCIAA] *P. leucopus* MHC class I gene, exon 5. **(M60613 = M33985)**

[HBB3BB] *P. leucopus* MHC class I *PeleM4* gene, exons 4 and 5 and partial cds. **(U21212)**

[MHCIM4] *P. leucopus* MHC class I *PeleM4 gene, exons 1,2 and 3.* **(U21213)**

[MHCCIa3] *P. leucopus* MHC class I antigen *alpha 3* domain gene, partial cds. **(U37435)**

[MHCIT24A] *P. maniculatus* nonclassical class I antigen (*PemaT24*) mRNA, complete cds. **(U03104)**

[MHCIA13A] *P. maniculatus* major histocompatibillity complex class I antigen mRNA, complete cds. **(U12822)**

[MHCI11A] *P. maniculatus* major histocompatibility complex class I antigen mRNA, clone *Pema11*, partial cds. **(U16846)**

[MHCIA53A] *P. maniculatus* major histocompatibility complex class I antigen mRNA,, clone *Pema53*, complete cds **(U12847)**

[MHCIA41A] *P. maniculatus* clone *Pema41* major histocompatibility complex class I antigen mRNA, complete cds. **(U12885)**

[MHCIA52A] *P. maniculatus* clone *Pema 52*major histocompatibility complex class I antigen mRNA, complete cds. **(U12886)**

[MHCIA62A] *P. maniculatus* clone *Pema 62*major histocompatibility complex class I antigen mRNA, complete cds. **(U12887)**

[MHCIIB] *P. pectoralis* MHC class I-b antigen M3 (PepeM302) gene, exon 3 and partial cds. **(AY263582)**

[MHCIIB] *P. pectoralis* MHC class I-b antigen M3 (PepeM301) gene, exon 3 and partial cds. **(AY263583)**

[MHCIIB] *P. leucopus* MHC class I-b antigen M3 (PeleM301) gene, exon 3 and partial cds. **(AY263581)**

[MHCIIB] *P. attwateri* MHC class I-b antigen M3 (PeatM301) gene, exon 3 and partial cds. **(AY263580)**

[MHCIIB] *P. pectoralis* MHC class I-b antigen M3 (PepeM302) gene, exon 3 and partial cds. **(AY263540)**

[MHCIIB] *P. pectoralis* MHC class I-b antigen M3 (PepeM301) gene, exon 3 and partial cds. **(AY263539)**

[MHCIIB] *P. leucopus* MHC class I-b antigen M3 (PeleM301) gene, exon 3 and partial cds. **(AY263538)**

[MHCIIB] *P. attwateri* MHC class I-b antigen M3 (PeatM301) gene, exon 3 and partial cds. **(AY263537)**

[MHC1B] *P. leucopus* MHC class 1-b antigen (PeleM4) gene, exon 3 and partial cds. **(AF079430 –AF079443)**

[MHC1B] *P. leucopus* MHC class 1-b antigen (PeleM4) gene, exon 3 and partial cds. **(AH006336 – AH006342)**

Major Histocompatibility Complex – CLASS II (*MHCII*)

[MHCII] *P. californicus* MHC clones Peca MHC class II antigens beta chain. partial cds. **(AY219807 – AY219812)**

[MHCII] *P. eremicus* MHC clones Peer MHC class II antigens beta chain. partial cds. **(AY219812 – AY219825)**

[MHCII] *P. eremicus* MHC Class II isolates beta chain mRNA partial cds. **(AF300853 – AF300852)**

[MHCII] *P. eremicus* MHC Class II isolates beta chain mRNA partial cds. **(AF300861 – AF300862)**

[MHCIIAa] *P. leucopus* MHC class II protein alpha-chain *PeleAa (MhcPeleAa)* gene, partial cds. **(U34805)**

[MHCII] *P. leucopus* MHC class II beta chain mRNA partial cds. **(AF300846 – AF300851)**

[MHCII] *P. leucopus* MHC class II beta chain mRNA partial cds. **(AF300856 – AF300860)**

[MHCII] *P. maniculatus* MHC class II protein beta chain. **(AF312748 – AF312761)**

[MHCII] *P. maniculatus* MHC class II beta chain mRNA, partial cds. **(AF300854 – AF300855)**

[MHCII] *P. maniculatus* MHC class II antigen beta chain (*Pema-EB*) mRNA, Pema-EB* alleles, partial cds. **(AF516929 – AF516946)**

[MHCII] *P. leucopus* MHC clones Pele MHC class II antigens beta chain. partial cds. **(AY219801 – AY219806)**

Myogenic regulatory factor (*MyoD*)

[MYOD] *P. maniculatus* myogenic regulatory factor (*MyoD*) gene, partial cds. **(AF213003)**

[MYOD] *P. polionotus* myogenic regulatory factor (*MyoD*) gene, partial cds. **(AF213004)**

Pancreatic ribonuclease (*PRNase*)

