

Let Me See Your Double Helix...

7th and 8th Grade Science and Mathematics

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Length of Unit: 12 Lessons

I. ABSTRACT

- A. Let Me See Your Double Helix is designed to combine 7th and 8th grade science and mathematics skills and topics. The unit focuses on cell division and the basic process for cell growth and reproduction. The students will focus on chromosomes and genes, and research by Gregor Mendel. The students will calculate cell size, including surface area and volume, as well as graph genetic traits and patterns such as gender of children.

II. OVERVIEW

- A. Concept Objectives
1. The students develop an appreciation for math and science.
 2. The students will develop an understanding of genetics and DNA.
 3. The students will understand how math and genetics apply to everyday life.
- B. Content from the *Core Knowledge Sequence*
1. Measurement
 - a. Choose appropriate units of measure and use ratios to convert within and between measurement systems to solve problems (page 173)
 - b. Compare weights, capacities, geometric measures, times and temperatures within and between measurement systems (page 173)
 - c. Know how perimeter, area, and volume are affected by changes of scale (page 173)
 2. Cell Division and Genetics
 - a. Cell division, the basic process for growth and reproduction (page 176)
 - b. Gregor Mendel's experiments with purebred and hybrid peas (page 176)
 - c. Modern understanding of chromosomes and genes (page 176)
- C. Skill Objectives
1. The students will demonstrate safe practices during lab investigation
 2. The students will use formulas and ratios to determine relationships
 3. The students will represent the natural world using models and identify their limitations.
 4. The students will observe the changes that take place in a cell during cell division
 5. Students will demonstrate an understanding of DNA and RNA

III. BACKGROUND KNOWLEDGE

- A. For Teachers
1. Microsoft Office software (Excel, PowerPoint and Publisher) for Windows XP these programs will be used to create student projects.
 2. *Laying the Foundation: A Resource and Strategies Guide for Middle Grades Life and Earth Science*, Advanced Placement Inc.
 3. Genetics resources, if needed: sciencespot.net

- B. For Students
 - 1. Technology skills in keyboarding
 - 2. Software application functions
 - 3. Introduction into ratios, proportions, and percents

IV. RESOURCES (Provide a list of key resources-literature selections, activity books, AV materials, etc.-that are critical in teaching this unit.)

- A. "Science and Mathematics Lab Manual" McGraw-Hill Companies
- B. "Laying the Foundation: A Resource and Strategies Guide for Middle Grades Life and Earth Science" Advanced Placement Strategies Inc
- C. Cells alive web page <http://www.cellsalive.com/>
- D. The Biology Project web page
http://www.biology.arizona.edu/cell_bio/tutorials/meiosis/main.html
- E. Miss. Noon's Biology Class web page <http://edweb.fdu.edu/folio/NoonJ/>
- F. Mitosis Flipbooks <http://sciencespot.net/Media/mitosisbook.pdf>
- G. Meiosis Flipbooks <http://sciencespot.net/Media/meiosispg1.pdf>
- H. What's your DNA Alias? http://www.nature.ca/genome/05/051/0511/0511_m205_e.cfm

V. LESSONS

Lesson One: Introduction to Cell Division (Day 1)

- A. *Daily Objectives*
 - 1. Concept Objective(s)
 - a. The students will develop an appreciation for math and science
 - b. The students will develop an understanding of genetics and DNA
 - c. The students will understand how math and genetics apply to everyday life.
 - 2. Lesson Content
 - a. Basic review of cellular functions
 - b. Presentation of information on mitosis and meiosis
 - c. Gallery walk of information
 - d. Initial Assessment
 - 3. Skill Objective(s)
 - a. Label basic organelles of a cell
 - b. List functions of organelles
 - c. Explain mitosis
 - d. Explain meiosis
- B. *Materials*
 - 1. Power Point presentation of lesson objectives (teacher made)
 - 2. Butcher paper
 - 3. Markers
 - 4. Note Cards
 - 5. Sticky notes
- C. *Key Vocabulary*
 - 1. Cell – smallest functional unit of life
 - 2. Organelle – structure of a cell having specialized functions
 - 3. Cell membrane – permeable lipid bilayer composing outer layer of a cell
 - 4. Cytoplasm – jelly like material that fills cells

