

KEYSTONE REVIEW SESSION #6

Genetics

GENETICS

- **Keystone Standards:**
- **BIO.B.2.1.1** Describe and/or predict observed patterns of inheritance (i.e., dominant, recessive, co-dominance, incomplete dominance, sex-linked, polygenic, and multiple alleles).
- **BIO.B.2.1.2** Describe processes that can alter composition or number of chromosomes (i.e., crossing-over, nondisjunction, duplication, translocation, deletion, insertion, and inversion).
- **BIO.B.2.3.1** Describe how genetic mutations alter the DNA sequence and may or may not affect phenotype (e.g., silent, nonsense, frame-shift).
- **BIO.B.2.4.1** Explain how genetic engineering has impacted the fields of medicine, forensics, and agriculture (e.g., selective breeding, gene splicing, cloning, genetically modified organisms, gene therapy).
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WHAT ARE THE “GENERATIONS”?

- P=Parental / purebred
- F₁ =filial (son) - produced from P x P “pures” with opposing traits; F₁ plants – showed dominant trait only
- F₂ plants- from F₁ cross showed a 3:1 ratio of dominant to recessive traits



REPRESENTING ALLELES

- allele is a form of a trait (the letter)
- Same “case” letter= homozygous / pure; genes are the same AA or aa
- One upper & one lower “case”= heterozygous /hybrid genes are different Aa
- Genotype - the set of alleles / letters (Eg: TT, Tt, or tt) represented by letters. Genome =entire set of genetic information
- Phenotype -physical appearance (Tall or dwarf) blue eyes, male, female, five fingers on a hand.



MENDEL'S HYPOTHESES

- ★ For each trait, you get 2 “factors” or alleles; one from each parent. An allele is a different form of a gene
- ★ If 2 different alleles occur, one may be dominant over the other- **Principle of dominance** (gametes carry one allele for each trait)
- Principle (Law) of Segregation - alleles separate when gametes are formed.
- Principle (Law) of Independent Assortment- alleles for different traits will separate without influencing each other when gametes are formed



PUNNETT SQUARES

Know that outside the box are the parents

Inside the box are PREDICTED offspring. Each box in an monohybrid cross counts for 25%. Probability is the likelihood that a certain event will occur.

| | | |
|---|----|----|
| | B | b |
| B | Bb | Bb |
| b | bB | bb |

| | | |
|---|----|----|
| | B | b |
| B | BB | Bb |
| b | bB | bb |



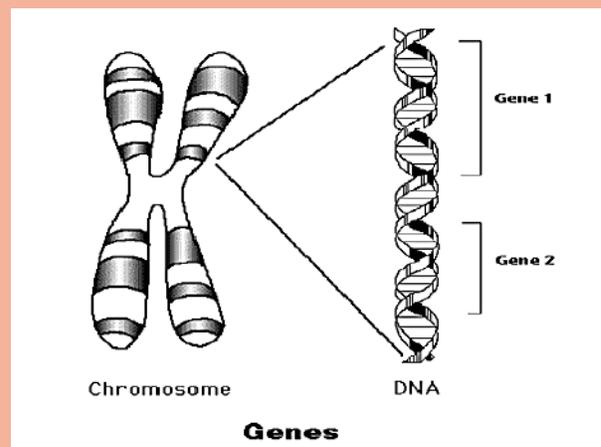
PATTERNS OF INHERITANCE

- Complete Dominance- the dominance trait is shown in the offspring
- Incomplete dominance- two traits can “blend”; one is “not completely dominant”. Black and white make gray
- Co-dominance- both traits show- black plus white make black with white spots/ or black and white feathers both come out.
- Multiple Alleles -genes with 3+ alleles such as blood typing
- Sex chromosomes vs sex linked
- Polygenic [trait](#) influenced by many genes such as height, corn cob length, bill length in birds