[PRN] *P. leucopus* pancreatic ribonuclease (*PRNASE*). Complete cds. **(AJ005770)**

Parathormone (*Pth*)

[PTHP] *P. maniculatus* parathormone precursor exons 2 and 3 and partial cds *P. polionotus* **(AF382952)**

[PTHP] *P. polionotus* parathormone precursor exons 2 and 3 and partial cds. **(AF382953)**

Plasminogen activator inhibitor (*Plai*)

[PLAI] *P. leucopus* plasminogen activator inhibitor (serpine1) mRNA, partial cds. **(AY591915)**

Recombination activating gene (*RAG1*)

[RAG1] *P. leucopus* recombination activating gene 1 (*RAG1*), partial cds. **(AY294957)**

RAS guanine nucleotide releasing factor 1 (*Rasgrf1*)

[RASGRF1] *P. maniculatus* RAS guanine nucleotide-releasing factor 1 (*Rasgrf1*) mRNA, partial cds. **(AF045648)**

[RASGRF1] *P. polionotus* RAS guanine nucleotide-releasing factor 1 (*Rasgrf1*) mRNA, partial cds. **(AF045647)**

Ribosomal RNA 18S (*18Srna*)

[rRNA] *P. leucopus* 18S ribosomal RNA gene, partial sequence **(AY591913)**

Signal transducer and activator 4 (*Stat4*)

[STAT4] *P. maniculatus* signal transducer and activator of transcription 4 (Stat4) mRNA, partial cds. **(AY455975)**

T-cell receptor (*Trcp*)

[T-B] *P. maniculatus* T cell receptor beta chain constant region (*T-b*) mRNA, partial cds. **(AY307417)**

Transcription factors (*TFT, GATA*)

[TFTb] *P. maniculatus* transcription factor T-bet (*T-bet*) mRNA, partial cds. **(AY271903)**

[GATA] *P. maniculatus* transcription factor GATA-3 (*Gata3I*) mRNA, partial cds. **(AY325113)**

Transforming growth factor (*Tgf*)

[TGF] *P. leucopus* transforming growth factor beta receptor 3 (tgfbr3) mRNA, partial cds. **(AY591914)**

[TGF] *P. maniculatus* .transforming growth factor beta 1 (*Tgfb1*) mRNA, partial cds. **(AY455973)**

Tumor necrosis Factor (*TNF*)

[TNF] *P. leucopus* tumor necrosis factor (*TNF*) gene sequence, cds. 5' end. **(M59233)**

[TNF] *P. leucopus* tumor necrosis factor (*TNF*) mRNA, partial cds. **(AY608911)**

[TNF] *P. maniculatus* tumor necrosis factor (*TNF*) alpha mRNA, partial cds. **(AF307013)**

[TNF] *P. maniculatus* tumor necrosis factor precursor (*Tnf*), partial cds. **(AY249143)**

TNF receptor associated protein 2 (*Traf2*)

[TRAF2] *P. maniculatus* TNF receptor-associated protein 2 (*Traf2*) **(AY541501)**

Von Willebrand factor (*Vwf*)

[VWF] *P. maniculatus* partial gene (Vwf) for von Willebrand factor. **(AJ402697)**

Section 2. NUCLEAR ELEMENTS, MICROSATELLITES, INTRONS and REPEATS

LINE-1

[L1RT-ps] *P. californicus* LINE-1 repetitive element reverse transcriptase pseudogenes, partial cds.
13 consecutive GenBank entries **(U70828 - U70840)**

[L1RT-ps] *P. leucopus* LINE-1 repetitive element reverse transcriptase pseudogenes, partial cds.
4 consecutive GenBank entries **(U70925 – U70928)**

[L11RT-ps] *P. leucopus* LINE-1 repetitive element reverse transcriptase gene, partial cds. **(U43365=U70932)**

[L1-ORFII] *P. leucopus* LINE-1 retrotransposon ORFII. **(AY041507 – AY041523)**

[L1PM55X] (*P. maniculatus* group) Deer mouse (*L1Pm55*) gene. **(M97518)**

[L1PM62X] (*P. maniculatus* group) Deer mouse (*L1Pm62*) gene. **(M97517)**

[L1RT] *P. maniculatus* LINE-1 repetitive element reverse transcriptase gene, partial cds. **(U43360)**

[L1RT-ps] *P. maniculatus* LINE-1 repetitive element reverse transcriptase pseudogenes, partial cds. **(U43361=U70924, U43362)**

[L1RT-ps] *P. maniculatus* LINE-1 repetitive element reverse transcriptase pseudogenes, partial cds. **(U70929, U70930, U70933, U70934=U43363)**

[L1RT] *P. maniculatus* LINE-1 repetitive element reverse transcriptase gene, partial cds. **(U70935=U43364)**

[L1-ORFII] *P. nudipes* LINE-1 retrotransposon ORFII. **(AY041546 – AY041575)**

MYS-1, MYS-2, MYS-9 (*Mys*)