5. Nucleus – membrane-bound organelle containing cells' chromosomes
 6. Nucleolus – sub organelle of the nucleus made of DNA sequences (makes RNA)
 7. Mitochondria – cell organelle that makes energy
 8. Vacuole – organelle that can secrete waste products and store water
 9. Endoplasmic Reticulum – network of tubes that transport proteins
 10. Mitosis – process by which a cell separates into 2 identical halves: occurs exclusively in eukaryotic cells
 11. Meiosis – process that allows one diploid cell to divide to generate haploid cells
 12. Sexual reproduction – type of reproduction that results in increasing genetic diversity in the offspring through mitosis and fertilization
 13. Asexual reproduction – form of reproduction that does not involve meiosis and only one “parent” involved: this is an exact replica of the “parent”
 14. haploid cells – cell having only one complete set of chromosomes
 15. diploid cells – cells that have 2 copies of each chromosomes: one from mother, one from father
- D. *Procedures/Activities*
1. Present information through Power Point
 2. Have students record notes
 3. Divide students into 3 groups
 4. Assign each group one of the following: mitosis, meiosis, and cell organelles and functions
 5. Give each group a piece of butcher paper and a marker
 6. Each group must write the main idea of the notes on their topic
 7. Hang each groups butcher paper in different places around the room for viewing
 8. Hand each student a note card
 9. Students will get 5 minutes to complete a gallery walk of all 3 topics
 10. Students will write 2 main ideas from each poster on their note card
 11. Students will share their note cards in their original groups
- E. *Assessment/Evaluation*
1. Hand each student a sticky note
 2. 3-2-1 Exit Card: Students will list 3 ways mitosis and meiosis are different, list 2 important functions of cell organelles, and 1 way how cell structure is involved in mitosis and meiosis.
 3. Students place sticky notes on doors as they leave class

LESSON TWO: A Mathematical Look at Cell Size (Day 2)

- A. *Daily Objectives*
1. Concept Objective(s)
 - a. The students develop an appreciation for math and science.
 - b. The students will develop an understanding of genetics and DNA.
 - c. The students will understand how math and genetics apply to everyday life.
 2. Lesson Content
 - a. Compute the surface area and volume
 - b. Use surface area and volume formulas
 - c. Completion of cell model
 - d. Analysis of cell model, measurements and ratios
 3. Skill Objectives

- a. The students will demonstrate safe practices during lab investigation
 - b. The students will collect data by observing and measuring
 - c. The students will use formulas and ratios to determine relationships
- B. Materials**
1. Photocopy of 2 cell models on card stock
 2. White Glue
 3. Scissors
 4. Balance
 5. Coarse Sand
 6. Small scoops
 7. *A Mathematical Look at Cell Size Lab* (Appendix 2a)
- C. Key Vocabulary**
1. Surface area – The extent of a 2 dimensional surface enclosed within a boundary
 2. Volume - The amount of space within an object
- D. Procedures/Activities**
1. Break students into pairs
 2. Give each group a copy of lab assignment
 3. Have students follow directions on how to assemble cell model
 4. Use formulas to calculate area for one face, total surface area, and volume of each cell model
 5. Fill each model with sand
 6. Determine mass of each cell using balance
 7. Calculate the ratio of total surface area to volume
 8. Calculate the ratio of total surface area to mass
 9. Complete student analysis sheet
- E. Assessment/Evaluations**
1. Teacher Observations
 2. Completion of lab analysis

LESSON THREE: Meiosis and Mitosis Flipbooks (Day 3)

- A. Daily Objectives**
1. Concept Objective(s)
 - a. The students develop an appreciation for math and science.
 - b. The students will understand how math and genetics apply to everyday life.
 - c. The students will develop an understanding of genetics and DNA.
 2. Lesson Content
 - a. Mitosis phases
 - b. Meiosis phases
 - c. Completion of flip charts
 3. Skill Objectives
 - a. The students will use cell knowledge to complete flipbooks
 - b. The students will represent the natural world using models and identify their limitations.
 - c. The students will collect data by observing
 - d. The students will illustrate the changes that take place in a cell during cell division
- B. Materials**
1. Diagram Masters (<http://sciencespot.net/Media/mitosisbook.pdf> and <http://sciencespot.net/Media/meiosispg1.pdf>)
 2. Scissors

3. Colored Pencils
 4. Stapler
- C. *Key Vocabulary*
1. Interphase – period of the cell cycle during which the nucleus is not undergoing division.
 2. Prophase – First stage of mitosis or meiosis during which the nuclear envelope breaks down and strands of chromatin form into chromosomes
 3. Metaphase – Stage in mitosis or meiosis in which the duplicated chromosomes line up along equatorial plate of the spindle
 4. Anaphase – stage in mitosis or meiosis in which the chromosomes move to opposite ends of the nuclear spindle
 5. Telophase – final stage of mitosis or meiosis during which the chromosomes of daughter cells are grouped in new nuclei
 6. Cytokinesis – the division of the cell cytoplasm following division of the nucleus
 7. Prophase II – stage in meiosis in which the nuclear envelope breaks down and the spindle apparatus forms
 8. Metaphase II – stage in meiosis in which the chromosomes become arranged on the equatorial plate and are attached to the newly formed spindle
 9. Anaphase II – stage in meiosis in which centromeres separate and the sister chromatids move toward the opposite poles of the cell.
 10. Telophase II – stage in meiosis in which 4 daughter cells are produced, each with a haploid set of chromosomes
- D. *Procedures/Activities*
1. Hand out mitosis and meiosis diagram masters to each student
 2. Read flip book directions with the class
 3. Students complete diagram illustrations on each stage
 4. Have students cut out each page
 5. Organize from first to last
 6. Staple book
 7. Flip through your book!
- E. *Assessments/Evaluations*
1. Teacher observations
 2. Students observations
 3. Completion of flip books

