

## Molecular Ecology Fall 2003

Date	Topic	Reading Assignment
August		
25	Introduction and Class Organization	
27	Lecture - Analytical Tools of ME	1 - Pp. 3-43, #2, #3, #4, #5
September		
1	Lecture - Analytical Tools of ME	#4, #5
3	Lecture - Analytical Tools of ME	"
8	Lecture - Immunoprecipitation	1 - Pp. 44-47, #6
10	Paper discussion	#7, #8
15	Lecture- Protein Electrophoresis	1 - Pp. 47-53, #9, #10
17	Paper discussion	#11, #12
22	Lecture - DNA-DNA hybridization	1 - Pp. 53-57. 331-333, #13
24	Paper discussion	#14, #15
29	Lecture-Modern Molecular Techniques	#16, #17, #18, #19
October		
1	Lecture cont. & Paper discussion	
6	Lecture - Cytoplasmic DNA	1 - Pp. 60-69 & 224-251, #20
18	Paper discussion - mitochondrial DNA	#21, #22
13	Lecture - Cytoplasmic DNA cont.	1 - Pp. 306-321
15	Paper discussion - chloroplast DNA	#23, #24
20	Lecture - Single-copy Nuclear DNA	1 - Pp. 69-75, #25, #26
22	Paper discussion	#27, #28
27	Lecture - Repetitive DNA	1 - Pp. 78-82
29	Lecture - Repetitive DNA	#29, #30, #31
November		
3	Lecture - Mini and Micro-satellites	1 - Pp. 78-82. #32, #33
5	Paper discussion	#34, #35
10	Lecture - RAPDs	1 - Pp. 87. #36. #37
12	Paper Discussion	#38, #39
17	Lecture - AFLPs	#40, #41
19	Paper discussion	#42, #43
24	Lecture - Microarray analysis	#44
26	Paper discussion	#45, #46
December		
1	15 minute presentation	
3	15 minute presentations	

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### Reading List

- 1) Avise, J.C. 1994. *Molecular Markers, Natural History and Evolution*. Chapman & Hall, New York, NY.
- 2) Hillis, D.M., Mable, B.K. & Moritz, C. 1996. Applications of Molecular Systematics: The state of the Field and a look to the future. in *Molecular Systematics*, 2nd ed., Hillis, D.M., Moritz, C. & Mable, B.K. (eds.). Pp. 515-543. Sinauer Associates Inc., Sunderland, MA.
- 3) Moritz, C. & Hillis, D.M. 1996. Molecular Systematics: Context and Controversies. in *Molecular Systematics*, 2nd ed., Hillis, D.M., Moritz, C. & Mable, B.K. (eds.). Pp. 1-13. Sinauer Associates Inc., Sunderland, MA.
- 4) Weir, B.S. 1996. Intraspecific Differentiation. in *Molecular Systematics*, 2nd ed., Hillis, D.M., Moritz, C. & Mable, B.K. (eds.). Pp. 385-405. Sinauer Associates Inc., Sunderland, MA.
- 5) Swofford, D.L., Olsen, G.J., Waddell, P.J. & Hillis, D.M. 1996. Phylogenetic Inference. in *Molecular Systematics*, 2nd ed., Hillis, D.M., Moritz, C. & Mable, B.K. (eds.). Pp. 407-514. Sinauer Associates Inc., Sunderland, MA.
- 6) Maxson, L.R. & Maxson, R.D. 1990. Protein II: Immunological Techniques. in *Molecular Systematics*, 1st ed. Hillis, D.H. & Moritz, C. (eds.). Pp. 127-155. Sinauer Associates Inc., Sunderland, MA.
- 7) Watts, C. H. S. and P. R. Baverstock. 1995. Evolution in the Murinae (Rodentia) assessed by microcomplement fixation of albumin. *Aus. J. Zool.* 43:105-118.
- 8) Hedges, S.B., Hass, C.A. & Maxson, L.R. 1992. Caribbean biogeography: molecular evidence for dispersal in the West Indian terrestrial vertebrates. *Proceedings of the National Academy of Sciences, USA* 89:1909-1913.
- 9) Murphy, R., Jr., J.W.S., Buth, D.G. & Haufler, C.H. 1996. Proteins: Isozyme electrophoresis. in *Molecular Systematics*, 2nd ed., Hillis, D.M., Moritz, C. & Mable, B.K. (eds.). Pp. 51-120. Sinauer Associates Inc., Sunderland, MA.
- 10) May, B. 1992. Starch gel electrophoresis of allozymes. in *Molecular genetic analysis of populations: A practical approach*. Hoelzel, A.R., ed. Pp. 1-27. IRL Press at Oxford University Press, New York, NY.
- 11) Grosberg, R.K. 1991. Sperm-mediated gene flow and the genetic structure of a population of the colonial ascidian *Botryllus schlosseri*. *Evolution* 45:130-142.
- 12) Kaplan, Z. and J. Stepanek. 2003. Genetic variation within and between populations of *Potamogeton pusillus* agg. *Plant Syst. Evol.* 239: 95-112.

