Further and Avanced Reading on
Molecular Population Genetics and Genomics

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The reading suggested below is **not compulsory**: the reading list is for students who would like to go beyond the course level and learn more about the materials which Vitor, Nicolas, Margot and I have touched upon in our lectures and exercises. The pdfs of the papers mentioned below (but not the books) can be found in dropbox.

Advanced books

- There is a great number of books on this subject; here is just a small selection:
- A quite readable introduction is *Molecular Population Genetics*, by Matthew Hahn (Oxford University Press, 2018).
- An excellent short book, in German, is *Molekulare Populationsgenetik*, by Wolfgang Stephan and Anja C. Hörger (Springer Spektrum, 2019)
- A comprehensive and detailed textbook is *Elements of Evolutionary Genetics*, referred to below, by Brian Charlesworth and Deborah Charlesworth (2010; Roberts & Co., Greenwood Village, Co, USA) (This textbook focuses on theoretical concepts and contains sometimes quite advanced mathematical material).
- Technically advanced state-of-the-art overview chapters, with much detail on computational and statistical methods, can be found in the *Handbook of Statistical Genomics*, edited by David J. Balding, Ida Moltke, and John Marioni (Volumes I and II, 4th edition, 2019, Wiley).
- Two encylopedic overviews of evolutionary quantitative genetics are provided by Michael Lynch and Bruce Walsh (1998) *Genetics and Analysis of Quantitative Traits* (Sinauer Associates, Sunderland, MA) and, in a 2nd volume (20 yrs in the making!), by Bruce Walsh and Michael Lynch (2018) E*volution and Selection of Quantitative Traits* (Oxford University Press, Oxford. https://doi.org/10.1093/oso/9780198830870.001.0001)

General overviews and review papers

The best place to start, if one wants to learn more, is to read some review papers. Here is a small selection:

- A relatively short overview of the whole subject: Charlesworth, B., 2001 Population Genetics, pp. 777-797 in *Encyclopedia of Biodiversity*, edited by S. A. Levin. Elsevier, New York
- Charlesworth, B., 2011 Molecular population genomics: a short history. *Genetics Research* 92:397-411.
- An excellent overview of molecular population genetics, with a strong focus on Drosophila: Casillas, S., and A. Barbadilla, 2017 Molecular Population Genetics. *Genetics* 205:1003-1035

Further reading related to Lecture 1 *Genetic variability and its measurement*

- Charlesworth & Charlesworth, chapter 1
- A good review paper on the coalescent process, its relation to genetic variability and its applications is Rosenberg, N. A., and M. Nordborg, 2002, Genealogical trees, coalescent theory and the analysis of genetic polymorphisms. *Nature Reviews Genetics* 3:380-390.
- A review of effective population size and its relation to genetic variability and the coalescent process is: Charlesworth, B., 2009, Effective population size and patterns of molecular evolution and variation. *Nature Reviews Genetics* 10:195-205.

Further reading related to Lecture 2 *Recombination, Linkage and Population Structure*

- Charlesworth & Charlesworth, chapter 8
- An excellent review of the concept of linkage disequilibrium and its applications is Slatkin, M., 2008, Linkage disequilibrium - understanding the evolutionary past and mapping the medical future. *Nature Reviews Genetics* 9: 477-485.
- A review of the evolutionary consequences of selection and recombination is Charlesworth, B., A. J. Betancourt, V. B. Kaiser and I. Gordo, 2009 Genetic Recombination and Molecular Evolution. *Cold Spring Harbor Symposia on Quantitative Biology* 74: 177-186.

Further reading related to Lecture 3 *Detecting Selection*

- Charlesworth & Charlesworth, chapter 2, 3, 6 and 8
- This review provides an excellent overview of adaptation genomics and experimental methods for inferring adaptation at the molecular level: Barrett, R. D. H., and H. E. Hoekstra, 2011 Molecular spandrels: tests of adaptation at the genetic level. *Nature Reviews Genetics* 12: 767-780.
- Nadeau, N. J., and C. D. Jiggins, 2010 A golden age for evolutionary genetics? Genomic studies of adaptation in natural populations. *Trends in Genetics* 26: 484-492.
- Novembre, J., and A. Di Rienzo, 2009 Spatial patterns of variation due to natural selection in humans. *Nature Reviews Genetics* 10: 745-755.
- A good brief introduction to selective sweeps: Pritchard, J. K., J. K. Pickrell and G. Coop, 2010 The Genetics of Human Adaptation: Hard Sweeps, Soft Sweeps, and Polygenic Adaptation. *Current Biology* 20: R208-R215.
- An excellent overview of ecological genomics and how to infer genomic signatures of local adaptation: Savolainen, O., M. Lascoux and J. Merila, 2013 Ecological genomics of local adaptation. *Nature Reviews Genetics* 14: 807-820.
- An overview of how next-generation sequencing and population genomics can be combined with experimental evolution experiments in the laboratory to study adaptation, i.e. so-called "Evolve & Resequence" experiments, especially in *Drosophila*: Schlötterer, C., R. Kofler, E. Versace, R. Tobler and S. U. Franssen, 2014 Combining experimental evolution with next-generation sequencing: a powerful tool to study adaptation from standing genetic variation. *Heredity* 114: 431-440.

- Similar to the review above but more general: Long, A., G. Liti, A. Luptak and O. Tenaillon, 2015 Elucidating the molecular architecture of adaptation via evolve and resequence experiments. *Nature Reviews Genetics* 16:567-.
- A review of pool-sequencing and its applications in evolutionary genomics: Schlötterer, C., R. Tobler, R. Kofler and V. Nolte, 2014 Sequencing pools of individuals –mining genome-wide polymorphism data without big funding. *Nature Reviews Genetics* 15:749-763.