LESSON FOUR: Mitosis and Meiosis Web Quest (Day 4)

- A. *Daily Objectives*
1. Concept Objectives
 - a. The students will develop an appreciation for math and science.
 - b. The students will understand how math and genetics apply to everyday life.
 - c. The students will develop an understanding of genetics and DNA
 2. Lesson Content
 - a. Meiosis Phases
 - b. Mitosis Phases
 - c. Research topic through completion of a Web Quest on mitosis and meiosis
 3. Skill Objectives
 - a. The student will determine and employ methods to evaluate the electronic information for accuracy and validity (6.A)

- b. The student will resolve information conflicts and validate information through accessing, researching, and comparing data. (6.B)
 - c. The student will demonstrate the ability to identify the source, location, media type, relevancy, and content validity of available information. (6.C)
 - d. The students will collect data by observing
 - e. The students will observe the changes that take place in a cell during cell division
- B. *Materials*
- 1. Computers
 - 2. Internet Access
 - 3. *Mitosis and Meiosis – Internet Lesson* (Appendix 4a)
 - 4. Word document and Netop program to transfer information for the Web quest to students
 - 5. H:drive folder to save Web quest document for future use in final presentations of the unit
- C. *Key Vocabulary*
- 1. Web Quest – research activity in which students collect information, where most of the information comes from the World Wide Web.
 - 2. WWW (World Wide Web) – all the resources and users on the Internet that are linked together by a hypermedia-based system for browsing Internet sites
 - 3. H:drive – A place on the server for students to save their work each day
 - 4. URL (Uniform Resource Locator) – the address of a Web page, which allows people to find the page on the Internet.
- D. *Procedures/Activities*
- 1. Students will log on to their computers and await instructions by teacher
 - 2. Students will come into the lab with prior information regarding Mitosis and meiosis
 - 3. Basic technology information and terms will be discussed with students
 - 4. Students will receive information and guide to complete web quest
 - 5. Students will individually have the opportunity to work through the web quest
 - 6. Teacher will monitor students’ progress and assist with questions and concerns
 - 7. Students will save their work to their own folder on the server for future use and will print the web quest document and turn in
- E. *Assessments/Evaluations*
- 1. *Finished Web quest printed and turned in*
 - 2. Ticket-Out-The-Door: Have students write down 5 things they discovered on the Web Quest.

LESSON FIVE: What is your DNA Alias? (days 5 and 6)

- A. *Daily Objectives*
- 1. Concept Objectives
 - a. The students will develop an appreciation for math and science.
 - b. The students will develop an understanding of genetics and DNA.
 - c. The students will understand how math and genetics apply to everyday life.
 - 2. Lesson Content
 - a. Learn basics of human DNA and RNA
 - b. Identify individual factors of DNA and RNA
 - c. Completion of DNA jewelry model
 - 3. Skill Objectives
 - a. Student will demonstrate safe practices during lab investigations

- b. Students will organize, analyze, make inferences and predict trends from direct and indirect evidence
 - c. Students will represent the natural world using models
 - d. Students will demonstrate an understanding of DNA and RNA
- B. *Materials*
 - 1. Elastized cord
 - 2. Red beads
 - 3. Green beads
 - 4. Yellow beads
 - 5. Blue beads
 - 6. Lanyard hooks
 - 7. Scissors
 - 8. *What's your DNA Alias? Lab* (Appendix 5a)
- C. *Key Vocabulary*
 - 1. DNA – nucleic acid that contains the genetic instructions of a cellular form of life
 - 2. RNA – a nucleic acid polymer which is transcribed from DNA by enzymes and serves as the template for translation of genes into proteins
 - 3. Double Helix – the spiral arrangement of the 2 complimentary strands of DNA
 - 4. DNA Replication – process of copying a double strand DNA in a cell prior to cell division
 - 5. Cytosine – a fundamental component of DNA and RNA that forms a base pair with guanine
 - 6. Guanine – a fundamental component of DNA and RNA that forms a base pair with cytosine
 - 7. Thymine – fundamental component of DNA that is paired with Adenine
 - 8. Adenine – fundamental component of DNA that is paired with Thymine
 - 9. Codon - a triplet of adjacent nucleotides in the messenger RNA chain
- D. *Procedures/Activities*
 - 1. Hand students the DNA Alias Activity Sheet
 - 2. Students will write their first name out and match each letter to the DNA code for each letter
 - 3. Students will replace each letter of their name with its three-letter codon
 - 4. Students will match the appropriate colors of beads to the DNA sequence for each letter of their name
 - 5. Cut the elasticized cord into a 10 cm-long piece
 - 6. Knot one end of the cord in order to prevent the beads from sliding off
 - 7. String beads in order as they appear in the student's name
 - 8. String the lanyard hook on the elasticized cord and secure it to the cord with a double knot.
- E. *Assessments/Evaluations*
 - 1. Teacher observations
 - 2. Completion of DNA Key Chain

