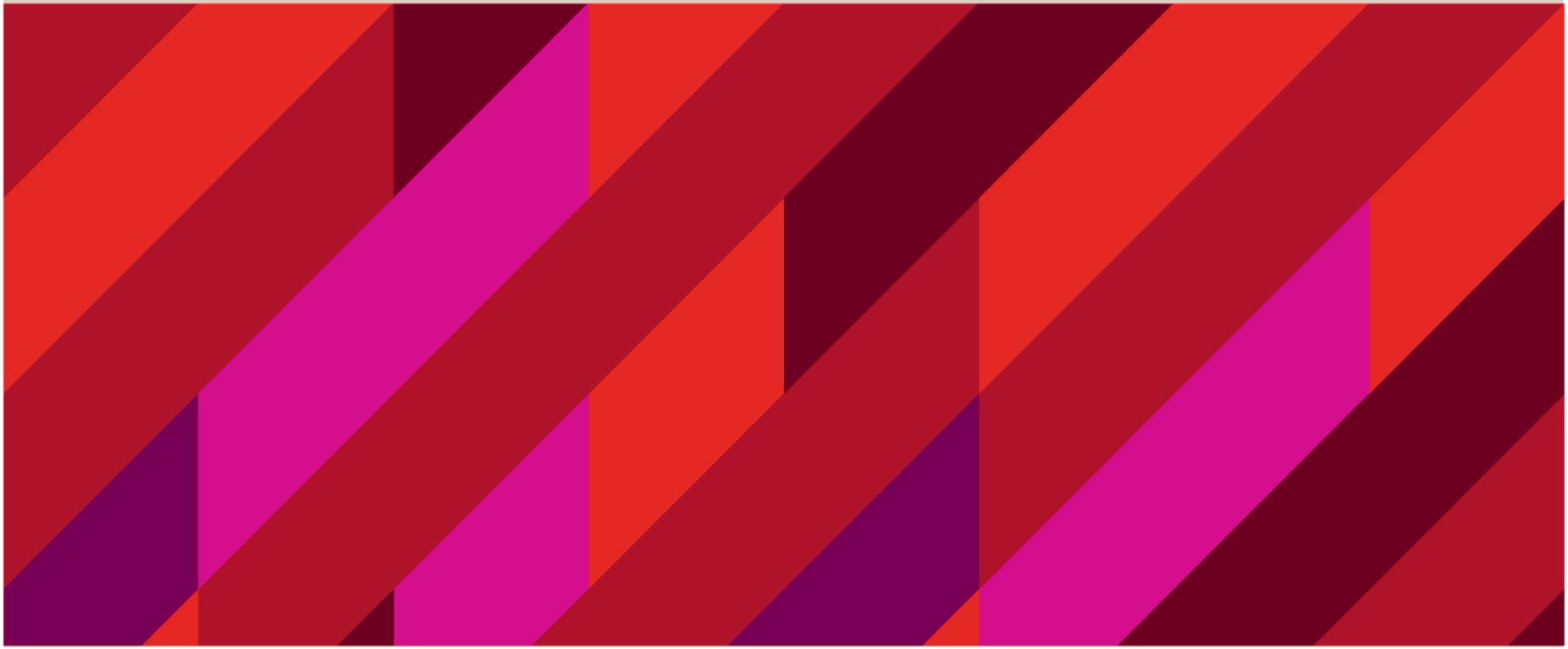
MACQUARIE University

BIOL3110 Conservation & Ecological Genetics

LECTURE 12: MAINTENANCE OF GENETIC VARIATION



Fate of Mutations

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