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- 13) Werman, S.D., Springer, M.S. & Britten, R.J. 1996. Nucleic acids I: DNA-DNA hybridization. in *Molecular Systematics*, 2nd ed., Hillis, D.M., Moritz, C. & Mable, B.K. (eds.). Pp. 169-203. Sinauer Associates Inc., Sunderland, MA.
- 14) Sheldon, F. and F. B. Gill. 1996. A reconsideration of songbird phylogeny, with emphasis on the evolution of titmice and their sylvioid relatives. *Syst. Biol.* 45:473-495.
- 15) Baker, G. M. 2002. Phylogenetic diversity: a quantitative framework for measurement of priority and achievement in biodiversity conservation. *Biol. J. Linn. Soc.* 76:165-194.
- 16) Dowling, T.E., Moritz, C., Palmer, J.D. & Riesenbergs, L.H. 1996. Nucleic acids III: Analysis of fragments and restriction sites. in *Molecular Systematics*, 2nd ed., Hillis, D.M., Moritz, C. & Mable, B.K. (eds.). Pp. 249-320. Sinauer Associates Inc., Sunderland, MA.
- 17) Palumbi, S.R. 1996. Nucleic acids II: The polymerase chain reaction. in *Molecular Systematics*, 2nd ed., Hillis, D.M., Moritz, C. & Mable, B.K. (eds.). Pp. 205-247. Sinauer Associates Inc., Sunderland, MA.
- 18) Hillis, D.M., Mable, B.K., Larson, A., Davis, S.K. & Zimmer, E.A. 1996. Nucleic acids IV: sequencing and cloning. in *Molecular Systematics*, 2nd ed., Hillis, D.M., Moritz, C. & Mable, B.K. (eds.). Pp. 321-381. Sinauer Associates Inc., Sunderland, MA.
- 19) Arnheim, N., White, T. & Rainey, W.E. Application of PCR: organismal and population biology. 1990. *BioScience* 40:174-182.
- 20) Harrison, R.G. Animal mitochondrial DNA as a genetic marker in population and evolutionary biology. 1989. *Trends in Ecology and Evolution* 4:6-11.
- 21) Michaux, J. R., E. Magnanou, E. Paradis, C. Nieberding, and R. Libois. 2003. Mitochondrial phylogeography of the woodmouse (*Apodemus sylvaticus*) in the western Palearctic region. *Mol. Ecol.* 12:685-697.
- 22) Churikov, D., M. Matsuoka, X. Luana, A. K. Gray, V. A. Brykov, and A. J. Gharrett. 2003. Assessment of concordance among genealogical reconstructions from various mtDNA segments in three species of Pacific salmon (genus *Oncorhynchus*). *Mol. Ecol.* 10:2329-2339.
- 23) Petit, R. J. et al. 2003. Glacial Refugia: hotspots but not melting pots of genetic diversity. *Science* 300:1563-1565.
- 24) Burban, C. and R. J. Petit. 2003. Phylogeography of maritime pine inferred with organelle markers having contrasted inheritance. *Mol. Ecol.* 12:1487-1495.
- 25) Zhang, De. X. and G. M. Hewitt. 2003. Nuclear DNA analyses in genetic studies of populatins: practice, problems and prospects. *Mol. Ecol.* 12:563-584.

