

What is Polygenic Inheritance?

Worksheet

Polygenic inheritance is the control of one trait by two or more genes, whose combined additive effects create a continuous range of phenotypes that follows a bell-shaped distribution.

Questions

1. Polygenic inheritance produces which kind of phenotype distribution?
 - A) Discrete, either/or
 - B) Continuous, bell-shaped
 - C) Always 3:1
 - D) Always 9:3:3:1
2. Which of these is a classic example of a polygenic trait in humans?
 - A) ABO blood type
 - B) Height
 - C) Cystic fibrosis
 - D) Huntington's disease
3. For a trait controlled by 3 gene pairs (AaBbCc AaBbCc), how many phenotype classes are possible?
 - A) 3
 - B) 4
 - C) 7
 - D) 9
4. What makes polygenic inheritance different from a simple dominant/recessive trait?
 - A) It involves only one gene
 - B) Multiple genes each add a small effect to the phenotype
 - C) It never shows environmental influence
 - D) It always gives a 1:1 ratio
5. Human skin color is controlled by roughly 3-6 genes with additive effects. If a trait were controlled by just 3 genes (6 alleles total), how many phenotype classes (levels of darkness) would be possible?
6. Two people, each heterozygous at three independently assorting genes for a polygenic trait (AaBbCc AaBbCc), have a child. What fraction of offspring is expected to have the extreme phenotype (all 6 dominant alleles, AABBCC)?
7. A population's height data forms a bell-shaped (normal) distribution rather than distinct short/tall categories. What does this indicate about the trait?
8. Define: What is polygenic inheritance?
9. Define: What kind of distribution does a polygenic trait follow?
10. Define: Name two examples of polygenic traits in humans.

Answer Key

1. B) Continuous, bell-shaped - Many small additive contributions create a smooth, continuous range of phenotypes.
2. B) Height - Height is controlled by many genes with small additive effects, plus environment.
3. C) $7 - 2n + 1 = 2(3) + 1 = 7$ classes.
4. B) Multiple genes each add a small effect to the phenotype - Polygenic traits are the additive sum of several genes' small effects, not one gene's on/off switch.
5. With n gene pairs ($2n$ alleles), the number of phenotype classes = $2n + 1$ Here $n = 3$, so classes = $2(3) + 1 = 7$ So 7 distinct shades are possible, from lightest to darkest
6. Each gene pair independently gives $1/4$ chance of the homozygous dominant genotype (AA, BB, or CC) Combined probability = $1/4 \cdot 1/4 \cdot 1/4 = 1/64$ So about $1/64$ of offspring show the extreme phenotype
7. A continuous, bell-shaped distribution suggests many genes contribute additively Each gene adds a small amount to the trait, plus environmental influence This is the signature of polygenic inheritance, not single-gene inheritance
8. When multiple genes at different loci each contribute additively to a single trait.
9. A continuous, bell-shaped (normal) distribution rather than discrete categories.
10. Height and skin color are classic examples (also eye color, to a degree).

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