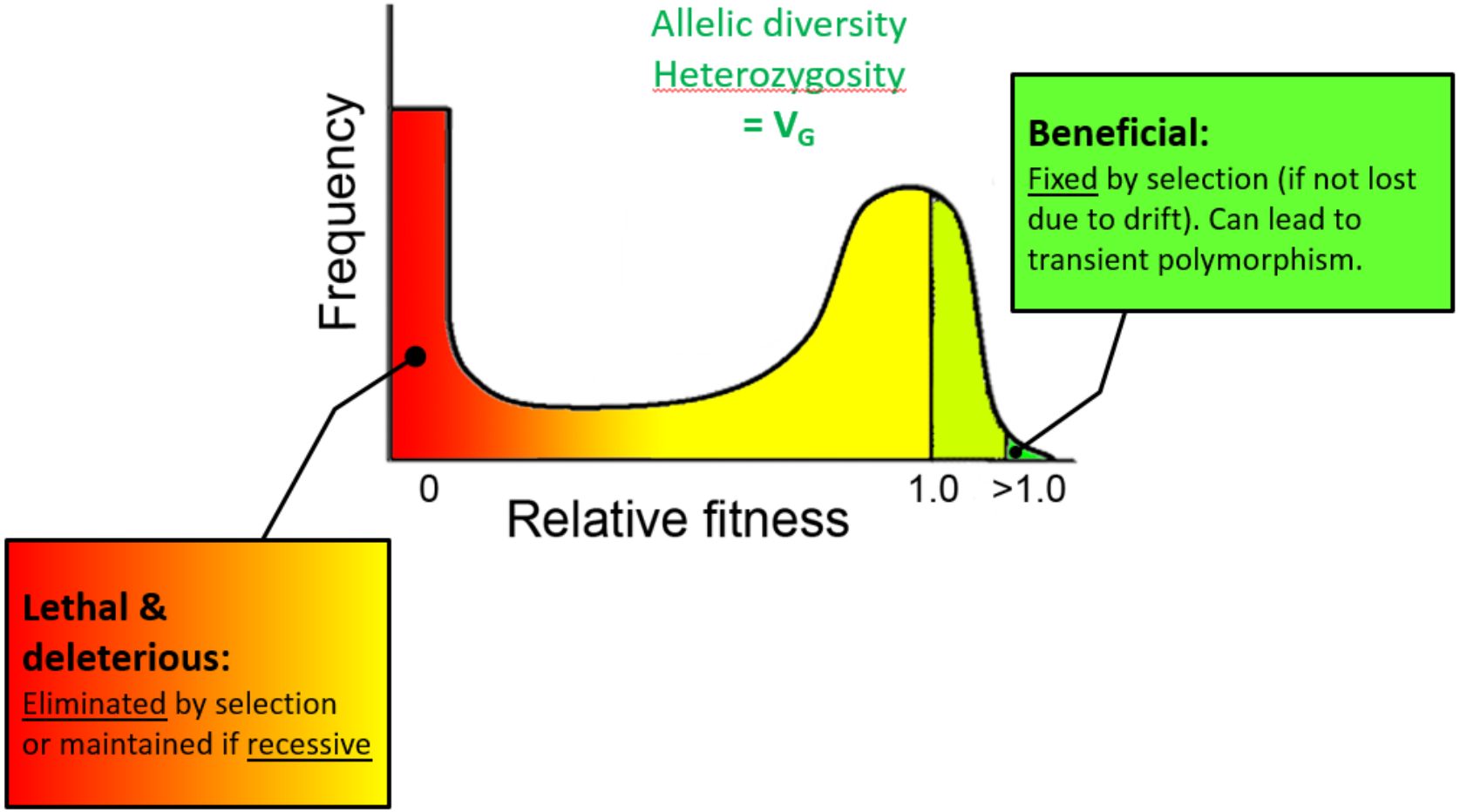
KEY GENERATOR OF V_G



Fate of Mutations

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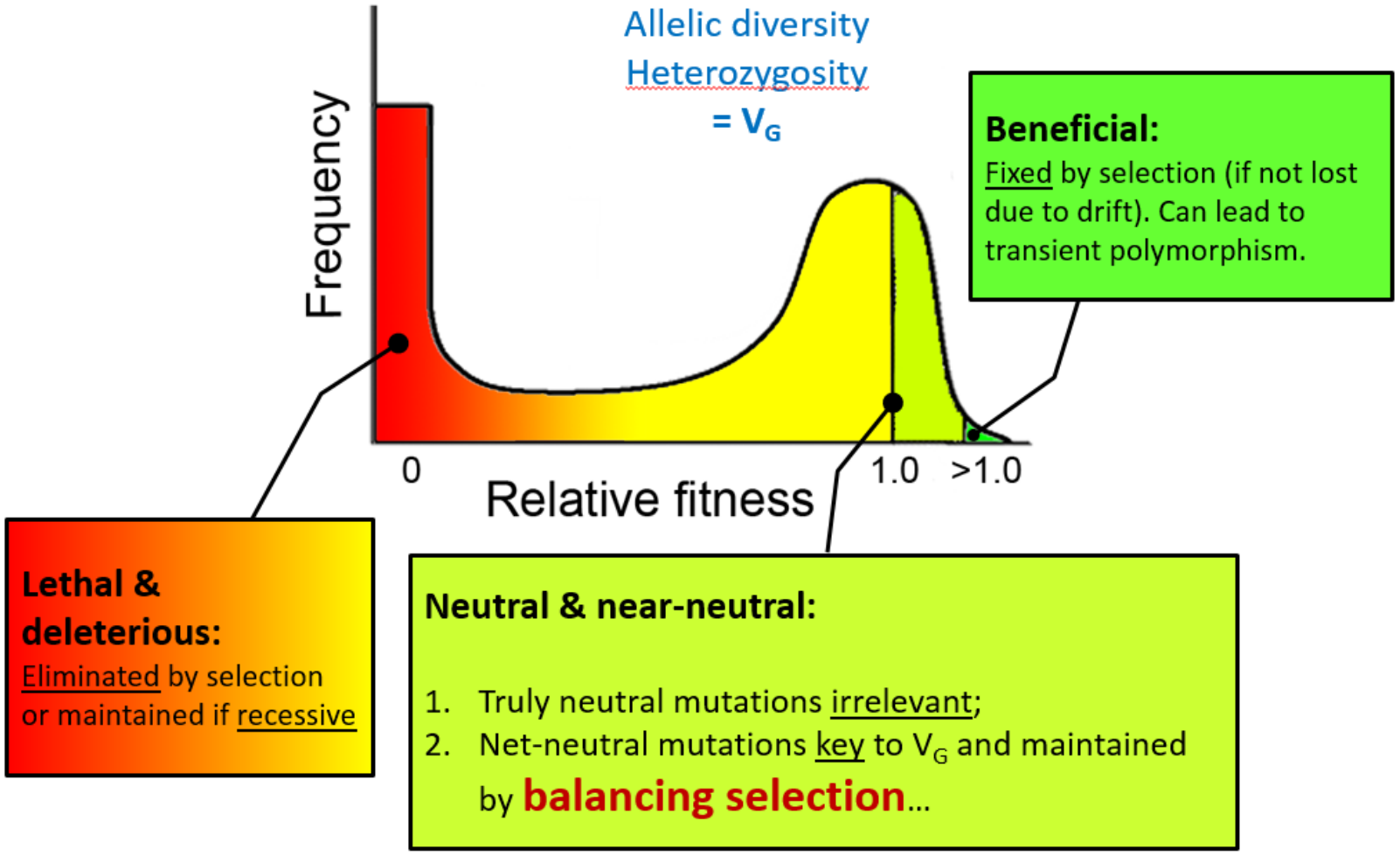
KEY GENERATOR OF V_G