[MYS1PL] *P. leucopus* retrovirus-like transposable element *mys-1* **(X02855)**

[MYS21PER] Mouse (*P. leucopus*) retrovirus-like transposable element *mys-2,* left flank. **(M13343)**

[MYS22PER] Mouse (*P. leucopus*) retrovirus-like transposable element *mys-2,* right flank. **(M13344)**

[MYSPER] Mouse (*P. leucopus*) retrovirus-like transposable element *mys-2,* left flank. **(AH002117)**

[MYS9] *P. leucopus* retrotransposon mys-9 **(AY017286 – AY017293)**

[MYS9] *P. maniculatus* retrotransposon mys-9 **(AY017276 – AY017285)**

[MYS9] *P. truei* retrotransposon mys-9 **(AY017274 – AY017275)**

[MYS9] *P .difficilis* retrotransposon mys-9 **(AY017272 – AY017273)**

[MYS9] *P. crinitus* retrotransposon mys-9 **(AY017268 – AY017271)**

[MYS9] *P. leucopus* retrotransposon mys-9 **(AH 010719 - AH010722)**

[MYS9] *P. maniculatus* retrotransposon mys-9 **(AH010714 – AH010718)**

[MYS9] *P. truei* retrotransposon mys-9 **(AH010713)**

[MYS9] *P. difficilis* retrotransposon mys-9 **(AH010712)**

[MYS9] *P. crinitus* retrotransposon mys-9 **(AH010710 - AH010711)**

ID Repeat (*ID*)

[IDPMA2] *P. maniculatus* clone *Pma2* ID repeat element. **(U33854)**

[IDPMA3] *P. maniculatus* clone *Pma3* ID repeat element. **(U33855)**

[IDPMF0] *P. maniculatus* clone *Pmf0* ID repeat element. **(U33856)**

[IDPMG1] *P. maniculatus* clone *Pmg1* ID repeat element. **(U33857)**

[IDPMG2] *P. maniculatus* clone *Pga2* ID repeat element. **(U33858)**

[IDPMG3] *P. maniculatus* clone *Pmg3* ID repeat element. **(U33859)**

[IDPMG4] *P. maniculatus* clone *Pmg4* ID repeat element. **(U33860)**

[IDPMG5] *P. maniculatus* clone *Pmg5* ID repeat element. **(U33861)**

[IDPMH1] *P. maniculatus* clone *Pmh1* ID repeat element. **(U33862)**

[IDPMH3] *P. maniculatus* clone *Pmh3* ID repeat element. **(U33863)**

[IDPMH5] *P. maniculatus* clone *Pmh5* ID repeat element. **(U33865)**

B2 Repeat

[PMB2] *P. maniculatus* B2 repetitive elements. **(U93039 – U93041)**

SINEs

[B1] *P. leucopus* retrotansposons. **(AY041703 – AY041734)**

[B1] *P. nudipes* retrotransposons. **(AY041546 – AY041575)**

ID Repeat (*ID*)

[IDPMA2] *P. maniculatus* clone *Pma2* ID repeat element. **(U33854)**

[IDPMA3] *P. maniculatus* clone *Pma3* ID repeat element. **(U33855)**

[IDPMF0] *P. maniculatus* clone *Pmf0* ID repeat element. **(U33856)**

[IDPMG1] *P. maniculatus* clone *Pmg1* ID repeat element. **(U33857)**

[IDPMG2] *P. maniculatus* clone *Pmg2* ID repeat element. **(U33858)**

[IDPMG3] *P. maniculatus* clone *Pmg3* ID repeat element. **(U33859)**

[IDPMG4] *P. maniculatus* clone *Pmg4* ID repeat element. **(U33860)**

[IDPMG5] *P. maniculatus* clone *Pmg5* ID repeat element. **(U33861)**

[IDPMH1] *P. maniculatus* clone *Pmh1* ID repeat element. **(U33862)**

[IDPMH3] *P. maniculatus* clone *Pmh3* ID repeat element. **(U33863)**

[IDPMH5] *P. maniculatus* clone *Pmh5* ID repeat element. **(U33864)**

Microsatellite sequences

[PML] *P. maniculatus* clones PML-01 – PML-12, microsatellites. **(AF251775 - AF251786)**

[PML] *P. maniculatus* clones PML microsatellites. **(AF526098 - AF526168)**

[PPO] *P. polionotus* clones PPO microsatellites. **(AY053424, AY053425)**

[PPO] *P. polionotus* clones PPO microsatellites. **(AF380232 - AF380250)**

Beta fibrinogen, intron7

[BFIBR, intrn 7] *P. attwateri* beta fibrinogen gene, intron 7. **(AY274207)**

[BFIBR, intrn 7] *P. boylii* beta fibrinogen gene, intron 7. **(AY274208)**

[BFIBR, intrn 7] *P. difficilis* beta fibrinogen gene, intron 7. **(AY274209)**

[BFIBR, intrn 7] *P. mexicanus* beta fibrinogen gene, intron 7. **(AY274210)**

Section 3. MITOCHONDRIAL GENES

Cytochrome B (*mtCytB*)