LESSON SIX: Going bananas for DNA! (day 7)

- A. *Daily Objectives*
 - 1. Concept Objectives
 - a. The students will develop an appreciation for math and science.
 - b. The students will develop an understanding of genetics and DNA.
 - c. The students will understand how math and genetics apply to everyday life.
 - 3. Lesson Content

- a. Extraction of DNA
 - b. Creating chemical reactions
 - c. Creation of a comic strip
3. Skill Objectives
 - a. Student will demonstrate safe practices during lab investigations
 - b. Students will collect data by observing and measuring
 - c. Students know that instructions for traits are contained in the genetic material
- B. *Materials*
1. Thumb sized pieces of banana
 2. Plastic, 15 mL reaction tubes
 3. Ice cold, 95% ethanol
 4. Beakers of distilled water
 5. Micro centrifuge tubes
 6. 10 mL graduated cylinders
 7. 1 mL disposable, transfer pipettes
 8. Plastic cups of liquid detergent
 9. 15 mL reaction tubes (labeled: meat tenderizer)
 10. Mortar and pestles
 11. Paper clips (bent)
 12. Lab instructions and write-up (Laying the Foundation)
- C. *Key Vocabulary*
1. Reagent – a substance used in a chemical reaction to detect, measure, examine, or produce other substances
 2. Lysate – a mixture of substances formed by the destruction of cells
 3. Extraction – the process of obtaining something from a mixture or compound by chemical, physical or mechanical means
 4. Histone – any of a group of 5 basic proteins occurring in the nucleus of eukaryotic cells
- D. *Procedures/Activities*
1. Students will get into their lab groups at the beginning of class
 2. Hand out lab procedures and lab analysis
 3. Weigh out 1.0 gram of salt
 4. Weigh out 2.0 grams of meat tenderizer
 5. Measure 9.0 mL of distilled water in the 10 mL graduated cylinder
 6. Add approximately 1 mL of liquid detergent soap into the mortar with the disposable pipettes
 7. Get a thumb-sized piece of banana
 8. Place banana in the mortar and pestle.
 9. Mash up the banana in the mortar.
 10. Carefully pour all reagents into the mortar and pestle and continue mashing (forms a lysate)
 11. Pour lysate into a clean plastic reaction tube
 12. Squirt 15-20 mL of ice cold ethanol down the side of the reaction tube
 13. Get the sample of DNA (mucus looking solid) by extracting with a paper clip
 14. Transfer the DNA to the bulb pipette
 15. Complete lab analysis
- E. *Assessment/Evaluation*
1. Teacher evaluation
 2. Successful DNA extraction
 3. Completed comic strip and lab write-up

LESSON SEVEN: Introduction to Genetics (day 8)

- A. *Daily Objectives*
 - 1. Concept Objectives
 - a. The students will develop an appreciation for math and science.
 - b. The students will develop an understanding of genetics and DNA.
 - c. The students will understand how math and genetics apply to everyday life.
 - 2. Lesson Content
 - a. Basic understanding of genetic make-up
 - b. Dominant and recessive genes
 - c. Post genetic assessment
 - 3. Skill Objectives
 - a. Students will demonstrate an understanding of genetic make-up, chromosomes and genes.
 - b. Students know that instructions for traits are contained in the genetic material
 - c. Students will distinguish between dominant and recessive traits and recognize that inherited traits of an individual are contained in genetic material.
- B. *Materials*
 - 1. Teacher made Power Point presentation
 - 2. *Slap Cards* (Appendix 7a)
- C. *Key Vocabulary*
 - 1. Chromosome – threadlike bodies consisting of chromatin that carry genes in a linear order
 - 2. Gene – basic unit of heredity
 - 3. Gregor Mendel – founder of the science of genetics
 - 4. Trait – distinguishing characteristic or quality
 - 5. Allele – several forms of a gene that is responsible for heredity variations
 - 6. Dominant allele – expresses its phenotypic effect even when heterozygous with a recessive allele
 - 7. Recessive allele – phenotypic effect is not expressed in a heterozygote
 - 8. Heterozygous – having dissimilar pairs of genes for any hereditary characteristic
 - 9. Homozygous – having identical pairs of genes for any hereditary characteristic
 - 10. Genotype – sum total of genes transmitted from parent to offspring
 - 11. Phenotype – observable genetic makeup
- D. *Procedures/Activities*
 - 1. Students will take notes from teacher made Power Point
 - 2. Teacher will lead class discussion of information
 - 3. Pass out a Slap Card to each student
 - 4. Students will group according to number or color of Slap Card
 - 5. Students will walk around the room and switch cards with every person they pass
 - 6. Students will answer genetic review questions in their respective groups
- E. *Assessment/Evaluation*
 - 4. Teacher observations
 - 5. Slap Card productivity