Balancing Selection

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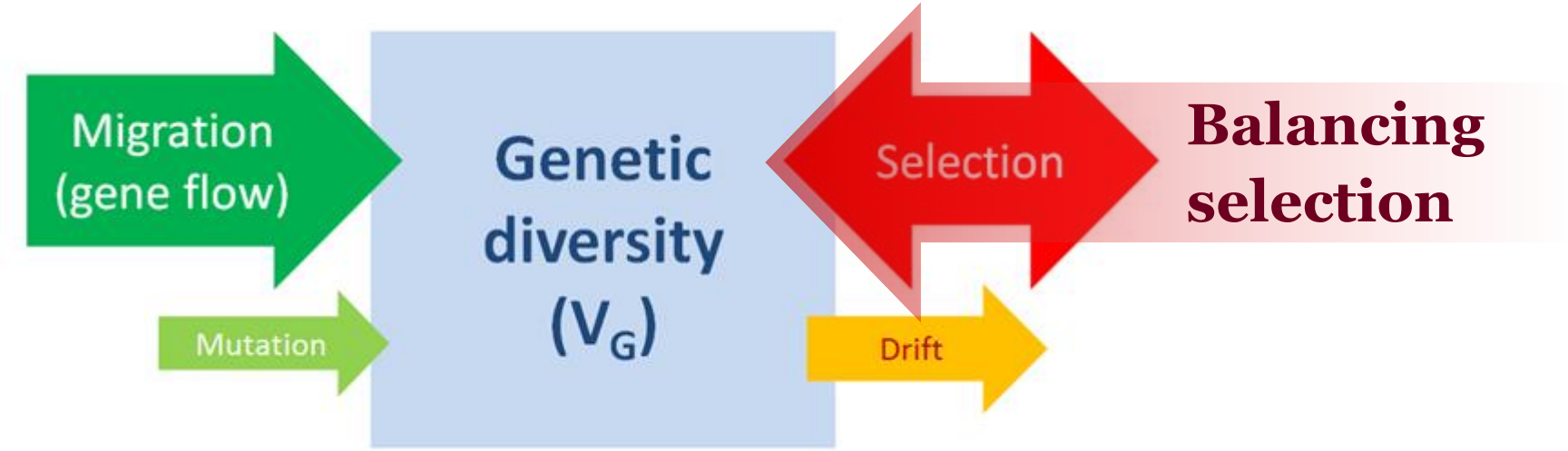
KEY IMPORTANCE TO MAINTAINING V_G



Three mechanisms:

1. Heterozygote advantage (overdominance)
2. Rare allele advantage
3. Gene-environment interaction

Balancing Selection

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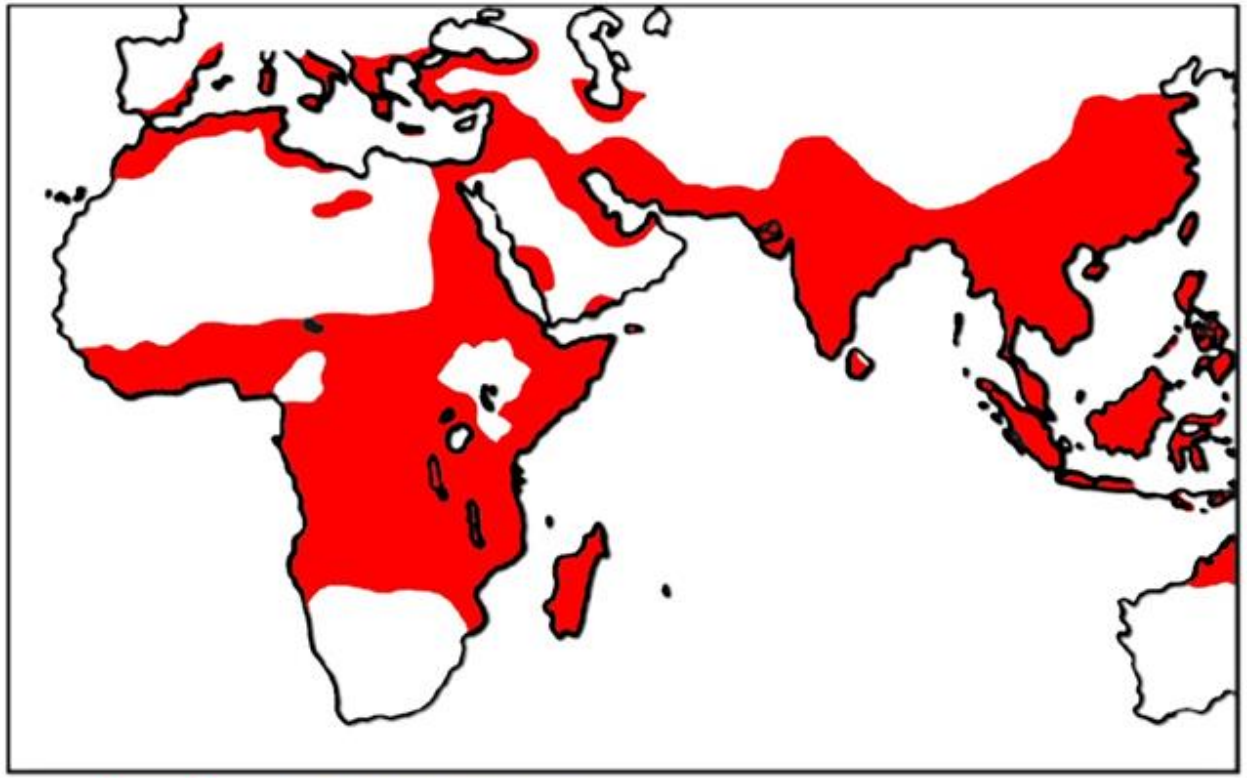
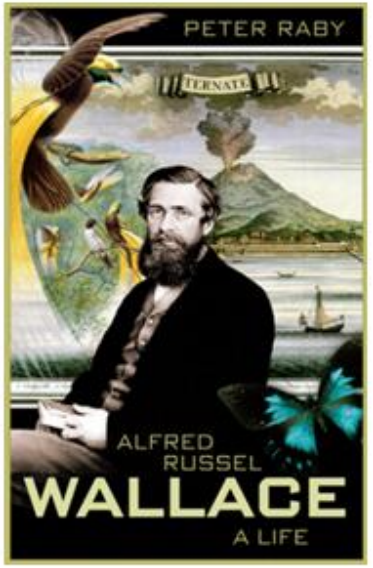
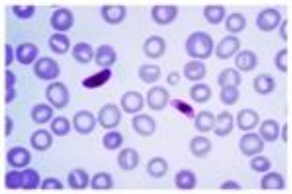
1. HETEROZYGOTE ADVANTAGE – eg MALARIA RESISTANCE





