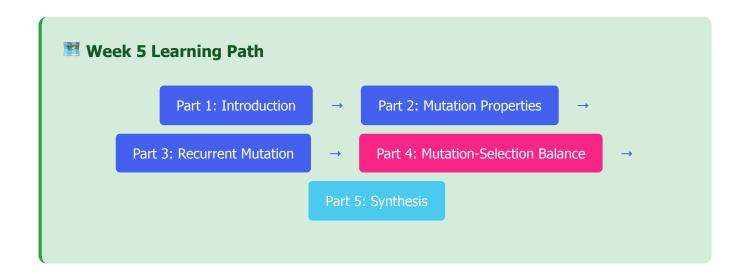
Week 5 at a Glance

Evolutionary Force I: Mutation & Balance





Mutation Basics

Ultimate source of genetic variation

Key Property: Weak but constant force



Recurrent Mutation

One-way mutation model

Formula: $p_t = p_0(1 - \mu)^t$



Mutation-Selection Balance

Opposing forces reach equilibrium

Formula: $\hat{q} = \sqrt{(\mu/s)}$



Real-World Applications

Genetic disorders, conservation, medicine

Concept: Genetic load

Essential Formulas

Recurrent Mutation

$$p1 = p0 (1 - \mu)$$

$$\Delta p = -\mu p_0$$

$$p_{t} = p_{0} (1 - \mu)^{t}$$

Mutation-Selection Balance

Recessive: $q^= \sqrt{(\mu/s)}$

Dominant: q^= \u00fc/s

Additive: $q^= \mu/(hs)$

Mutation Rate (μ)

Selection Coefficient (s)

Genetic Load

Probability of mutation per

generation

Reduction in fitness due to allele

Range: 0 to 1

Reduction in population fitness

Typical: 10⁻⁵ to 10⁻⁸

Formula: $L = 2\mu$ (recessive)

Equilibrium

Balance point of opposing forces

Condition: Input = Output

Concept Recurrent Mutation Mutation-Selection Balance **Forces Involved** Mutation only Mutation + Selection **Equilibrium** p = 0 (all alleles mutate) $\hat{q} = \sqrt{(\mu/s)}$ (stable balance) **Time Scale** Very slow (thousands of generations) Reached relatively quickly **Real-World Relevance** Limited (other forces usually present) High (explains genetic disorder persistence) **Key Formula** $p_t = p_0(1 - \mu)^t \hat{q} = \sqrt{(\mu/s)}$

Quick Problem-Solving Guide

Step 1: Identify the Scenario

- Only mutation? → Use recurrent mutation formulas
- **Mutation + selection?** → Use balance formulas
- Check inheritance pattern: recessive, dominant, or additive

Step 2: Choose the Right Formula

- Recurrent mutation: $p_t = p_0(1 \mu)^t$
- Recessive balance: $\hat{q} = \sqrt{(\mu/s)}$
- Dominant balance: $\hat{q} = \mu/s$

Step 3: Calculate Carefully

- Watch units and exponents
- Use approximations for small μ : $(1 \mu)^t \approx e^{-\mu t}$
- Check if answer makes biological sense

Step 4: Interpret Results

- · Compare with real-world data
- · Consider other evolutionary forces
- Think about practical implications

Common Pitfalls & Tips

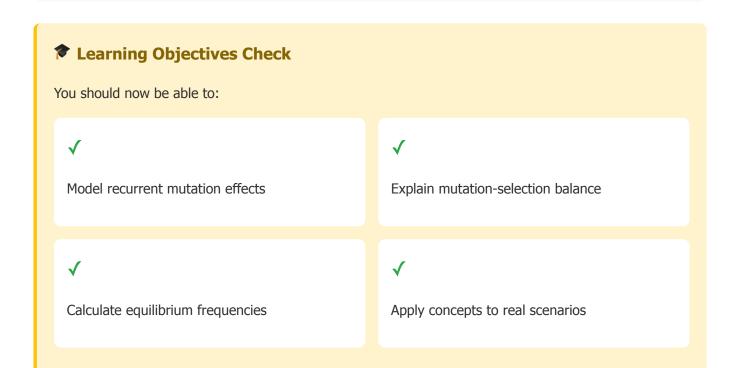
X Common Mistakes

- Using wrong inheritance formula
- Forgetting square root for recessives
- Mixing up μ and s values

▼ Success Strategies

- · Always write down known values first
- Double-check units and exponents
- Use reality checks for answers

• Consider multiple evolutionary forces



Looking Ahead

Next Week: Evolutionary Force II: Genetic Drift

We'll explore how random sampling in finite populations affects allele frequencies, completing our toolkit of evolutionary forces!

BGEN 55 - Advanced Genetics II | Week 5 at a Glance

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