Conditional Neutrality

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Genómica e Alterações Ambientais

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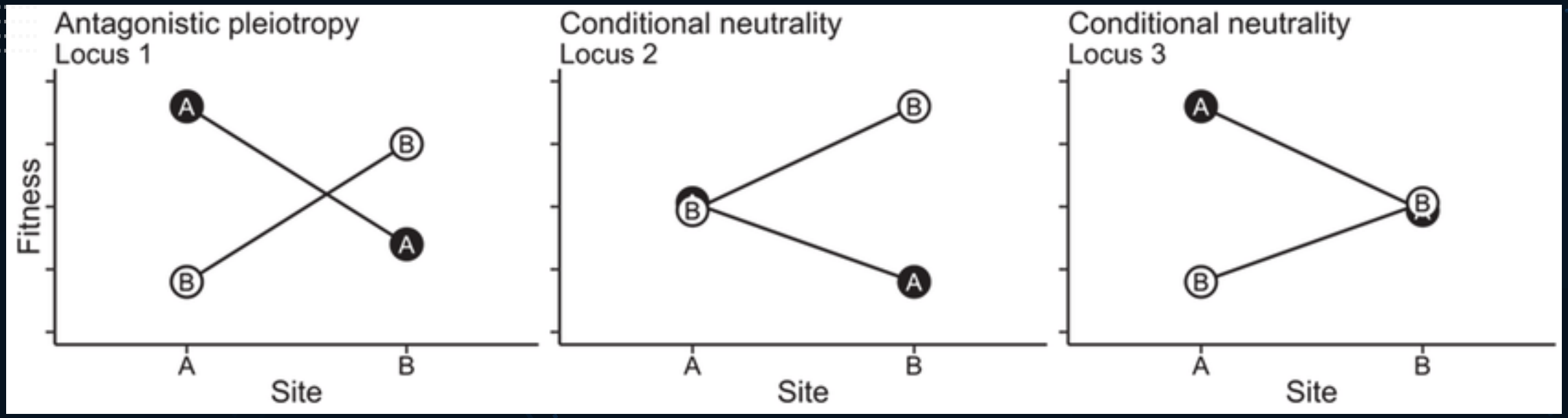


What is Conditional Neutrality?

- Condition “wherein an allele shows a fitness advantage in one environment, but is neutral in the contrasting environment”

How does Conditional Neutrality affect the genome?

- Increased genetic variation
- Local adaptation
- Complex trait evolution

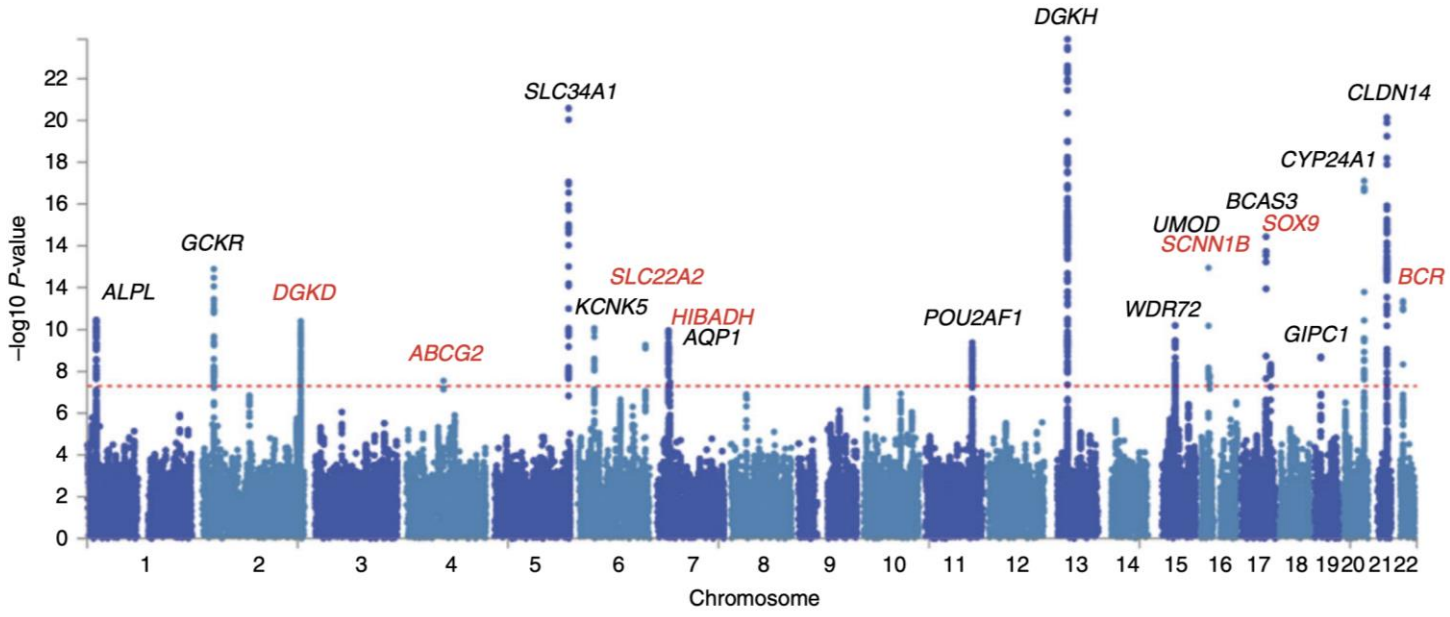
How to measure Conditional Neutrality?