Plasmodium falciparum



Balancing Selection

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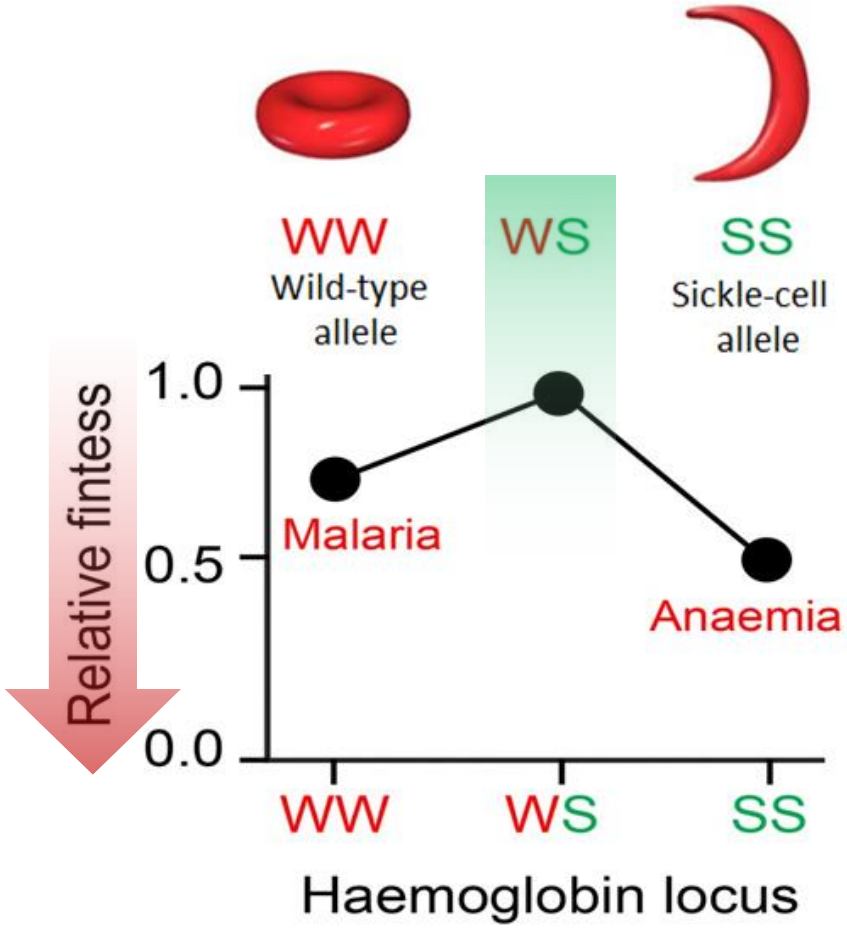
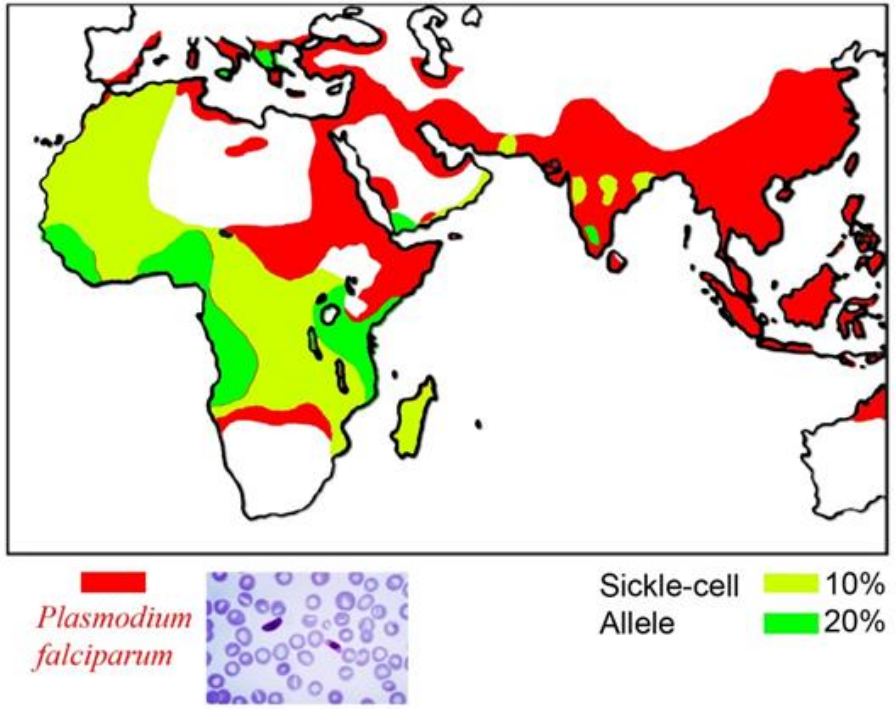
1. HETEROZYGOTE ADVANTAGE – eg MALARIA RESISTANCE