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- 26) Karl, S.A. & Avise, J.C. PCR-based assays of Mendelian polymorphisms from anonymous single-copy nuclear DNA: techniques and applications for population genetics. 1993. *Mol. Biol. Evol.* 10:342-361.
- 27) Buonaccorsi, V. P., K. S. Reece, L. W. Morgan, and J. E. Graves. 1999. Geographic distribution of molecular variance within the blue marlin (*Makaira nigricans*): A hierarchical analysis of allozyme, single-copy nuclear DNA, and mitochondrial DNA markers. *Evolution* 53:568-579.
- 28) Poinar, H., M. Kuch, G. McDonald, P. Martin, and S. Paabo. 2003. Nuclear gene sequences from a late Pleistocene sloth coprolite. *Current Biol.* 13:1150-1152.
- 29) Bannikova, A. A., V. A. Matveev, and D. A. Kramerov. 2002. Using inter-SINE-PCR to study mammalian phylogeny. *Russ. J. Genetic.* 38:714-724.
- 30) Walker, J. A., D. A. Hughes, B. A. Anders, J. Shewale, S. K. Sinha, and M. A. Batzer. 2003. Quantitative intra-short interspersed element PCR for species-specific DNA identification. *Anal. Biochem.* 316:259-269.
- 31) Smulders, M. J. M., L. B. Snoek, G. Booy, and B. Vosman. 2003. Complete loss of MHC genetic diversity in the common hamster (*Cricetus cricetus*) population in the Netherlands. Consequences for conservation strategies. *Conser. Genet.* 4:441-451.
- 32) Jeffreys, A.J., Wilson, V. & Thein, S.L. 1985. Hypervariable 'minisatellite' regions in human DNA. *Nature* 314:67-73.
- 33) Litt, M. & Luty, J.A. 1989. A hypervariable microsatellite revealed by in vitro amplification of a dinucleotide repeat within the cardiac muscle actin gene. *Am. J. Human Genet.* 44:397-401.
- 34) Jones, A. G., G. Rosenqvist, A. Berglund, and J. C. Avise. 2000. Mate quality influences multiple maternity in the sex-role-reversed pipefish *Syngnathus typhle*. *Oikos* 90:321-326.
- 35) Arnaud, J-F. 2003. Metapopulation genetic structure and migration pathways in the land snail *Helix aspersa*: influences of landscape heterogeneity. *Land. Ecol.* 18:333-346.
- 36) Hadrys, H., M. Blaick, and B. Schierwater. 1992. Applications of random amplified polymorphic DNA (RAPD) in molecular ecology. *Mol. Ecol.* 1:55-63.
- 37) Williams, J.G.K., A. R. Kubellk, K. J. Livak, J. A. Rafalski, and S. V. Tingey. 1991. DNA polymorphisms amplified by arbitrary primers are useful as genetic markers. 1991. *NAR* 18:6531-6535.
- 38) Hahn, R. C., A. M. Macedo, C. J. F. Fontes, R. D. Batista, N. L. Santos, and J. S. Hamdan. 2003. Randomly amplified polymorphic DNA as a valuable tool for epidemiological studies of *Paracoccidioides brasiliensis*. *J. Clinical Microbiol.* 41:2849-2854.