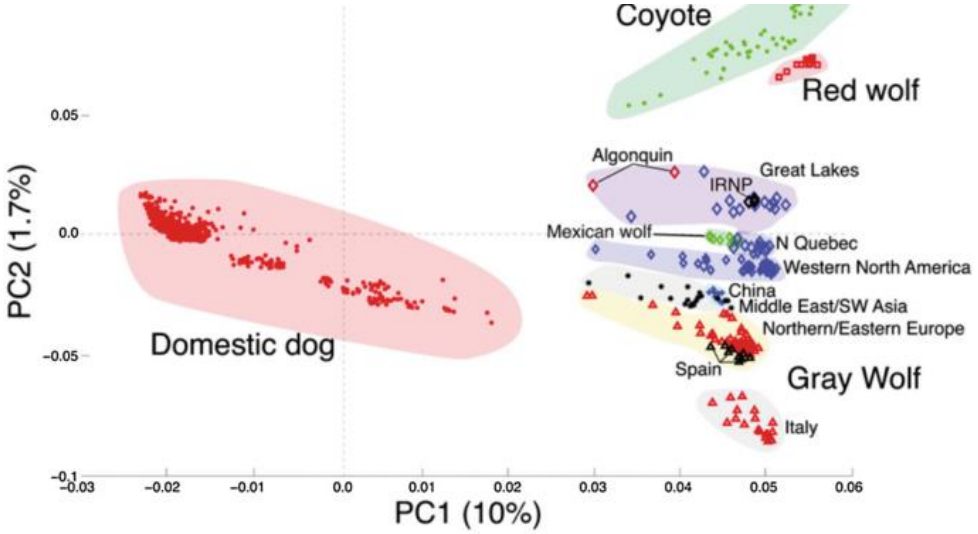
Experimental evolution

Genomic approaches

Experimental Evolution

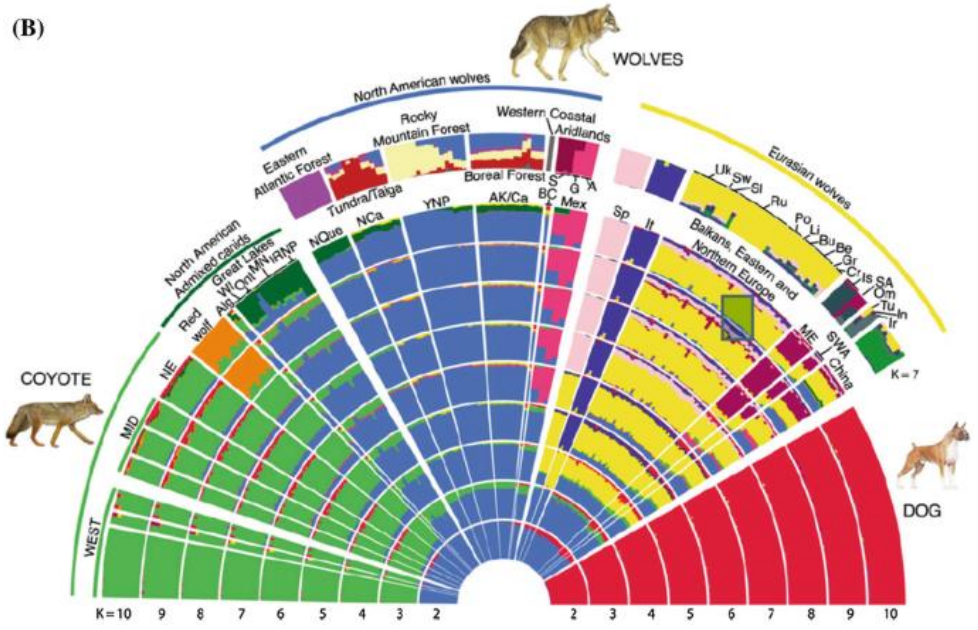
- Observation of evolutionary dynamics
- Controlled environment
- Exploration of allele fitness in different environments





