Chromosomal Basis of Inheritance

- Chromosome Theory
- Sex-linkage
- Linkage of genes

Sex-Linkage

- Genes on Sex Chromosomes
- Sex-linkage/ determination in Drosophila
- Chromosome theory of Inheritance
- Sex-linkage/ determination in Humans
- Sex limited and Sex influenced traits
Genes on Sex Chromosomes

- Homologous chromosomes
- Pair in meiosis
- Heterogametic/homogametic sex
- Hemizygous
- Chromosome theory of inheritance
- Nomenclature
- + = wild type

Sex-linkage/ determination in Drosophila

- Sex determination in Fruit Flies
- White eye gene
- Inheritance patterns of sex-linked genes
- Hemizygosity
Sex-linkage

- Carried on x chromosome
- Males hemizygous
- Show mendelian ratio of 3:1
- Males show recessive trait
- Females are normal diploid, rarer in females

Chromosome Theory

- Genes carried on chromosomes
- Work with fruit fly—Drosophila
- Thomas Hunt Morgan
- Wild type
Sex determination

- Location of testicular determining factor (TDF)
- XX males/XY females, unequal crossovers
- Transgenic mice: sex change

Sex-linkage/ determination in Humans
Sex determination

- TDF gene
- Protein product
- Transcription factor
- Testes development
- Testosterone
- DHT
- Testicular feminization
- X-linked

X-Inactivation
Sex-linked traits

<table>
<thead>
<tr>
<th>Condition</th>
<th>Characteristics</th>
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<tbody>
<tr>
<td>Color blindness, dream type</td>
<td>Insestivity to green light.</td>
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<tr>
<td>Color blindness, pocus type</td>
<td>Insestivity to red light.</td>
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<tr>
<td>Fabry's disease</td>
<td>Deficiency of galactosidase A; heart and kidney defects, early death.</td>
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<tr>
<td>G-6-PD deficiency</td>
<td>Deficiency of glucose-6-phosphate dehydrogenase, severe acute reaction following</td>
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<td>of primapin in drugs and certain foods, including fava beans.</td>
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<tr>
<td>Hemophilia A</td>
<td>Classical form of clotting deficiency; lack of clotting factor VIII.</td>
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<tr>
<td>Hemophilia B</td>
<td>Classical disease; deficiency of clotting factor IX.</td>
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<tr>
<td>Hunter syndrome</td>
<td>Macroglobulinemia storage disease resulting from iduronate sulfatase enzyme defi</td>
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<td>cit, short stature, claw-like fingers, coarse facial features, slow mental defi</td>
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<td>tration, and deafness.</td>
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<tr>
<td>Ehlers-Danlos</td>
<td>Deficiency of steroid sulfatase enzyme, notably on extremities.</td>
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<tr>
<td>Lath-Nyhan syndrome (HGPRT)</td>
<td>Deficiency of hypoxanthine-guanine phosphoribosyl transferase enzyme leading to</td>
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<td>mental retardation, self-mutilation, and early death.</td>
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<tr>
<td>Muscular dystrophy (Duchenne type)</td>
<td>Progressive, life-shortening disorder characterized by muscle degeneration and</td>
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<td>weak; sometimes associated with mental retardation; deficiency of the protein</td>
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<td>dystrophin.</td>
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Pedigree analysis

[Diagram showing a pedigree analysis of recessive X-linked inheritance.]

- An affected son can have parents who have the normal phenotype.
- In order for a female to have the characteristic, her father must also have it. Her mother must have it or be a carrier.
- The characteristic often skips a generation from the grandfather to the grandson.
- If a woman has the characteristic, all of her sons will have it.

[Key: X° is normal male; X° is carrier female; X° X° is color blind female; X° Y is normal male; X° Y is color blind male]
Sex-linked recessive traits

- Primarily in males
- Grandfather to grandson
- Rare in females

Sex limited

- Autosomal trait
- Expressed only in one sex
- Cock feathering
- Milk production
Sex influenced traits

• Autosomal trait
• Hormonal balance
• Dominant in one sex, recessive in the other
• Pattern baldness

Linkage of genes
Linkage & mapping