[MTCYTB] *P. attwateri* mitochondrial cytochrome *cytB* gene, partial cds. Two consecutive sequences. **(AF155384 - AF155385)**

[MTCYTB] *P. attwateri* mitochondrial cytochrome *cytB* gene, partial sequence. **(AY263614)**

[MTCYTB] *P. aztecus* mitochondrial DNA *cytB* gene, partial cds. Eight consecutive Gen Bank entries. **(U89966 - U89973)**

[MTCYTB] *P. beatae* mitochondrial *cytB* gene, partial cds. Nine consecutive GenBank entries representing different specimens: **(AF131915 - AF131923)**

[MTCYTB] *P. beatae (sacarensis)* mitochondrial *cytB* gene, partial cds. **(AF131914)**

[MTCYTB] *P. boylii sacarensis* cytochrome B (*cytB*) gene, partial cds. **(AF131915)**

[MTCYTB] *P. boylii* cytochrome B (*cytB*) gene, partial cds. Seven consecutive GenBank entries representing different subspecies and individuals. **(AF155386 - AF155392)**

[MTCYTB] *P. boylii rowleyi* cytochrome B (*cytB*) gene, partial cds. **(AF155413)**

[MTCYTB] *P. boylii* cytochrome B (*cytB*) gene, partial cds. **(U89965)**

[MTCYTB] *P. boylii* mitochondrial cytochrome B (*cytB*) gene, partial cds. Two consecutive GenBank entries: **(AF131924 - AF131925)**

[MTCYTB] *P. boylii* cytochrome B (*cytB*) gene, partial cds. Seven consecutive GenBank entries representing different subspecies and individuals. **(AF155386 - AF155392)**

[MYCYTB] *P.* (*boylii* species group) cytochrome B (*cytB*) gene, partial cds. Six consecutive GenBank entries representing distinct populations of uncertain specific status: **(AF155405 – AF155410)**

[MTCYTB] *P. boylii* (*rowleyi*) cytochrome B (*cytB*) gene, partial cds. **(AF155413)**

[MTCYTB] *P. boylii* (*sacarensis*) cytochrome B (*cytB*) gene, partial cds. **(AF131915)**

[MTCYTB] *P. boylii* cytochrome B (*cytB*) gene, partial cds. **(U89965)**

[MTCYTB] *P. californicus* cytochrome B (*cytB*) gene., partial cds. **(AF155393**

[MTCYTB] *P. difficilis* cytochrome B (*cytB*) gene, partial cds. **(AF155394)**

[MTCYTB] *P. eremicus* mitochondrial DNA *cytB* gene. **(X89799)**

[MTCYTB] *P. eremicus* cytochrome B (*cytB*) gene, partial cds. **(AY195799)**

[MTCYTB] *P. furvus* cytochrome B (*cytB*) gene partial cds. Fifty-two consecutive GenBank entries representing different specimens from various localities: **(AF270980 - AF271032)**

[MTCYTB] *P. gossypinus* (*P. leucopus* group) mitochondrial DNA *cytB* gene. **(X89786)**

[MTCYTB] *P. gratus* cytochrome B (*cytB*) gene partial cds. **(AF155395)**

[MTCYTB] *P. hylocetes* cytochrome B (*cytB*) gene partial cds. Five consecutive GenBank entries representing different specimens: **(U89974 - U89978)**

[MTCYTB] *P. keeni* (*P. maniculatus* group) mitochondrial DNA *cytB* gene. **(X89787)**

[MTCYTB] *P. leucopus* mitochondrial DNA *cytB* gene. **(AF131926)**

[MTCYTB] *P. leucopus* mitochondrial DNA (*cytB*) gene. **(X89790)**

[MTCYTB] *P. leucopus* mitochondrial DNA (*cytB*) gene, partial cds. **(AY041198)**

[MTCYTB] *P. leucopus* mitochondrial DNA (*cytB*) gene, partial cds. **(AY509666)**

[MTCYTB] *P. leucopus* mitochondrial DNA (*cytB*) gene, partial sequence. **(AY263615)**

[MTCYTB] *P. leviceps* cytochrome B (*cytB*) gene, partial cds. Two consecutive GenBank entries representing different specimens: **(AF131928 - AF131929)**

[MTCYTB] *P. leviceps* cytochrome B (*cytB*) gene, partial cds. **(AF155396)**

[MTCYTB] *P. madrensis* cytochrome B (*cytB*) gene, partial cds. **(AF155397)**

[MTCYTB] *P. maniculatus* cytochrome B (*cytB*) gene, mitochondrial product. **(AF119261)**

[MTCYTB] *P. maniculatus* cytochrome B (*cytB*) gene, partial cds. **(AY184679 – AY184725)**

[MTCYTB] *P. maniculatus* cytochrome B (*cytB*) partial cds. **(AY184551 - AY184600)**