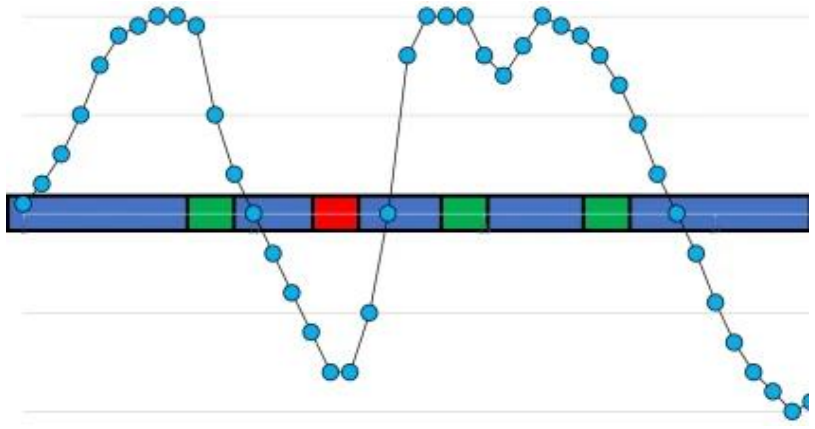
Genomic Approaches

- Genome-wide association studies (GWAS)
- Population genomics

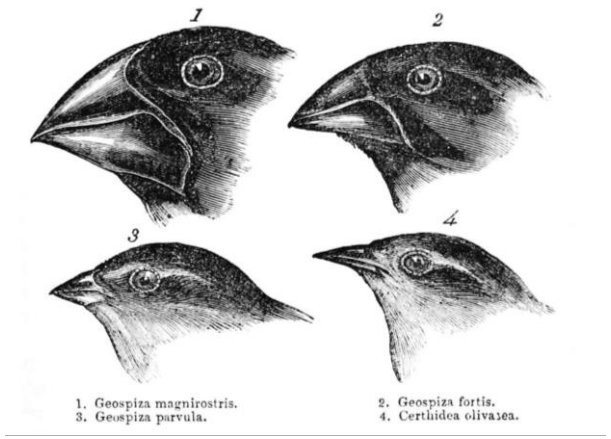


Importance of Conditional Neutrality in Genomics

Understanding the complex dynamics of genetic variation

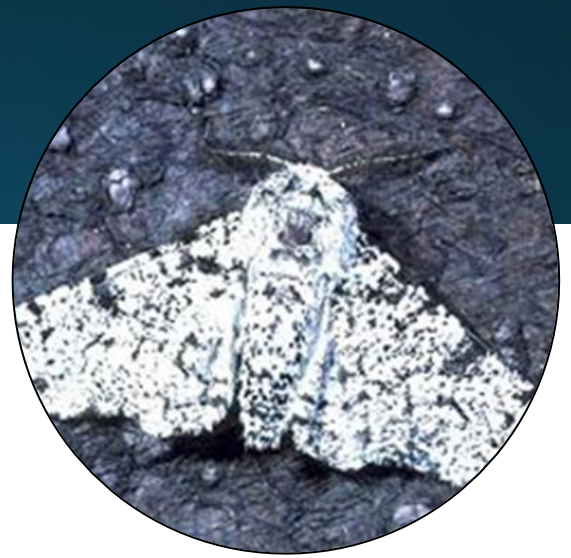


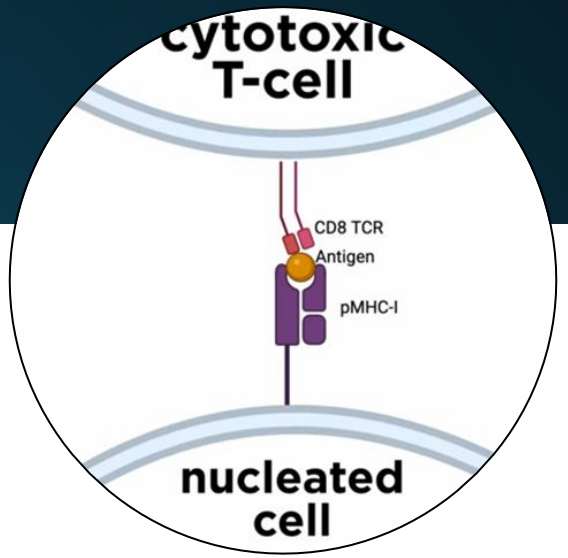
Shows functional significance of genetic variants