LESSON EIGHT: The Gender of Children (Day 9)

- A. *Daily Objectives*
1. Concept Objectives
 - a. The students develop an appreciation for math and science
 - b. The students will develop an understanding of genetics and DNA.
 - c. The students will understand how math and genetics apply to everyday life.
 2. Lesson Content
 - a. Probability
 - b. Independent Events in genetics
 - c. Graphing the results of experiment
 3. Skill Objectives
 - a. The student will identify patterns in collected information using probability.
 - b. The student will collect by data by observations
 - c. The students will construct graphs and tables to organize, examine and evaluate data.
 - d. The students will understand that species will change through generations.
- B. *Materials*
1. *Gender of Children Lab* (8a)
 2. Coin
 3. Graph paper
 4. Colored Pencils
- C. *Key Vocabulary*
1. Probability – a measure of how likely it is that some event will occur
 2. Independent event – an event not influenced or controlled by others
 3. Offspring – children or young of a particular parent
- D. *Procedures/Activities*
1. Pass out student lab worksheet
 2. Explain that they will find the gender of each child in 10 families, and each family will have 3 children.
 3. Students will toss a coin to find the gender of each child (H-male, T-female)
 4. Students will record data in table
 5. Students will turn data into bar graphs (each family will have 2 bar graphs – one for female, one for male offspring)
 6. Students will complete lab analysis questions independently.
- E. *Assessment/Evaluation*
1. Teacher observations
 2. Students bar graphs
 3. Student lab analysis

LESSON NINE: Genetic Traits (Day 10)

- A. *Daily Objectives*
1. Concept Objectives
 - a. The students will develop an appreciation for math and science.
 - b. The students will develop an understanding of genetics and DNA.
 - c. The students will understand how math and genetics apply to everyday life.
 2. Lesson Content
 - a. Calculation of Percent
 - b. Observation and data collection

- c. Completion of lab analysis
 - 3. Skill Objectives
 - a. The students will compare traits of different organisms
 - b. The students will collect data by observing
 - c. The students will construct data tables to organize, examine and evaluate data.
- B. *Materials*
 - 1. *Genetic Traits Lab* (Appendix 9a)
- C. *Key Vocabulary*
 - 1. Hair whorl – the particular direction in which your hair “circles” from
 - 2. Hair line - the outline of the growth of hair on the head
- D. *Procedures/Activities*
 - 1. Pass out student lab worksheet
 - 2. Students will get into partners
 - 3. Students will complete the column labeled “you” in the data table for each of the genetic traits.
 - 4. Record totals of each trait for the entire class and calculate the percentage present for each.
 - 5. Students will answer questions from the lab analysis
- E. *Assessments/Evaluations*
 - 1. Teacher Observations
 - 2. Calculation of percents
 - 3. Student lab worksheet

LESSON TEN: Egg Genetics (Day 11)

- A. *Daily Objectives*
 - 1. Concept Objectives
 - a. The students will develop an appreciation for math and science.
 - b. The students will develop and understanding of genetics and DNA.
 - c. The students will understand how math and genetics apply to everyday life.
 - 2. Lesson Content
 - a. Calculation of ratios
 - b. Dominant and recessive genes and their affects on phenotype
 - c. Prediction of phenotypes
 - d. Completion of Punnett Squares on student worksheet
 - 3. Skill Objectives
 - a. The students will extrapolate from collected evidence to make predictions.
 - b. The students will make predictions about possible outcomes of various genetic combinations of inherited characteristics.
 - c. The students will use Punnett Squares effectively to represent ratios of genetic combinations.
- B. *Materials*
 - 1. Plastic eggs (the type that splits into halves)
 - 2. Purple candy
 - 3. Pink candy
 - 4. Orange candy
 - 5. Blue candy
 - 6. Yellow candy
 - 7. Green candy