[MTCYTB] *P. maniculatus* cytochrome B (*cytB*) partial cds. **(AY184679 – AY184756)**

[MTCYTB] *P. maniculatus* cytochrome B (*cytB*) gene, partial cds. **(AY041199)**

[MTCYTB] *P. melanotis* cytochrome B (*cytB*) gene, partial cds. **(AF155398)**

[MTCYTB] *P. melanotis* (*P. maniculatus* group) mitochondrial DNA *cytB* gene. **(X89791)**

[MTCYTB] *P. nasutus* (*P. truei* group) cytochrome B (*cytB*) gene, partial cds. **(AF155399)**

[MTCYTB] *P. nudipes* cytochrome B gene, partial cds. **(AY041200)**

MTCY[TB] *P. pectoralis* cytochrome B (*cytB*) gene, partial cds. Three consecutive GenBank entries representing two subspecies. **(AF155400 – AF155402)**

[MTCYTB] *P. pectoralis* cytochrome B (*cytB*) gene, partial sequence **(AY263616)**

[MTCYTB] *P. polionotus* (*P. maniculatus* group) mitochondrial DNA *cytB* gene. **(X89792)**

[MTCYTB] *P. polius* cytochrome B (*cyt*B) gene, partial cds. **(AF155403)**

[MTCYTB] *P. sagax* cytochrome B (*cytB*) gene, partial cds. **(AF155404)**

[MTCYTB] *P. simulus* cytochrome B (*cytB*) gene, partial cds. **(AF131927)**

[MTCYTB] *P. spicilegus* cytochrome B (cytB) gene, partial cds. Two consecutive GenBank entries representing distinct samples. **(U89979 – U89980)**

[MTCYTB] *P. stephani* cytochrome B (*cytB*) gene, partial cds. **(AF155411)**

[MTCYTB] *P. truei* cytochrome B (*cytB*) gene, partial cds.. **(AF108703)**

[MTCYTB] *P. truei* cytochrome B (*cytB*) gene, partial cds.. **(AF155412)**

[MTCYTB] *P. winkelmanni* cytochrome B (*cytB*) gene, partial cds. **(AF131930)**

[MTCYTB] *P. winkelmanni* cytochrome B (*cytB*) gene, partial cds. Three consecutive GenBank entries representing distinct samples **(U89981 – U89983)**

[MTCYTB] *P. zarhynchus* cytochrome B (*cytB*) gene, partial cds. **(AY195800)**

Cytochrome oxidase (*mtCO*)

[MTCOII] *P. leucopus* mitochomdrial cytochrome oxidase haplotypes subunit II (*COII*) partial cds. **(AY266677 - AY266679)**

[MTCOII] *P. maniculatus* cytochrome oxidase subunit II (*COII*) complete cds. **(AY289746)**

[MTCOIII] *P. boylii* mitochondrial cytochrome oxidase subunit III (*COIII*) gene, partial cds. **(AY009175)**

[MTCOIII] *P. boylii* mitochondrial cytochrome oxidase subunit III (*COIII*) gene, partial cds. **(AF343771)**

[MTCOIII] *P. boylii* mitochondrial cytochrome oxidase subunit III (*COIII*) gene, partial cds. **(AF343772)**

[MTCOIII] *P. californicus* cytochrome oxidase subunit III. (*COIII*) gene, partial cds. **(AY009176)**

[MTCOIII] *P. caniceps* cytochrome oxidase subunit III. (*COIII*) gene, partial cds. **(AF343761)**

[MTCOIII] *P. collatus* cytochrome oxidase subunit III. (*COIII*) gene, partial cds. **(AF343768)**

[MTCOIII] *P. crinitus* cytochrome oxidase subunit III. (*COIII*) gene, partial cds. **(AY009177)**

[MTCOIII] *P. crinitus* cytochrome oxidase subunit III. (*COIII*) gene, partial cds. **(AF343766)**

[MTCOIII] *P. dickeyi* cytochrome oxidase subunit III (*COIII*) gene, partial cds. **(AF343759)**

[MTCOIII] *P. dickeyi* cytochrome oxidase subunit III (*COIII*) gene partial cds. Two consecutive GenBank entries for distinct samples: **(AF343772 – AF343773)**

[MTCOIII] *P. eremicus* mitochrondrial cytochrome oxidase subunit III (*COIII*) gene, partial cds. **(AF343756)**

[MTCOIII] *P. eremicus* mitochrondrial cytochrome oxidase subunit III (*COIII*) gene, partial cds. **(AF343760)**

[MTCOIII] *P. eremicus* mitochrondrial cytochrome oxidase subunit III (*COIII*) gene, partial cds. Three consecutive GenBank entries representing distinct specimens **(AF343763 – AF343765)**

[MTCOIII] *P. eremicus* mitochondrial cytochrome oxidase subunit III (*COIII*) gene, partial cds. Thirty-five consecutive GenBank entries representing distinct specimens: **(AY009186 - AY009220)**