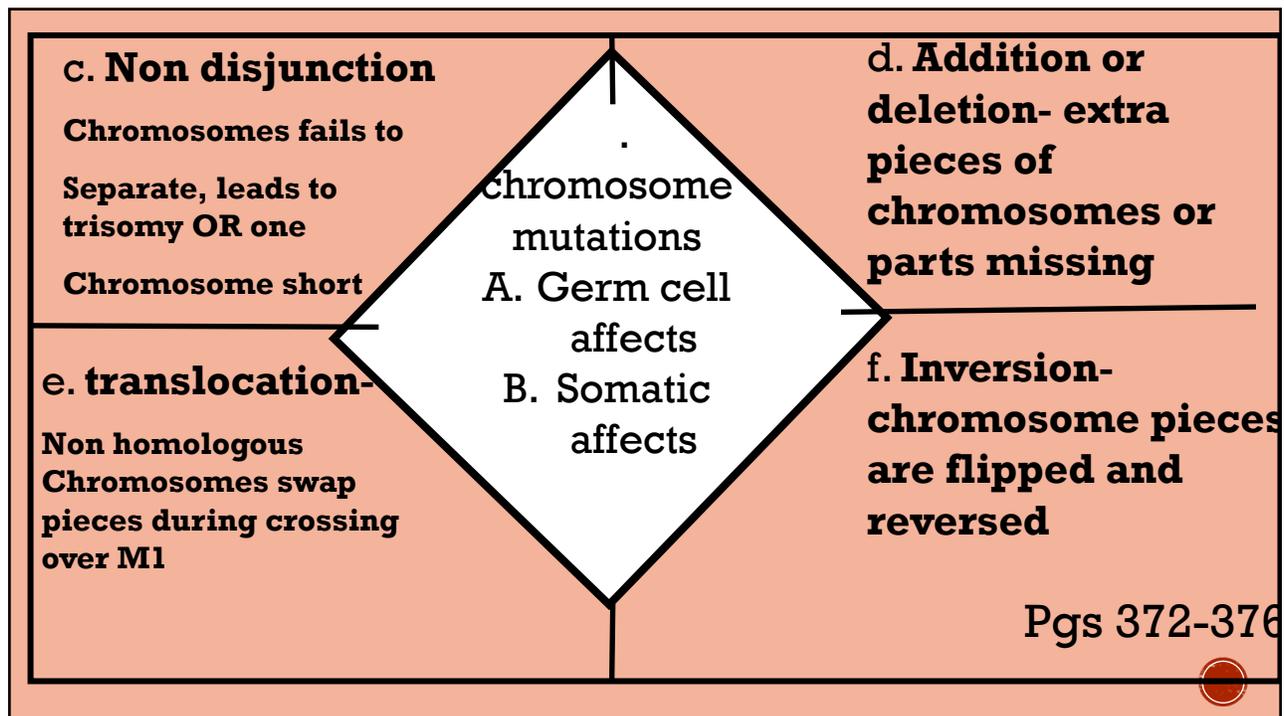
MUTATIONS

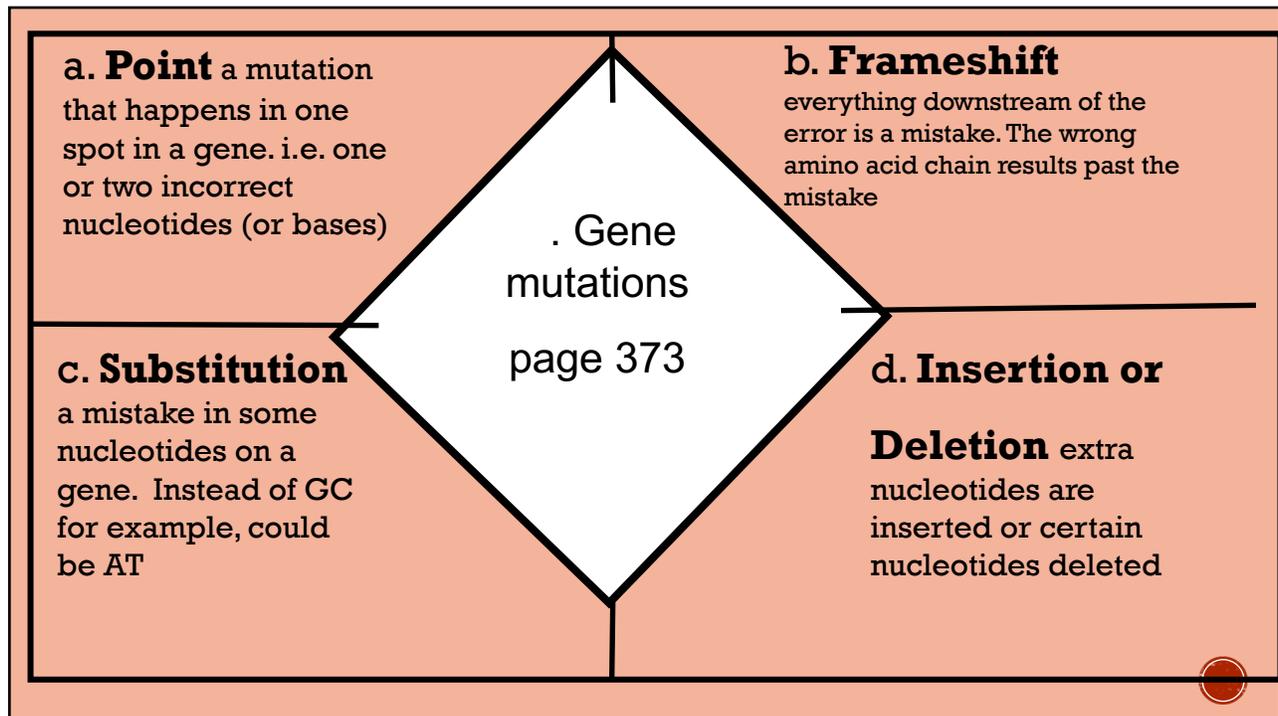
- Heritable changes in DNA; can be on the chromosome OR on the gene itself
- A gene mutation involves a few nucleotides; point mutation, substitution, frame shift, insertion or deletion
- A chromosomal mutation involves the entire chromosome (more than one gene) such as non-disjunction, translocation, inversion, addition, deletion