8. *Egg Genetics* (Appendix 10a)
- C. *Key Vocabulary*
 1. Punnett Square – type of grid used to show the alleles of each parent and their offspring
 2. Ratio – relation in degree or number between two similar things
- D. *Procedures/Activities*
 1. Pass out student worksheet.
 2. Students will pick out one egg.
 3. Students will figure the genotypes for their two “parents’ by referring to the genotype and phenotype chart on their worksheet .
 4. Complete Punnett Squares to determine the phenotype of the offspring.
 5. Open the egg to see if the color of candy is the phenotypes figured in the Punnett Squares.
 6. Eat the candy if the phenotypes match was what found using the Punnett Squares.
 7. Complete all Punnett Squares on the lab worksheet.
- E. *Assessments/Evaluations*
 1. Teacher observations
 2. Student observations
 3. Completed Punnett Squares

LESSON ELEVEN: Bean Bunny Evolution (Day 12)

- A. *Daily Objectives*
 1. Concept Objectives
 - a. The students will develop an appreciation for math and science.
 - b. The students will develop an understanding of genetics and DNA.
 - c. The students will understand how math and genetics apply to everyday life.
 2. Lesson Content
 - a. Natural selection of alleles
 - b. Evolution of a species
 - c. Completion of graph and lab analysis
 3. Skill Objectives
 - a. The students will construct data tables to organize, examine and evaluate data.
 - b. The students will identify that change in environmental conditions can affect the survival of individuals and of species.
 - c. The students will collect data by observing and communicate valid conclusions.
- B. *Materials*
 1. Bag of small pinto beans or “red beans”; dried
 2. Paper, lunch bags
 3. Bag of small lima beans or “white beans”; dried
 4. Petri dishes
 5. Lab analysis (Laying the Foundation)
- C. *Key Vocabulary*
 1. Evolution - change in the gene pool of a population from generation to generation by such processes as mutation, natural selection, and genetic drift
 2. Natural selection - the process by which forms of life having traits that better enable them to adapt to specific environmental pressures will tend to survive and reproduce in greater numbers than others of their kind, thus ensuring the perpetuation of those favorable traits in succeeding generations.

3. Frequency - the number of periods or regularly occurring events of any given kind in unit of time
 4. Generation - the offspring of a certain parent or couple, considered as a step in natural descent
- D. *Procedures/Activities*
1. Students will divide into pairs.
 2. Students will form a hypothesis regarding natural selection and gene frequency.
 3. Label 3 Petri dishes FF (homozygous dominant), Ff (heterozygous dominant), and ff (homozygous recessive)
 4. Place 50 red and 50 white beans in the paper bag and shake up.
 5. Without looking, select two beans at a time.
 6. Record results in the data table next to "Generation 1".
 7. Continue drawing pairs of beans and recording results.
 8. Place the "rabbits" into the appropriate Petri dishes as they are drawn.
 9. Divide total number of beans in each Petri dish by two to determine the number of individual rabbits produced.
 10. Record the number of individuals in the data table in the appropriate columns.
 11. Place ff bunnies to the side before continuing to the next round because they are killed off due to the lack of fur.
 12. Place the alleles of the surviving rabbits back into the sack and mate them again to get the next generation.
 13. Repeat these steps until information is obtained for ten generations.
 14. Determine the frequency for each generation and record in the chart.
 15. Complete conclusion questions.
- E. *Assessments/Evaluations*
1. Teacher observations
 2. Student observations
 3. Completed lab analysis

LESSON TWELVE: Putting it together with PowerPoint or Publisher (days 13 and 14)

- A. *Daily Objectives*
1. Concept Objective(s)
 - a. The students will develop an appreciation for math and science.
 - b. The students will develop an understanding of genetics and DNA.
 - c. The students will understand how math and genetics apply to everyday life.
 2. Lesson Content
 - a. Students reflect on learned information from unit and combine the information into a presentation to the class and teacher using a PowerPoint or Brochure
 3. Skill Objective(s)
 - a. The students demonstrate the ability to select and use software for a defined task according to quality, appropriateness, effectiveness, and efficiency.
 - b. The students perform basic software application functions including, but not limited to, opening an application program and creating modifying, printing, and saving documents
 - c. The students demonstrate proper etiquette and knowledge of acceptable use while in an individual classroom, lab, or on the Internet and intranet