[MTCOIII] *P. eva* mitochondrial cytochrome oxidase subunit III (*COIII*) gene, partial cds. **(AY009223)**

[MTCOIII] *P. eva* mitochondrial cytochrome oxidase subunit III (*COIII*) gene, partial cds. Five consecutive GenBank entries representing different specimens: **(AY009226 - AY009230)**

[MTCOIII] *P. eva* mitochondrial cytochrome oxidase subunit III (*COIII*) gene, partial cds. **(AY009237)**

[MTCOIII] *P. eva* mitochondrial cytochrome oxidase subunit III (*COIII*) gene, partial cds. **(AF343754)**

[MTCOIII] *P. fraterculus* mitochondrial cytochrome oxidase subunit III (*COIII*) gene, partial cds. Two consecutive GenBank entries representing different specimens: **(AY009221 - AY009222)**

[MTCOIII] *P. fraterculus* mitochondrial cytochrome oxidase subunit III (*COIII*) gene, partial cds. Two consecutive GenBank entries representing different specimens: **(AY009224 - AY009225)**

[MTCOIII] *P. fraterculus* mitochondrial cytochrome oxidase subunit III (*COIII*) gene, partial cds. Six consecutive GenBank entries representing different specimens: **(AY009231 - AY009236)**

[MTCOIII] *P. interparietalis* mitochondrial cytochrome oxidase subunit III (*COIII*) gene, partial cds. Two consecutive GenBank entries representing distinct specimens. **(AF343757 - AF343758)**

[MTCOIII] *P. leucopus* cytochrome oxidase subunit III (*COIII*) gene, partial cds. **(AY009173)**

[MTCOIII] *P. maniculatus* cytochrome oxidase subunit III (*COIII*) gene, partial cds. **(AY009174)**

[MTCOIII] *P.merriami* cytochrome oxidazse subunit III (*COIII*) gene, partial cds. **(AY009178 - AY009184)**

[MTCOIII] *P. sejugis* cytochrome oxidase subunit III (*COIII*) gene, partial cds. Two consecutive GenBank entries for distinct samples **(AF343772 - AF343773)**

[MTCOIII] *P. sejugis* cytochrome oxidase subunit III (*COIII*) gene, partial cds. **(AF343769)**

[MTCOIII] *P. sejugis* cytochrome oxidase subunit III (*COIII*) gene, partial cds. **(AF343762)**

[MTCOIII] *P. slevini* cytochrome oxidase subunit III (*COIII*) gene partial cds. **(AF343755)**

[MTCOIII] *P. slevini* cytochrome oxidase subunit III (*COIII*) gene partial cds. Two consecutive GenBank entries for distinct samples **(AF343774 – AF343775)**

[MTCOIII] *P. stephani* cytochrome oxidase subunit III (*COIII*) gene partial cds. **(AF343767)**

NADH dehydrogenase and transfer RNAs (*NADHDH* and *tRNAs*)

[MTNADHDH/tRNA-arg] *P. boylii* ND3 and ND4 genes, complete cds., tRNA-Arg complete seq., ND4 partial cds. **(U83864)**

[MTNADHDH/tRNA-arg] *P. eremicus* ND3 and ND4 genes, complete cds., tRNA-Arg complete seq., ND4 partial cds. **(U83861)**

[MTNADHDH/tRNA-arg, gly] *P. gossypinus* ND3 and ND4 genes, complete cds., tRNA-Arg complete seq., tRNA-gly gene partial seq. and ND4 gene partial cds. **(U40246)**

[MTtRNA-Phe] *P. gossypinus* mt D-loop, partial seqs., and tRNA-Pro gene, partial seqs. encoding mt RNA. Two consecutive GenBank entries **(AF031757 - AF031758)**

[MTtRNA-Pro] *P. gossypinus* mt D-loop, partial seqs., tRNA-Pro gene, partial seqs. encoding mtRNA. Two consecutive GenBank entries **(AF031806 - AF031807)**

[MTNADHDH/tRNAs] *P. keeni* (*oreas*) ND3 and ND4L genes, complete cds., tRNA(arg) gene, complete seq., tRNA(gly) gene, partial seq., and ND4 gene partial cds.; mt DNA gene products. **(U40062)**

[MTtRNA-Gly ff seq] *P. keeni* [*P. maniculatus*] isolates cds tGLY, NADH (ND3), tRNA-arg, NADHdh (ND4L), partial cds. **(AF374553 - AF374579)**

[MTNADHDH/tRNAs] *P. keeni interdictus* ND3 and ND4L genes, complete cds., tRNA(arg) gene, complete seq., tRNA(gly) gene, partial seq., and ND4 gene partial cds.; mt DNA gene products. **(U40063)**

[MTtRNA-Phe] *P. leucopus* mt D-loop, partial seqs., and tRNA-Phe gene, partial seqs. encoding mt tRNA. Forty-six consecutive GenBank entries representing samples from throughout the range of the species. **(AF031710 - AF031756)**

