Extensions to Mendel

Today's question: Mendel was not aware of linkage. What other patterns of inheritance occur that he didn't describe?

I. **Genetic recombination**
II. **Linkage mapping**
III. **Co-dominance**
IV. **Gene x gene and gene x environment interactions**
V. **Pleiotropy, multiple allelism, etc.**

(cell phones off, please)

III. Linkage

A. Morgan's lab found a series of genes on the X chromosome (inheritance patterns like *white*)

B. Notation for linked genes

X-linked linked genes: X^{wY} (*y* = yellow body)

Autosomes: *AC*/*ac* or *AC*//*ac*; gametes as <u>AC</u>

I. The discovery of genetic recombination

Morgan's first cross with linked genes
X^{Y} = normal body color; X^{y} = yellow body color

Parental genotypes: $X^{wY}\ X^{wY}$ x $X^{Wy}\ Y$

F_1 females: **F_1 males:**

Let F_1s mate. What are the genotypes and phenotypes of F_2 MALE offspring?

What are the genotypes of the weird males?

Crossing over as a physical mechanism for genetic recombination.

II. Linkage mapping

Sturtevant's insight: The percentage of recombinants is proportional to the physical distance between genes.

Yellow is at 0

Yellow and white eye: 1.4% recombinants

Yellow and sable body: 43% recombinants

Sable and white eye 41.6%

Crossveinless wings and sable: 29.3% recombinants

Crossveinless wings and white: 12.3% recombinants

II. Co-dominance

All of the alleles that Mendel analyzed were completely dominant or completely recessive with respect to each other.

ABO blood types in humans

I^A allele: Glycoprotein A on red blood cells

I^B allele: Glycoprotein B on red blood cells

***i* allele: no gene product on red blood cells**

I^AI^A and I^Ai	A blood type
I^BI^B and I^Bi	B blood type
I^AI^B	AB blood type
ii	O blood type

III. Gene x gene and gene x environment interactions

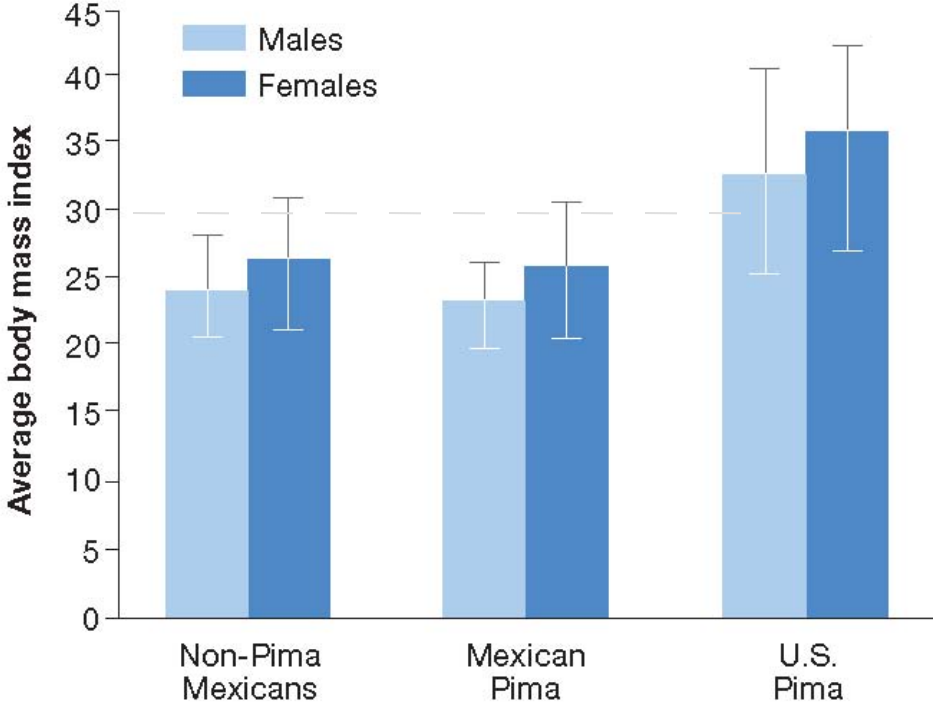
Implications for inheritance: When studying the effects of a gene, you need to control for "genetic background" (other genes present) and the physical environment.

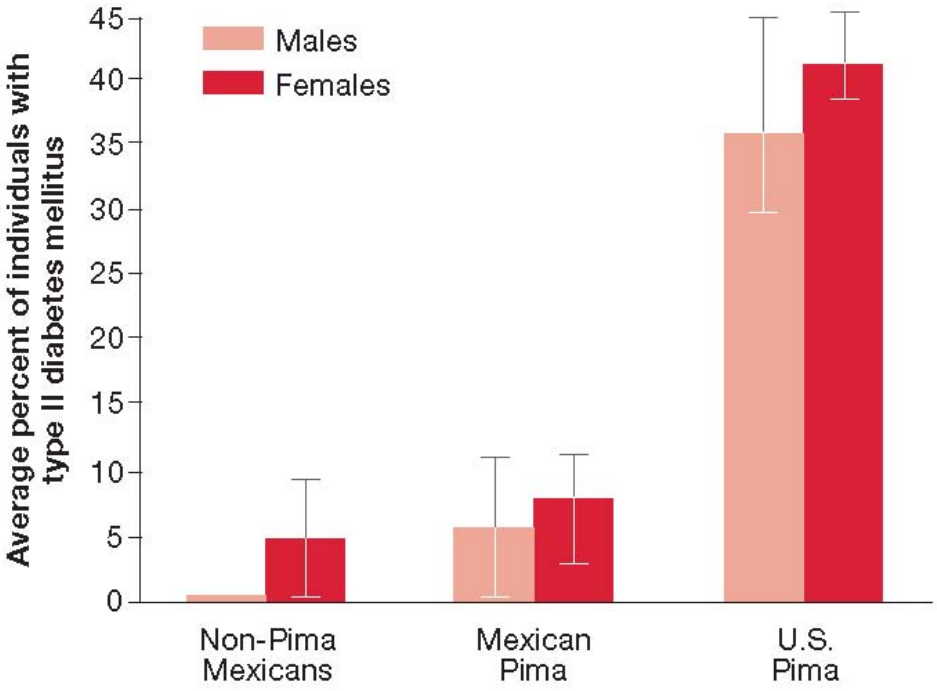
Case 1: Inuit residents of Barrow, Alaska, where people over 35 had not attended American-style schools.

Age	% diagnosed myopic (sample size)
6-35	42 (348)
36-88	5 (160)

State whether these data are evidence of a gene x gene or a gene x environment interaction. Explain your logic.

Case 2: Genetically, Pima people from Mexico and the sw USA are indistinguishable.





Assume that if the black lines on different bars do not overlap, it indicates statistically significant differences.

1. Explain what the data in the left graph mean.

2. Explain what the data in the right graph mean.

3. Some researchers suggest that there is a connection between the two graphs. State this as a hypothesis.

4. State whether these data indicate a gene x gene or a gene x environment interaction, or both. Explain.