- d. the students use productivity tools to create effective document files for defined audiences such as slide shows, poster, multimedia presentations, newsletters, brochures, or reports
- F. *Materials*
- 1. Computers
 - 2. *Step-By-Step Instructions* (Appendix 12a)
 - 3. *Rubric* (Appendix 12b)
 - 4. H:drive folder to save projects
 - 5. Microsoft PowerPoint or Publisher software
 - 6. All previous information learned from this unit
- G. *Key Vocabulary*
- 1. H:drive - place on a server used to store students projects
 - 2. Rubric – a guide that gives expectations for a project which includes grading possibilities
 - 3. All of the terms covered by this unit
- H. *Procedures/Activities*
- 1. Students will come into the lab with all the information obtained from this unit
 - 2. Students will use a rubric as a guide to create a presentation choosing either PowerPoint or Publisher from the information they have learned in this unit
 - 3. The use of both programs will be covered by the teacher
 - 4. The students will then work individually on their presentation projects
 - 5. During the process students will save their work often to their H:drive folder
 - 6. Teacher will monitor students' progress and assist with questions and concerns
 - 7. At the completion of student projects, the students will present using their brochures or PowerPoint's. A copy of their projects will also be printed and turned in to the teacher.
- I. *Assessment/Evaluation*
- 1. Informal assessment – teacher observation of group dynamics and productivity
 - 2. Formal assessment – PowerPoint/Publisher Rubric

VI. CULMINATING ACTIVITY

At the end of this unit, we will take our students on a field trip to the Texas Tech University Health Sciences Center to tour the genetics lab. The students will observe geneticists at work in the laboratories. The students will come back to school and write an essay over what they observed on the field trip compared to what they observed in the classroom.

VII. HANDOUTS/WORKSHEETS

- A. Lesson Two: Mathematical Look at Cell Size
 - 1. Appendix 2a (A Mathematical Look at Cell Size)
- B. Lesson Four: Mitosis and Meiosis Web Quest
 - 1. Appendix 4a (Mitosis and Meiosis Internet Lesson)
- C. Lesson Five: What is your DNA alias?
 - 1. Appendix 5a (What is your DNA Alias?)
- D. Lesson Six: Introduction to Genetics
 - 1. Appendix 6a (Slap Cards)
- E. Lesson Eight: Gender of Children
 - 1. Appendix 8a (Gender of Children)
- F. Lesson Nine: Genetic Traits
 - 1. Appendix 9a (Genetic Traits)
- G. Lesson Ten: Egg Genetics

1. Appendix 10a (Egg Genetics)
- H. Lesson Twelve: Putting it Together with Power Point or Publisher
 1. Appendix 12a (Step by Step Instructions)
 2. Appendix 12b (Rubric)

VIII. BIBLIOGRAPHY

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- B. Internet Resources
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Appendix 2a
A Mathematical Look at Cell Size

A Mathematical Look at Cell Size

The cells in your body are continuously dividing to make new cells. Because of this process, your body continues growth, repairs tissue, and forms reproductive cells. Cells grow until they reach a certain size and then divide.

Think about this: What if cells grew indefinitely? What would happen if cells never divided?

To answer this question, we will find the surface area, volume and mass of cell models.

Materials Needed:

- Photocopy of 3 cell models
- Glue
- Scissors
- Balance
- Sand
- Small scoop

Procedures:

1. Get with your lab partner
2. Cut out your 3 cell models
3. Fold and glue together all sides of each model, making a box without a top
4. Imagine that the cell models are 6 sided and is closed.
5. This represents the cell at three different stages of growth
6. Use the formulas in Table 1 to calculate the area for one face, the total surface area, and the volume for each cell model.
7. Fill each cell with sand
8. Determine the mass using the balance. Record the mass in the last column of table 1.
9. Calculate the ratio of total surface area to volume for each cell model. Record answers in table 2.
10. Calculate the ratio of total surface area to mass for each cell model. Record answers in Table 2.

A Mathematical Look at Cell Size
Lab Sheet

Table 1
Measurement of cell models

Cell Size (length of one side, s)	Area for one face $A = l \times w$	Total surface area of cell	Volume of cell: $L \times w \times h$	Mass of cell (grams)
1				
2				
4				

Table 2
Ratios of Cell Model Measurements

Cell Size	Total surface area to volume	Total surface area to mass
1		
2		
4		

Answer the following questions on a separate sheet of paper with your partner:

1. What parts of your cell model represent the parts of an actual cell?
2. As a cell grows larger and accumulates more contents; will it need more or less cell membrane to survive? Why?
3. As a cell grows larger, what happens to the surface area to mass ratio?
4. Which cell model has the greatest surface area to volume and surface area to mass ratios?
5. How many cells with a side of 1 will fit into a cell with a side of 3?
6. Which has more total surface area: one cell with sides of 3, or 27 cells, each with sides of 1?

Appendix 4a
Mitosis and Meiosis - Internet Lesson

Mitosis and Meiosis – Internet Lesson

In this internet lesson, you will review the steps of mitosis and meiosis and view video simulations of cell division. You will also view an onion root tip and calculate the percentage of cells at each of the stages of cell division.

Mitosis Tutorial

<http://www.cellsalive.com/>

On the left side of the screen is a navigation bar, click on the link to “MITOSIS” Read the text on this page and view the animation, you can slow down the video by clicking step by step through the phases.