MUTATIONS

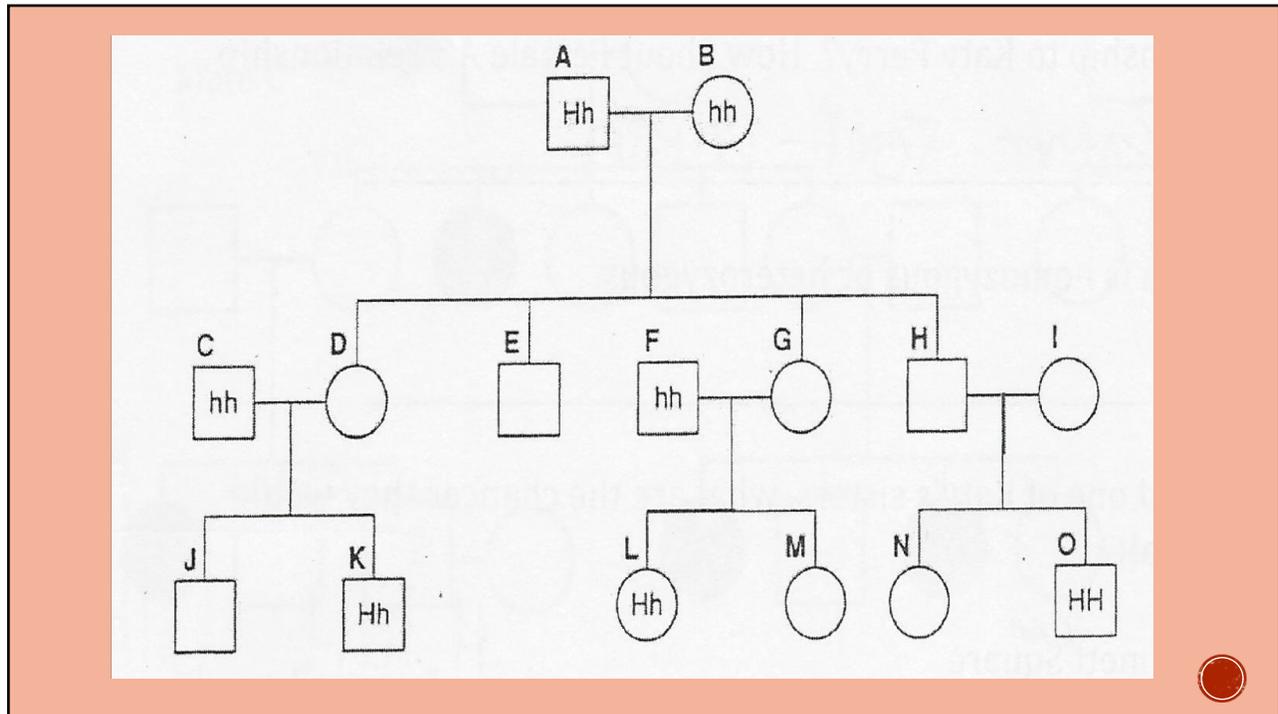
- A. Silent mutation- protein unaffected silent does not speak
- B. Missense mutation- wrong nucleotides lead to incorrect aa's being brought & wrong protein! Missense=mistake
- C. Nonsense mutation- translation stops too soon (that's nonsense to end your job)
- D. Real world : cancer





PEDIGREE- DIAGRAM THAT SHOWS HOW A GENE IS INHERITED OVER GENERATIONS

- Circles-F, Squares-M
- Filled in= affected, 1/2 filled=carrier of a recessive trait
- Horizontal line=mating, vertical lines indicate offspring
- Recessive if trait does not appear in parents but DOES appear in kids (dominant if it's in every generation)
- Autosomal if both genders are affected (sex linked if predominantly one gender)



GENETIC ENGINEERING

- Gene splicing- insertion of genes
- GMOs- put the genomes of 2 organisms together
- Gel Electrophoresis- to get DNA fingerprint
- Selective Breeding- artificial selection; to get the best
- Gene Therapy- to cure disease
- Cloning- identical twins or making another individual with the same DNA

VIDEO REVIEW

- Amoeba sisters Genetics
- Hank Green: genetics
- Frameshift Mutations explained in 5 min: <https://tinyurl.com/y8ocaskt>
- <https://www.youtube.com/watch?v=gOrq3CuPjxs>