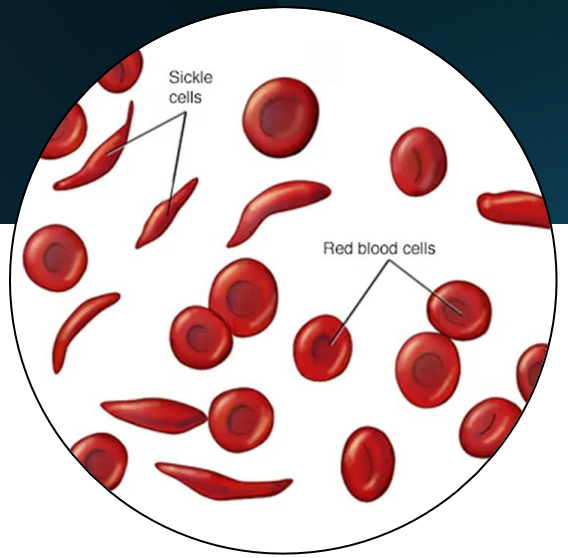


Reveals importance of genetic diversity in conservation efforts

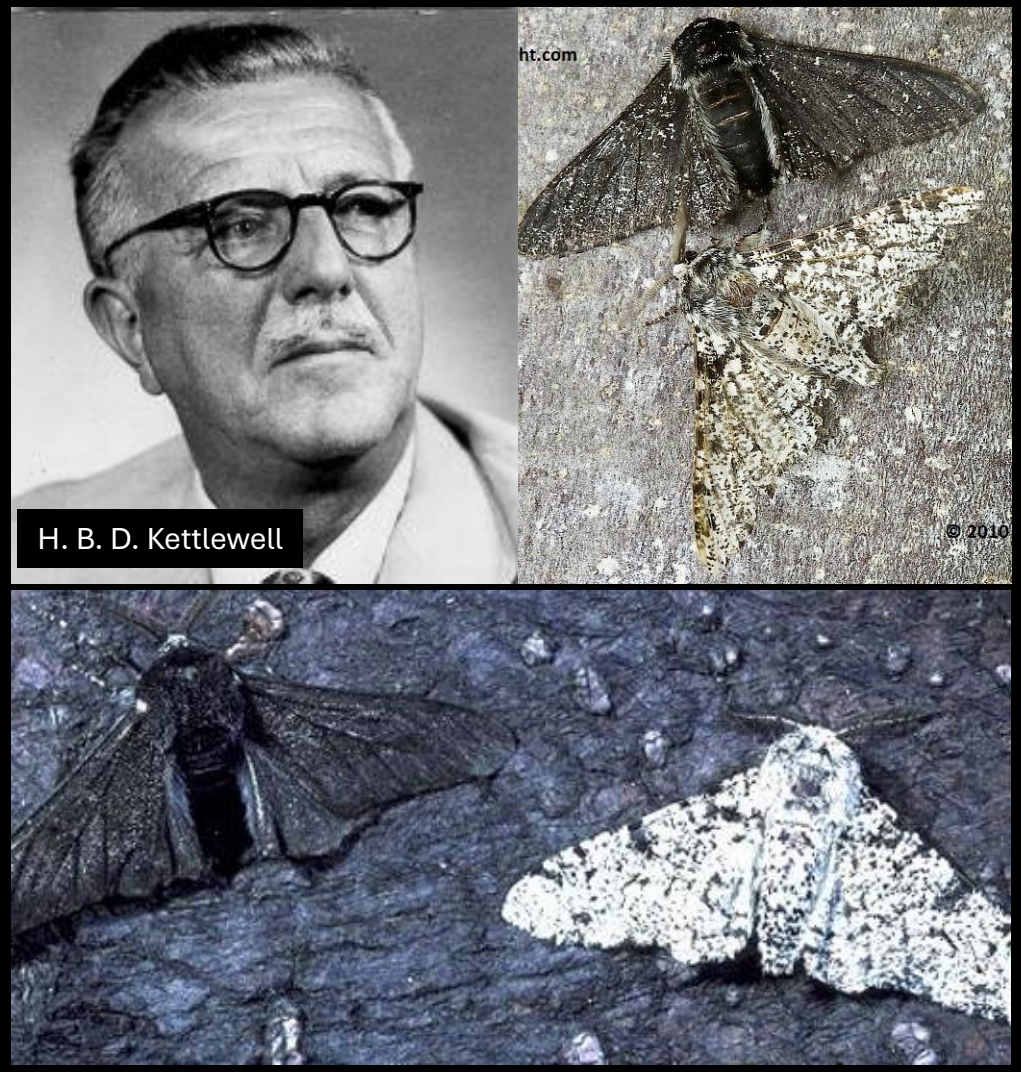
Examples of Conditional Neutrality







- Peppered moth
- Addaptive Immunity genes
- Sickle Cell Anemia