[MTtRNA-Pro] *P. leucopus* mt D-loop, partial seqs., and tRNA-Pro gene, partial seqs. encoding mt tRNA. Forty-seven consecutive GenBank entries representing samples from throughout the range of the species. **(AF031759 - AF031805)**

[MTNADHDH/tRNAs] *P. leucopus* ND3 and ND4L genes, complete cds., tRNA(arg) gene, complete seq., tRNA(gly) gene, partial seq., and ND4 gene partial cds.; mt DNA gene products. **(U40252)**

[MTNADHDH/tRNAs] *P. maniculatus austerus* ND3 and ND4L genes, complete cds., tRNA(arg) gene, complete seq., tRNA(gly) gene, partial seq., and ND4 gene partial cds.; mt DNA gene products. **(U40249)**

[MTNADHDH/tRNAs] *P. maniculatus rufinus* ND3 and ND4L genes, complete cds., tRNA(arg) gene, complete seq., tRNA(gly) gene, partial seq., and ND4 gene partial cds.; mt DNA gene products. **(U40250)**

[MTNADHDH/tRNAs] *P. maniculatus coolidgei* ND3 and ND4L genes, complete cds., tRNA(arg) gene, complete seq., tRNA(gly) gene, partial seq., and ND4 gene partial cds.; mt DNA gene products. **(U40251)**

[MTNADHDH/tRNAs] *P. melanotis* ND3 and ND4L genes, complete cds., tRNA(arg) gene, complete seq., tRNA(gly) gene, partial seq., and ND4 gene partial cds.; mt DNA gene products. **(U40247)**

[MTNADHDH/tRNAs] *P. mexicanus* ND3 and ND4L genes, complete cds., tRNA-Arg complete seq., ND4 partial cds. **(U83862)**

[MTNADHDH/tRNAs] *P. polionotus* ND3 and ND4L genes, complete cds., tRNA(arg) gene, complete seq., tRNA(gly) gene partial seq., and ND4 partial cds.; mtDNA products. **(U40254)**

[MTNADHDH/tRNAs] *P. sejugis* ND3 and ND4L genes, complete cds., tRNA(arg) gene, complete seq., tRNA(gly) gene partial seq., and ND4 partial cds.; mtDNA products. Two entries in GenBank **(U40253, U40255)**

[MTNADHDH/tRNAs] *P. slevini* ND3 and ND4L genes, complete cds., tRNA(arg) gene, complete seq., tRNA(gly) gene partial seq., and ND4 partial cds.; mtDNA products. **(U40248)**

Mitochondrial control region

[MTctrl] *P. maniculatus* mitochondrial control region (*mtCtrl*) partial sequences. **(AY184601 – AY184678)**

[MTctrl] *P. maniculatus* mitochondrial control region (*mtCtrl*) partial sequences. **(AY184501 – AY184550)**

Ribosomal RNAs

[MTsnRNA] *P. californicus* snRNA (*Bci RNA*) gene, partial sequence. **(U33850)**

[MT12SrRNA] *P. eremicus* mitochondrial DNA for SSU ribosomal RNA gene. **(X89784)**

[MT12SrRNA] *P. leucopus* mitochondrial DNA for 12S ribosomal RNA gene. **(X89797)**

[MT12SrRNA] (*P. leucopus* group) *P. gossypinus* mitochondrial DNA for SSU ribosomal RNA gene. **(X89795)**

[MT12SrRNA] *P. leucopus* mitochondrial 12S rRNA gene. **(X99463)**

[MT16SrRNA] *P. leucopus* 16S ribosomal RNA gene, partial seq. **(AF364506)**

[MT12SrRNA] (*P. maniculatus* group) *P. keeni* mitochondrial DNA for SSU ribosomal RNA gene. **(X89796)**

[MT12SrRNA] (*P. maniculatus* group) *P. polionotus* DNA for 12S ribosomal RNA gene. **(X89888)**

[MTsnRNA] *P. maniculatus* snRNA (*Bci RNA*) gene, partial sequence. **(U33851)**

[MT12SrRNA] *P. melanotis* mitochondrial DNA for 12S ribosomal RNA gene **(X89785)**

D-loop undefined sequences

[MTDloop] *P. atterwateri* mitochondrial D-loop region sequence, complete. **(AF081492)**

[MTDloop] *P. beatae* D-loop region sequence, complete. **(AF081487)**

[MTDloop] *P. boylii rowleyi* D-loop region sequence, complete. **(AF081486)**

[MTDloop] *P. leviceps ambiguous* D-loop region sequence, complete. **(AF081488)**

[MTDloop] *P. leviceps leviceps* D-loop region sequence, complete. **(AF081489)**

[MTDloop] *P. simulus* D-loop region sequence, complete. **(AF081491)**

Nucleic Acid Sequences in GenBank for other Peromyscine Genera

NUCLEAR GENES

Neotomodon:

