
Bio 101 Notes
MUTATION AND VARIATION

CUT OBJECTIVE 26!!!

NON-MENDELIAN INHERITANCE

- Mendelian = Complete Dominance
 - Only the dominant allele's protein is produced
 - When a yellow and purple parent produce a purple offspring
- Not all traits are simply determined by a single dominant and a single recessive allele.
- Incomplete Dominance (see Diana's picture)
 - A little of each allele's protein is produced.
- Codominance
 - A lot of each allele's protein is produced.
- Polygenic - Multiple genes determine the trait
 - Eye color
 - Bell Peppers
 - Colon Cancer - Human needs to have mutations in about 7 different genes.
- Sex-Linked Traits
 - Gene for trait is on portion of "X" chromosomes not matched by "Y"

COMPLEXITY

- Variable Expression: All cells in an organism have the same genes, but only some are used.
 - Muscle Cell
 - Pancreatic Cell
- Molecular "bookmarks" are put in each cell's DNA to indicate which genes should be active.
- Modifier Genes: Some genes can modify the effect of another gene.
 - Albino: Gene stops production of pigment proteins
- Master Control Genes: Activate numerous genes to control complex tasks
- Environmental Effects: A cell's surroundings can impact how genes function
 - Diet and hormones
 - Which is a bigger influence: Genetics or Environment? (Nature vs Nurture)
 - Heterochromia: your eye has 2 distinct color

MUTATIONS

- Mutations produce new alleles (versions of genes)
- Mutation: DNA is altered
 - "Big" Chromosomal Mutations - structured changes or irregular number (uncommon)
 - Base "Point" Mutation - common
 - Mutations in sperm and eggs can be passed on to future generations.
- Causes of Mutations
 - Mistakes during DNA replication

- Damage from external agents (mutagens)
- Defenses Against Mutation
 - Mutation repair proteins
- Effects of Mutations
 - Primary Impact: No change (in protein or cell function)
 - Less Frequent: Negative Impact
 - Rare: Positive Impact

Day 6

1/24/2013

DEVELOPMENT

EXAM ON MONDAY AT 7PM!!!!

FRUIT FLIES

- “Fruit Fly” *Drosophila Melanogaster*
 - Easy to care for
 - Short generation time (7+ days)
 - Large numbers of offspring
 - Identifiable mutations
- Fruit fly mutations
 - Different eye color, eye shape, wings, color. larva, etc.
- Thomas Hunt Morgan (1866-1945)
 - Demonstrated that genes are located on chromosomes.
 - Sex-linked traits
 - Crossing-over between chromosomes.
 - Famous for his paper where he talks about genetics and evolution.
 - Linked Mendel’s principles of inheritance and Darwin’s theory of natural selection as a means for transforming species.
- Fruit Fly Genome
 - A genome is all of the hereditary information found in an organism.
 - # of Chromosomes: Fruit Flies $2N = 8$, Humans $2N = 46$
 - # of Genes: Fruit Flies $\sim 13,600$, Humans $\sim 23,000$
- Fruit Fly Life Cycle
 - See Picture
 - Meiosis: only happens to produce sperm and eggs, just for sexual reproduction.
 - ($2N \rightarrow 1N$)
 - Meiosis has an E and Sex has an E
 - Fertilization: ($1N + 1N = 2N$)
 - Mitosis: a cell make a genetic copy ($2N \rightarrow 2N$)
 - Excessive Mitosis: Cancer

GENES AND DEVELOPMENT

- See Diana’s Pictures
- Master Control Genes
 - HOX Genes: organize head, thorax, abdomen

- Different species have many similar genes
 - Myosin Protein - allows fruit flies muscles to work for flight
- Different species have similar proteins
 - Kinase proteins necessary for mitosis
- If different species have many similar genes, where do the differences come from?
- Only a small part of DNA is genes, the rest is non-coding (“junk”) DNA
- Transposons - non-coding DNA that can be copied and move around
 - Increased variation

NATURE VS NURTURE

- Genetics and the environment can impact phenotypes.
 - Partly both nature and nurture
- Molecules can impact DNA:
 - Recall the “Bookmarks”
- Epigenetics: chemicals attach themselves to chromosomes and change the way genes function.
 - Methyl added to bases represses genes
 - Molecules attach to histone proteins alter surrounding DNA activity
 - Possible Paradigm Switch: Inheritance = DNA + Chemicals?