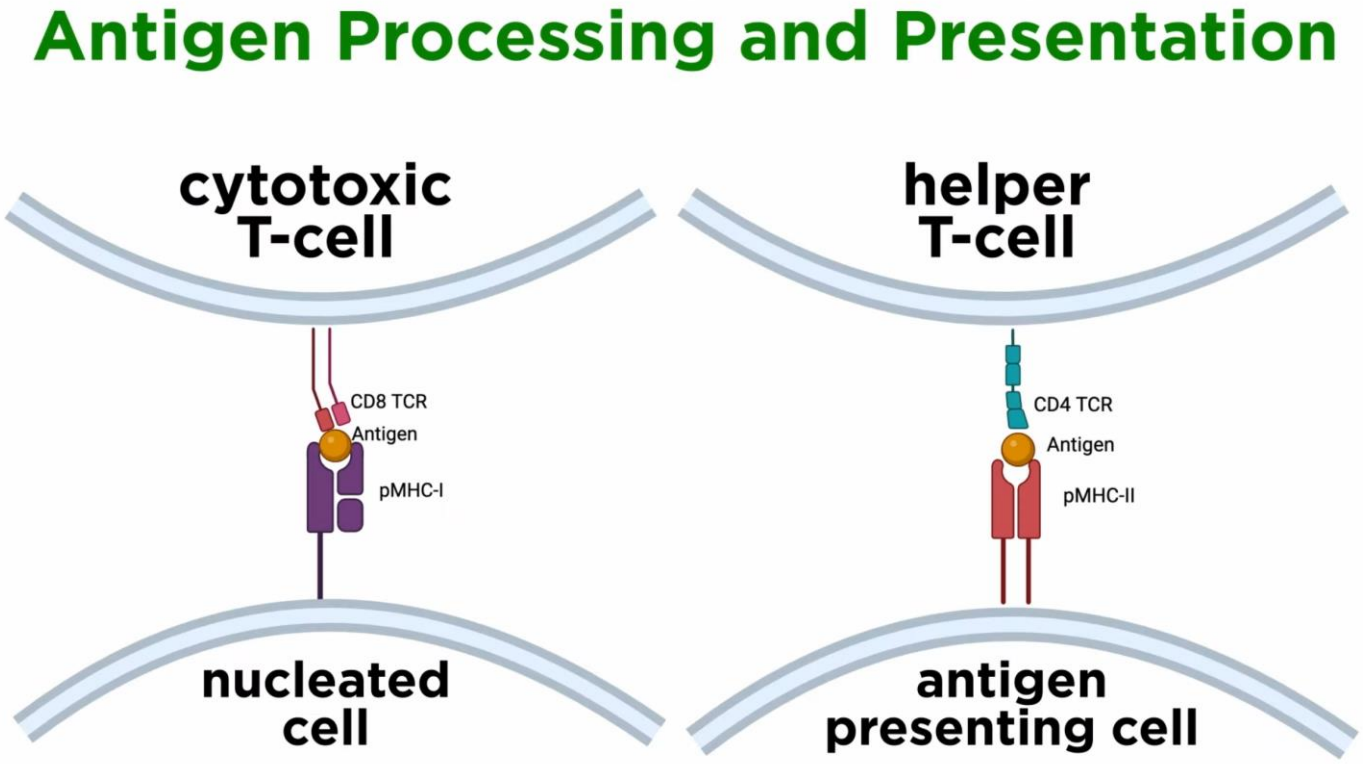


Peppered Moth

- Initial population possessed both white and black variants.
- Under effects of heavy industrialization, the fitness of the neutral black pigmentation became higher due to camouflage.