Balancing Selection

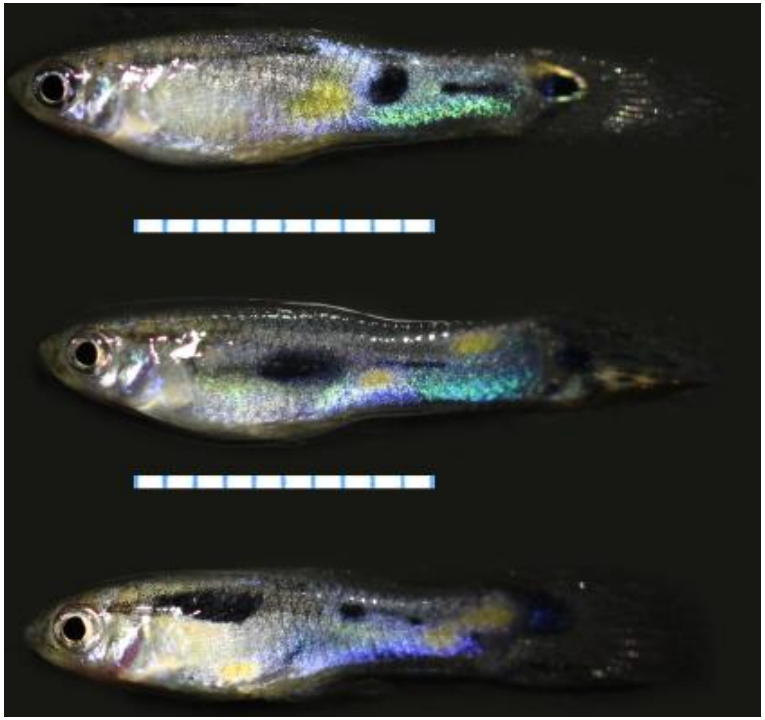
2. RARE ALLELE ADVANTAGE

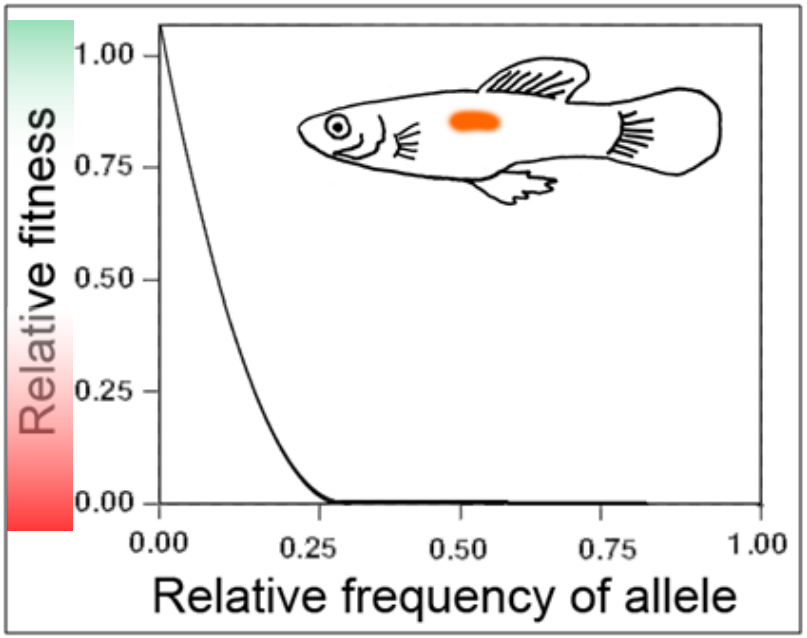
Vol 441|1 June 2006|doi:10.1038/nature04646 nature

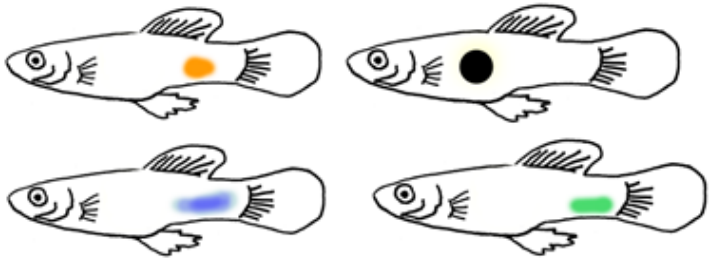
LETTERS

Frequency-dependent survival in natural guppy populations

Robert Olendorf[1], F. Helen Rodd[3], David Punzalan[3], Anne E. Houde[4], Carla Hurt[5], David N. Reznick[6] & Kimberly A. Hughes[1,2]







