

7. Title: **The ancestral selection graph in Mathematical Genetics**

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A random graph describing the ancestry of a collection of n genes under selection with different reproductive rates depending on the type of the gene is called the Ancestral Selection Graph (ASG). The graph which was introduced by Krone and Neuhauser is a generalization of the coalescent process of Kingman (1982). The graph is related to diffusion process models of how population frequencies change over time.

The project is to review the literature on the ASG and then add a theoretical research study, or a simulation study of a model with selection. An easy reading overview paper is Neuhauser (2007).

Prerequisites.

BS3a Applied Probability

Part C Mathematical Genetics course.- notes at

http://www.stats.ox.ac.uk/%7Egriff/mathgen_ht08.pdf

Computer skills with the ability to write simulation code in C or R.

References

Barton, N. H., Etheridge, A. M. (2004). The effect of selection on genealogies. *Genetics*, 166, 1115-1131.

Barton, N. H., Etheridge, A. M., Sturm, A. K. (2004). Coalescence in a random background. *Annals of Applied Probability*, 14, 754-785.

Coop, G., Griffiths, R. C. (2004). Ancestral inference on gene trees under selection. *Theoretical Population Biology*, 66, 219-232.

Krone, S. M., Neuhauser, C. (1997). Ancestral processes with selection. *Theoretical Population Biology*, 51, 210-237.

Neuhauser, C. (2007). Mathematical models in population genetics. In '*Handbook of Statistical Genetics*, 3rd ed. p755-780' ed Balding, D. J., Bishop, M., Cannings, C.

Neuhauser, C., Krone, S. M. (1997). The genealogy of samples in models with selection. *Genetics* 145, 519-534.