MHC Genes

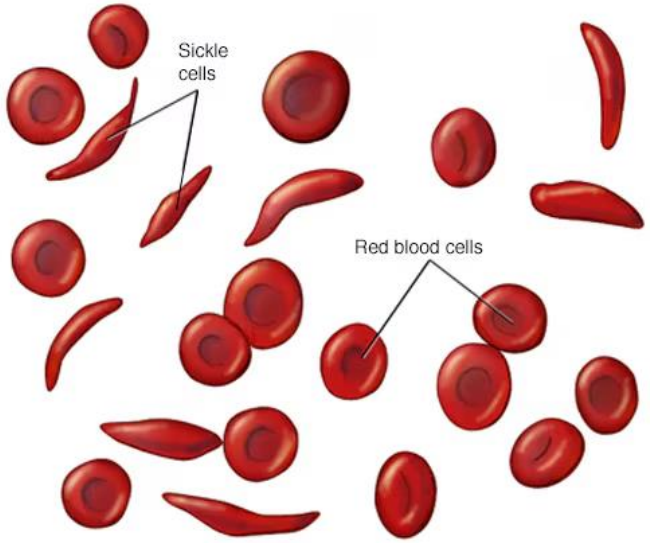
- Codify the Major Histocompatibility Complex.
- Responsible for adherence and presenting of antigens to the adaptative immune system.
- Gene loci are highly polymorphic.
- Many of these variants are neutral.
- Their presence increases fitness for many future unknown diseases.



Sickle Cell Anemia

- Homozygous sickle cell allele carriers suffer the full effect of this severe blood disorder.
- Heterozygous carriers show lessened harmful effects of the disease. Being closer to a neutral is still harmful effect.
- In malaria prone regions, heterozygous carriers have resistance to the parasite, granting them a great advantage.

A. C. Allison

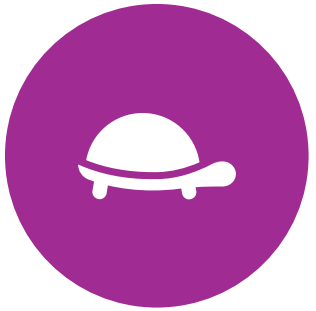


Conclusion

Conditional neutrality explores context dependent fitness of genetic variants.

Impacts genetic diversity, local adaptation and complex trait evolution.

Primarily measured through experimental evolution, GWAS an population genomics.



Important mechanic for understanding of adaptation for species conservation.

Conclusion

Conditional neutrality shows us that **genetic variants** are an integral part of species' **survival** and **adaptation**. Presence of **seemingly neutral variants** may provide traits required to allow the population to **adapt to changing environments**.

Bibliography

- Anderson JT, Lee CR, Rushworth CA, Colautti RI, Mitchell-Olds T. Genetic trade-offs and conditional neutrality contribute to local adaptation. Mol Ecol. 2013 Feb;22(3):699-708. doi: 10.1111/j.1365-294X.2012.05522.x. Epub 2012 Mar 15. PMID: 22420446; PMCID: PMC3492549.
- Kettlewell, H. Further selection experiments on industrial melanism in the Lepidoptera. Heredity 10, 287–301 (1956). https://doi.org/10.1038/hdy.1956.28
- Hughes AL, Yeager M. Natural selection at major histocompatibility complex loci of vertebrates. Annu Rev Genet. 1998;32:415-35. doi: 10.1146/annurev.genet.32.1.415. PMID: 9928486.
- Sickle cell anemia - Symptoms & causes - Mayo Clinic -mayoclinic.org
- ALLISON AC. Protection afforded by sickle-cell trait against subtertian malareal infection. Br Med J. 1954 Feb 6;1(4857):290-4. doi: 10.1136/bmj.1.4857.290. PMID: 13115700; PMCID: PMC2093356.