Balancing Selection

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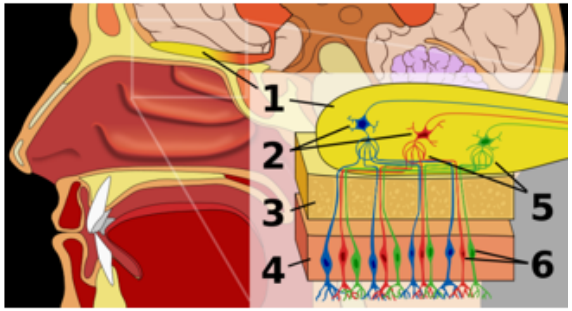
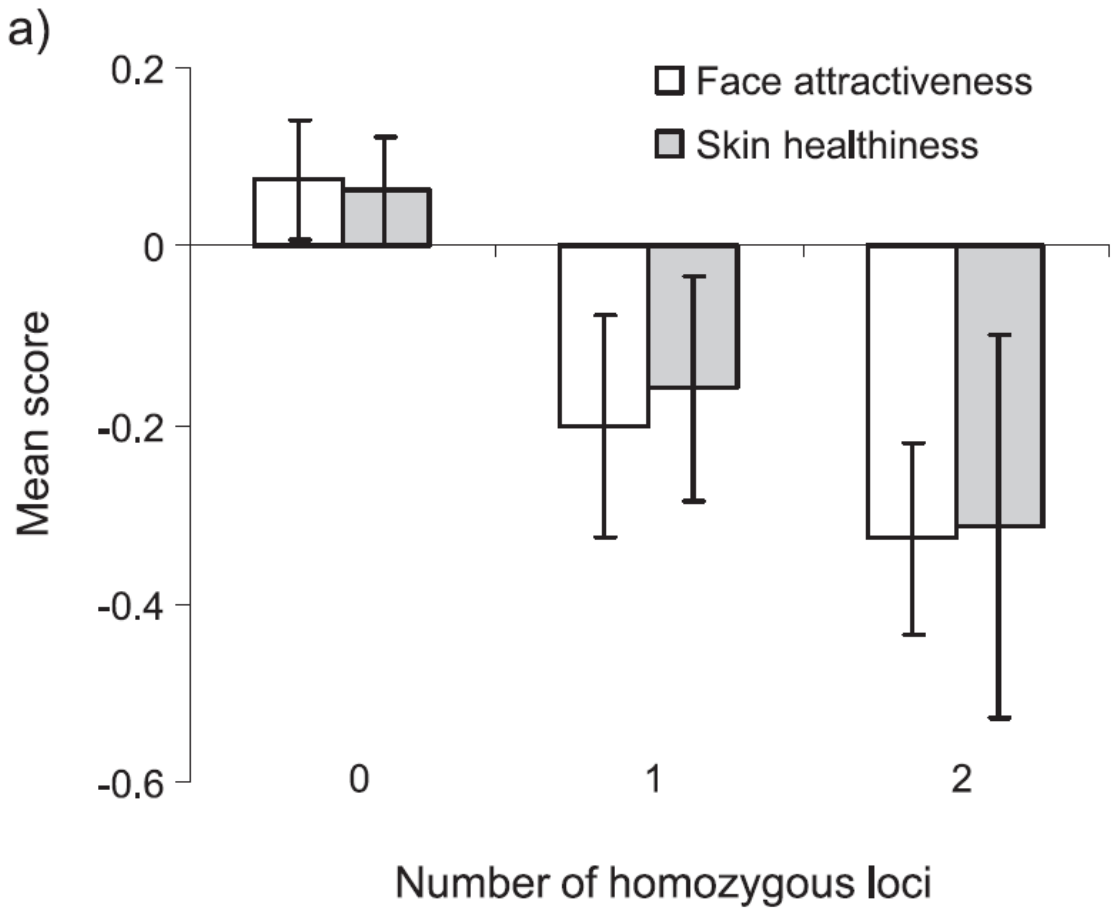
2. RARE ALLELE ADVANTAGE

- Code for proteins for surface antigens in 2 classes:
  - Class I — Recognize intracellular pathogens and 'tag' the cell for immune system components (T-cells, phages etc).
  - Class II
- Highly polymorphic loci with very high allelic diversity
- Sexual selection implicated in maximising population heterozygosity: mate choice for MHC diversity (via olfactory cues in humans)



MHC heterozygosity associated with increased attractiveness in both males and females



