Section 12.3
Other Patterns of Inheritance
I Can...

• **LS 3.3** I can compare different modes of inheritance (sex-linkage, codominance, incomplete dominance, multiple alleles, and polygenic traits).
Key Questions

1. What are some exceptions to Mendel’s principles?
2. How does the environment play a role in how genes determine traits?
Vocabulary

• Incomplete dominance
• Codominance
• Multiple alleles
• Polygenic trait
Beyond Dominant and Recessive Alleles

• Most genes do not behave as neatly as the pattern of simple dominance shown by Mendel’s peas

• Simple dominance review:
  • BB – purple
  • Bb – purple
  • bb – white
Incomplete Dominance

• “blended”
• One allele is not completely dominant over another allele
  
  • AA – red
  • Aa – pink
  • aa – white
Codominance

• “speckled”
• Both alleles are expressed in the phenotype
Multiple Alleles

• In nature, genes with just two alleles are the exception rather than the rule

• A gene with more than two alleles is said to have multiple alleles

\[ C \] = full color; dominant to all other alleles
\[ c^{th} \] = chinchilla; partial defect in pigmentation; dominant to \( c^{h} \) and \( c \) alleles
\[ c^{h} \] = Himalayan; color in certain parts of the body; dominant to \( c \) allele
\[ c \] = albino; no color; recessive to all other alleles
Multiple Alleles – Human Blood Type

- Three alleles: $I^A$, $I^B$, and $i$
Polygenic Traits

• “many genes”
• Traits controlled by two or more genes are said to be **polygenic traits**
• Traits typically show a wide range of phenotypes

<table>
<thead>
<tr>
<th>POLYGENIC</th>
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<tbody>
<tr>
<td>Skin pigment in humans</td>
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<tr>
<td>Eye color</td>
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<tr>
<td>Weight</td>
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<tr>
<td>Hair color</td>
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<tr>
<td>Height (humans and plants)</td>
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<td>Reddish-brown eye color in fruit flies</td>
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Non-Mendelian Inheritance Example

• Leaf color in the morning glory (*Mirabilis jalapa*)
  • Determined solely by the color of petal tissue in the maternal parent (maternal inheritance)
  • What causes this?
  • Chloroplasts contain genes of their own on small DNA molecules
  • Chloroplasts in the morning glory plant are inherited from the egg cell, and these determine the leaf colors of the offspring
Non-Mendelian Inheritance Example

• Mice body size
  • Genetic imprinting (chemical modification of certain genes)
  • A gene regulating body size is imprinted in a way that silences it in the next generation whenever it is carried by a female
  • Mice inheriting the genes from their mothers may suffer from dwarfism
  • Mice inheriting the genes from their fathers do not
Genes and the Environment

• Environmental conditions can affect gene expression and influence genetically determined traits

• Example – western white butterfly
  • In order to fly effectively, body temp must be between 28-40°C
  • Hatching in the spring
    • darker wing color
  • Hatching in the summer
    • less pigmentation
Section 12.3 Exit Ticket

1. What are the differences between the various patterns of inheritance—including simple dominance, incomplete dominance, codominance, sex-linked traits, and multiple alleles?
The End 😊