[DMP1] *N. alstoni* dentin matrix protein 1(*DMP*). gene, exon 6 and partial cds **(AY269973)**

Onychomys:

[DMP1] *O. arenicola* dentin matrix protein 1(*DMP*). gene, exon 6 and partial cds **(AY269975)**

[DMP1] *O. leucogaster* dentin matrix protein 1(*DMP*). gene, exon 6 and partial cds **(AY269976)**

[IRBP] *O. torridus* (MVZ 196051) Interphotoreceptor retinoid bimnding protein(*IRBP*) gene, partial cds. **(AY277412)**

Osgoodomys:

[DMP1] *O. banderanus* dentin matrix protein 1(*DMP*). gene, exon 6 and partial cds **(AY269977)**

NUCLEAR REPEATS, INTRONS, MICROSATELITES, ELEMENTS

Neotomodon:

[BFBRNentr7] *N. alstoni* fibrinogen gene, intron 7. **(AY274202)**

Onychomys:

[BFBRNentr7] *O. arenicola* fibrinogen gene, intron 7. **(AY274204)**

[BFBRNentr7] *O. leucogaster* fibrinogen gene, intron 7. **(AY274205)**

Osgoodomys:

[BFBRNentr7] *O. leucogaster* fibrinogen gene, intron 7. **(AY274206)**

MITOCHONDRIAL GENES :

Habromys:

[MTNADH/tRNA-Arg] *H. lophurus* NADHdh subunit 3 (ND3), tRNA-Arg, subunit 4L (ND4L), subunit 4 (ND4) complete cds. **(U83863)**

Isthmomys:

[MTNADH/tRNA-Arg] *I. pirrensis* NADHdh subunit 3 (ND3), tRNA-Arg, subunit 4L (ND4L), subunit 4 (ND4) complete cds. **(U83859)**

Megadontomys:

[MTCYTB] *M. megadontomys* mitochondrial DNA cytochrome B (*cytb*) gene. **(AY195795)**

Neotomodon:

[MTCYTB] *N. alstoni* mitochondrial DNA cytochrome B (*cytb*) gene. **(AY195796, AY195797)**

Onychomys:

[MTCYTB] *O. arenicola* mitochondrial DNA for cytB (*cytB*) gene. **(X89793)**

[MTCYTB] *O. arenicolar* mitochondrial DNA cytochrome B (*cytb*) gene. **(AY195793)**

[MTCYTB] *O. leucogaster* mitochondrial DNA for cytB (*cytB*) gene. **(X89794)**

[MTCYTB] *O. leucogaster* mitochondrial DNA cytochrome B (*cytb*) gene. **(AY195794)**

[MTCYTB] *O. torridus* mitochondrial DNA for cytB (*cytB*) gene. **(X89798)**

[MTCYTB] *O. torridus* mitochondrial DNA cytochrome B (*cytb*) gene. **(AY275110)**

[MTCOIII] *O. arenicola* cytochrome oxidase subunit III(*COIII*) gene. Three isolates from different specimens. **(U21648 - U21650)**

[MTCOIII] *O. leucogaster* cytochrome oxidase subunit III(*COIII*) gene. Three isolates from different specimens. **(U21614 - U21616)**

[MTCOIII] *O. torridus* cytochrome oxidase subunit III(*COIII*) gene. Three isolates from different specimens. **(U21633 - U21635)**

[MT12SrRNA] *O. arenicola* mitochondrial DNA for SSU ribosomal RNA (*ssuRNA*) gene. **(X89782)**

[MT12SrRNA] *O. leucogaster* mitochondrial DNA for SSU ribosomal RNA (*ssuRNA*) gene. **(X89889)**

[MT12SrRNA] *O. torridus* mitochondrial DNA for SSU ribosomal RNA (*ssuRNA*) gene. **(X89783)**

[MTNADH/tRNA-Arg] *O. leucogaster* NADHdh subunit 3 (ND3), tRNA-Arg, subunit 4L (ND4L), subunit 4 (ND4) complete cds. **(U83858)**

Osgoodomys:

[MTCYTB] *O. banderanus* cytochrome b mitochondrial gene , partial cds. **(AF155383)**

[MTCOIII] *O. (Peromyscus) banderanus* cytochrome C oxidase subunit II complete cds. **(U62572)**

[MTCOIII] *O. (Peromyscus) banderanus* cytochrome C oxidase subunit II gene, partial cds. **(U18836)**

[MTNADH/tRNA-Arg] *O. banderanus* NADHdh subunit 3 (ND3), tRNA-Arg, subunit 4L (ND4L), subunit 4 (ND4) complete cds. **(U83860)**

[MT12SrRNA] *O. banderanus* 12 ribosomal RNA mitochondrial encoding rRNA **(U67295)**

Podomys:

[MTNADH/tRNA-Arg] *P. floridanusr* NADHdh subunit 3 (ND3), tRNA-Arg, subunit 4L (ND4L), subunit 4 (ND4) complete cds. **(U83865)**

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