Evolution and Human Behavior 26 (2005) 213–226

Balancing Selection

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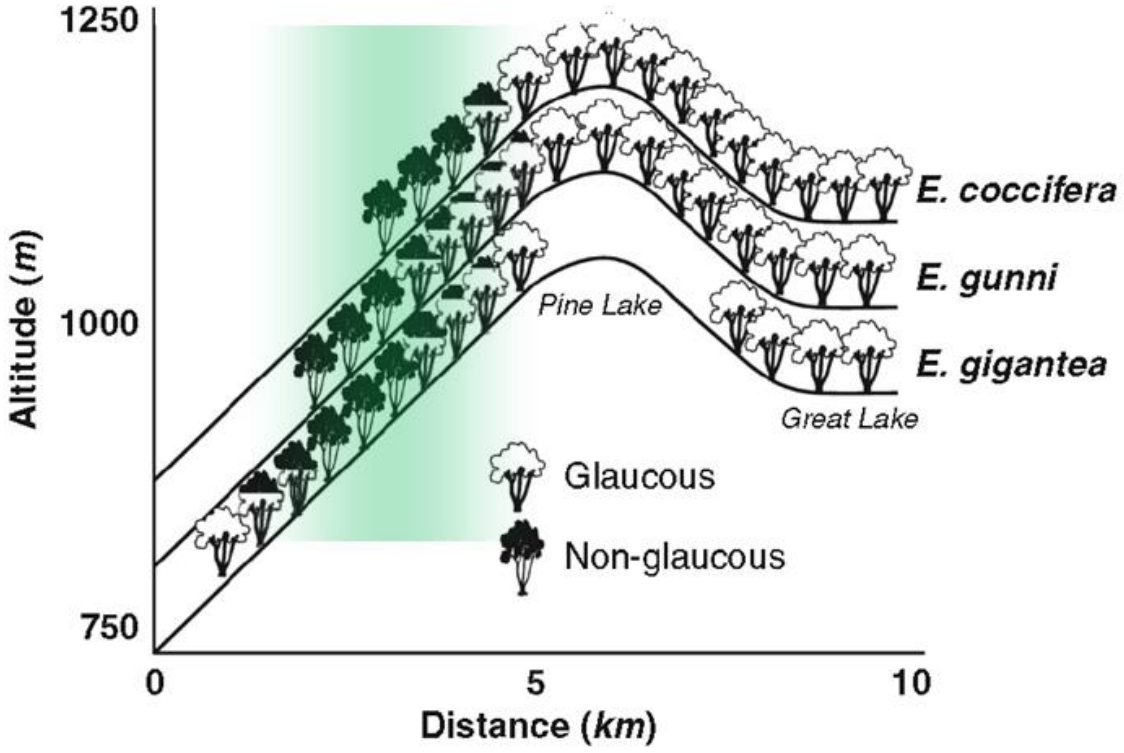
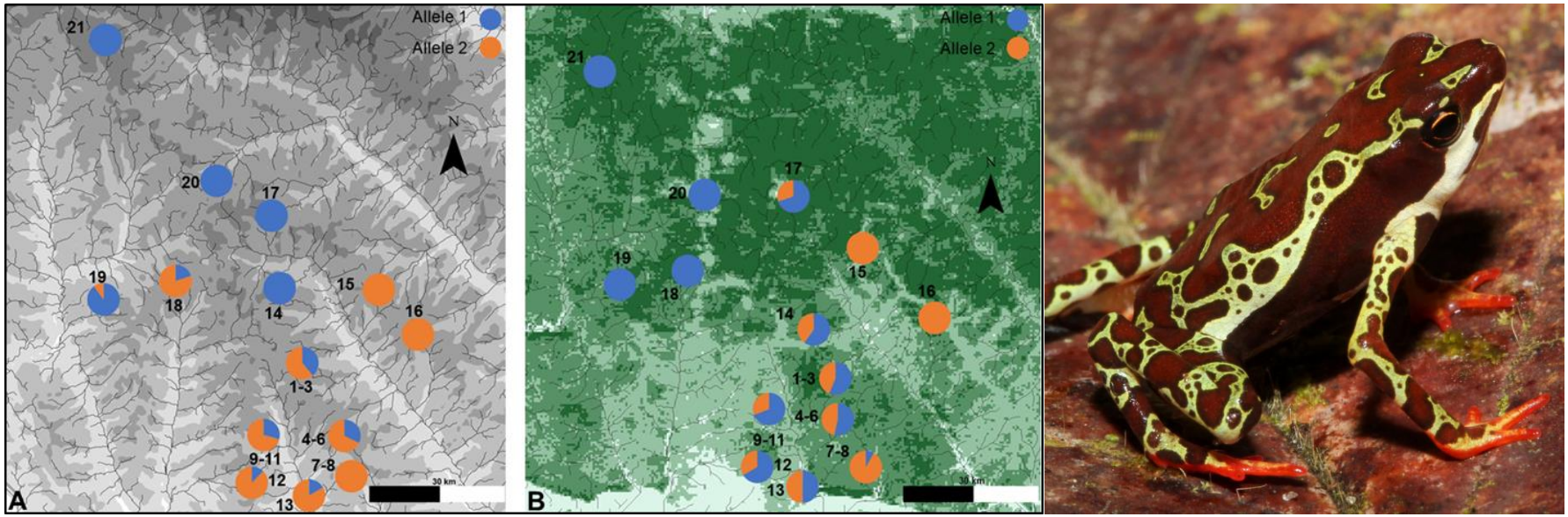
3. GENE ENVIRONMENT INTERACTION