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- 39) Figueroa, M. E., J. M. Castillo, S. Redondo, T. Luque, E. M. Castellanos, F. J. Nieva, C. Luque, A. E. Rubio-Casal, and A. J. Davy. 2003. Facilitated invasion by hybridization of *Sarcocornia* species in a salt-marsh succession. *J. Ecol.* 91:616-626.
- 40) Vos et al.
- 41) Brugmans, B., R. G. M. van der Hulst, R. G. F. Visser, P. Lindhout, and H. J. van Eck. 2003. A new and versatile method for the successful conversion of AFLP markers into simple single locus markers. *NAR* 31, E55:1-9.
- 42) Kruse, I, T. B. H. Reusch, and M. V. Schneider. 2003. Sibling species or poecilogony in the polychaete *Scoloplos armiger*. *Mar. Biol.* 142:93-947.
- 43) Ziegenhagen, B., R. Bialozyt, V. Kuhlenkamp, I. Schulze, A. Ulrich, and M. Wulf. 2003. Spatial patterns of maternal lineages and clones of *Galium odoratum* in a large ancient woodland: inferences about seedling recruitment. *J. Ecol.* 91:578-586.
- 44) microarray technique paper
- 45) Streelman J. T., and T. D. Kocher. 2000. From phenotype to genotype. *Evol. Develop.* 2:166-173.
- 46) Townsend, J. P., D. Cavalieri, and D. L. Hartl. 2003. Population genetic variation in genome-wide gene expression. *Mol. Biol. Evol.* 20:955-963.

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### General

Molecular Ecology and Evolution is a combination survey course and a paper discussion group. Each week we will be covering a different molecular approach generally used in MEE studies. Some approaches (e.g., DNA-DNA hybridization) are not used that often and others (e.g., PCR and mtDNA sequencing) are core techniques. All are useful and bring certain strengths and weaknesses with them. The course is ideally suited for someone with a strong background in ecology but little molecular training. Other students with weaker ecological backgrounds also can benefit if they have a basic understanding of ecology and moderate level of familiarity with at least one of the following: transmission genetics, population genetics, molecular biology, or evolution.

All general University requirements governing academic policies and procedures contained either in the USF Undergraduate Catalog or as specified in the Biology Department or University Graduate Catalogs are in effect. It is your responsibility to be familiar with these documents.

### Course Structure

The course is structured as alternating days of lecture and discussion. Typically, the first class of a week will be a lecture by me. For the second class of the week, I have assigned readings, usually from journals, that we will discuss as a group. In general, at the start of the discussion class I will pick a student to present the goal, approach and results of the paper(s). This means that everyone must be prepared to formally present each paper. After the presentation it is expected that all students will participate in a "round table" discussion of the paper(s).

### Requirements and Grading

*Class participation:* One quarter of your class grade will be based upon participation. There are 10 discussion classes. If you participate in 8 or more classes you will receive 100 points. Ten points will be deducted for each class for which you don't participate. Don't be fooled. This can significantly change your grade in this class. Basically, I expect all students to participate fully each discussion class.

*Written critique of a paper:* You must choose 2 papers from the ones discuss and write a formal critique of them. Briefly, these are short (i.e., 2 - 3 pages) evaluations of the papers. To receive credit for the assignment the written critique MUST be turned in BEFORE the day on which that paper is discussed. These are individual assignments, but discussion with other students is encouraged. You MAY NOT, however, share in the writing - the pages turned in must be your thoughts and ideas and cannot be a group effort. Each paper is worth 50 points.

*Take home exam:* Some time around the eight-week of classes I will be handing out a take home exam. The exam is in the basic format of dissertation written exam questions and will consist of from 2 to 5 questions. Your answers must be independent work (i.e., no working in

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groups, no discussion with other people). These will be very open-ended questions usually dealing with a broad topic. You will have until November 24 to complete this assignment. The exam is worth 100 points.

*Oral presentation:* As you will note on the Schedule, the last 2 classes are reserved for oral presentations. You will be required to present to the class an area of research in molecular ecology or evolution in which you are particularly interested. Topics must be approved by me in advance to receive full credit. Presentations are worth 100 points and scores will be assigned by the other students in the class. I will use the average score as your score for this assignment. I reserve the right, however, to remove from the average scores that clearly are outliers.

*Grading:* Final grades will be assigned based on the percentage of total points you earned overall during the semester and letter grades will be assigned on a straight percentage scale with A = 91 to 100%, B = 81 to 90%, C = 71 to 80%, F ≤ 70%. Note: there is no letter grade of D and I will not be using the +/- grading system.