Fitness consequences of variants depend upon the environment



Gene environment interaction



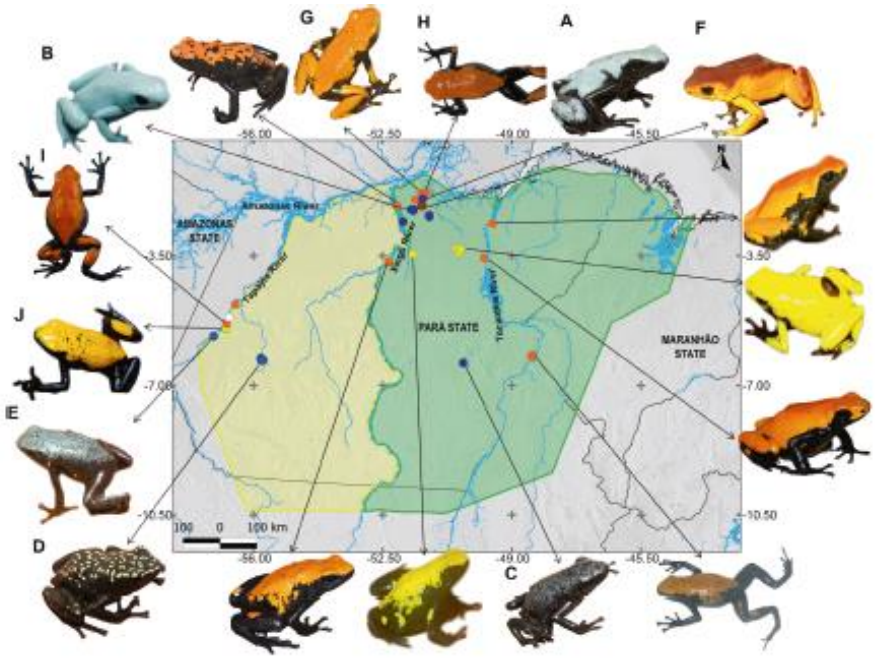
altitude

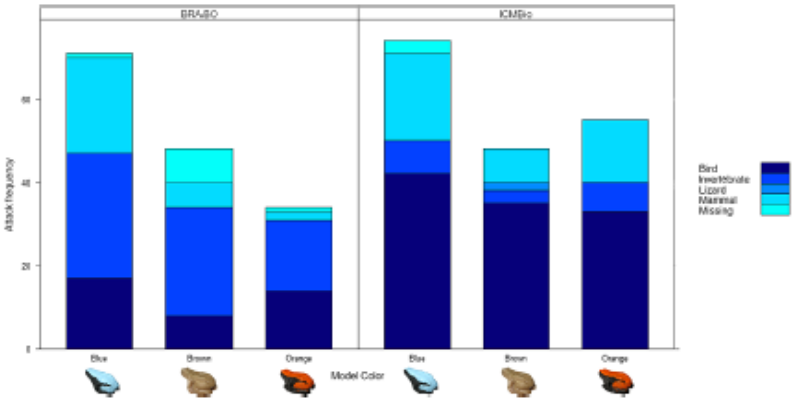
Forest biomass

Harlequin frog

Rafael Jorge et al 2022

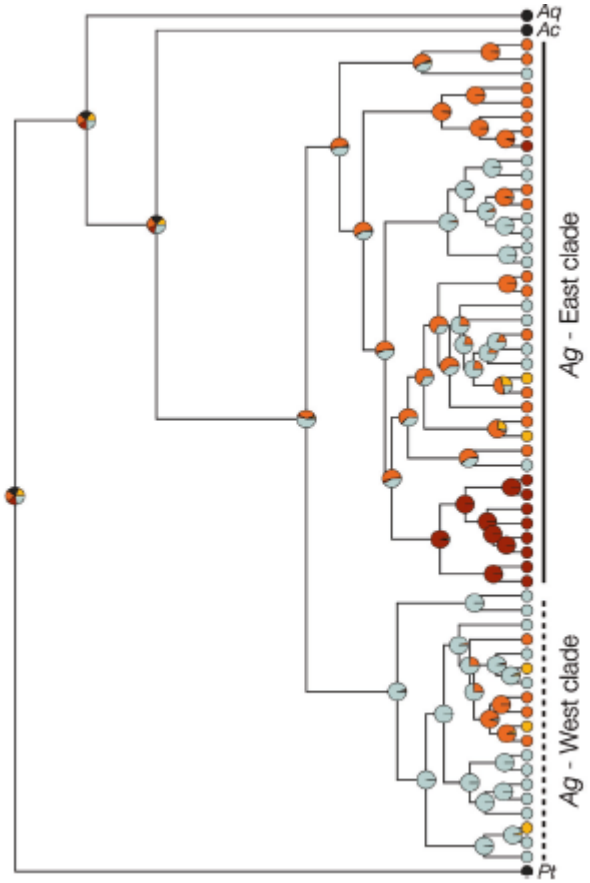
Color Polymorphisms *Adelphobates galactonotus* Rojas et al 2020

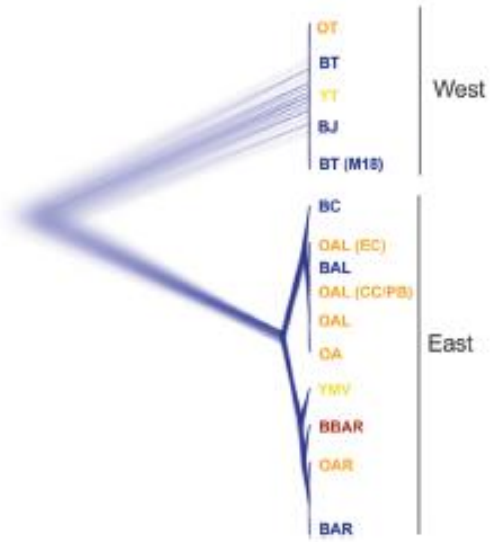




‘Translocation experiments (wax model) – no difference in predation

GENE ENVIRONMENT INTERACTION





Same color type arose independently several times

Hypothesis: lower hybrid fitness selected for mate choice based on same coloration

Next Lecture

Effective population size