1. List the stages of mitosis

2. Which stage does the following occur?

- Chromatin condenses into chromosomes _____
- Chromosomes align in center of cell. _____
- Longest part of the cell cycle. _____
- Nuclear envelope breaks down. _____
- Cell is cleaved into two new daughter cells. _____
- Daughter chromosomes arrive at the poles. _____

Watch the video carefully.

3. The colored chromosomes represent chromatids. There is two of each color because one is an exact duplicate of the other.

--How many chromosomes are visible at the beginning of mitosis?

-- How many are in each daughter cell at the end of mitosis?

The little green T shaped things on the cell are centrioles.

-- What happens to the centrioles during mitosis?

Meiosis Tutorial

http://www.biology.arizona.edu/cell_bio/tutorials/meiosis/main.html

See the Contents: You will browse through each topic.

Part 1: Reproduction

1. Give an example of asexual reproduction.
2. What is a clone?
3. Name the two types of gametes produced by meiosis.

(click the “next button”)

Part 2: Chromosomes in a Diploid Cell

4. What is the diploid chromosome number for humans?
5. Egg and sperm cells are [haploid / diploid]

(click the “next” button)

Part 3: Meiosis 1 and Meiosis 2

6. Name the stage of meiosis 1 where each of the following occurs:

Homologous chromosomes pair and _____

form synapses

Bivalents align at metaphase plate

Two complete daughter cells form

Nuclear membrane disappears.

Nuclear membrane reforms.

Chromosomes move to separate poles.

View the meiosis 1 and 2 animation

12. At the end of meiosis 2, each cell contains how many chromosomes?

(Click the “next” button)

Part 4: A Review of Meiosis

13. Name 2 errors that can occur during meiosis.

Onion Root Tip - Online Activity

http://www.biology.arizona.edu/cell_bio/activities/cell_cycle/cell_cycle.html

Read the introduction, and then click the “next” button.

You will have 36 cells to classify. When you’re finished, record your data in the chart below.

	Interphase	Prophase	Metaphase	Anaphase	Telophase	Total
Number of cells						36
Percent of cells (calculate: number of cells divided by total cells x 100)						100%

Did you forget a calculator -- no problem? Go to www.calculator.com and click on the "fractions" calculator. A window with a virtual calculator will open and you can do the math from there.

Appendix 5a
What's your DNA Alias?

What is your DNA Alias?

Background Information

We will use four letters to code all the information contained in DNA: A, T, C, and G. The letters are used in groups of three. A group is called a codon

DNA contains the information that is needed by your body to make proteins. The different proteins have specific functions, such as making our hearts, hair, eyes and ears. The smallest part of proteins is amino acids. There are 20 amino acids. One or more can make up a protein, depending on the specific protein.

Each amino acid is represented by at least one codon. Because each codon is coded with three letters, the string of letters used to represent the amino acids in a specific protein can get pretty long. To avoid this, scientists have made a kind of shorthand, and have given each amino acid its own letter, corresponding to our alphabet.

Using this shorthand to represent the amino acids in a protein is a way of describing, or "spelling" this part of the protein. Written in this shorthand, the code is called the DNA Alias; each letter in the DNA Alias actually represents a group of three letters (a codon).

When scientists see the DNA Alias of a particular protein, they can find the protein's DNA sequence by reversing the coding process. For fun, we can perform the same process on any word by converting each letter to the corresponding codon, and in so doing, find its "DNA sequence".

Write each letter of your name on the lines below:

Use the table below to help you convert your name into its DNA Alias.

Step 1: Find each letter of your name.

Step 2: Look at the Simplified Codon column to find the DNA code for each letter.

Step 3: Replace each letter of your name with its three-letter codon:

____,	____,	____,	____,	____,
____,	____,	____,	____,	____,
____,	____,	____,	____,	____,

Base colors: **A** = green
T = red
C = blue
G = yellow

Our Alphabet	Amino Acid Name	Simplified Codon
A	Alanine	GCT
B		GCA (Alanine)
C	Cysteine	TGC
D	Aspartic acid	GAT
E	Glutamic acid	GAG
F	Phenylalanine	TTT
G	Glycine	GGG
H	Histidine	CAT
I	Isoleucine	ATA
J		ATC (Isoleucine)
K	Lysine	AAG
L	Leucine	CTC
M	Methionine	ATG
N	Asparagine	GAC
O		GAT (Asparagine)
P	Proline	CCC
Q	Glutamine	GAG
R	Arginine	CGT
S	Serine	TCA
T	Threonine	ACT
U		ACG (Threonine)
V	Valine	GTC
W	Tryptophan	TGG
X		GTA (Valine)
Y	Tyrosine	TAC
Z		TAT (Tyrosine)

Making Your Zipper Pull

Materials

DNA Alias Activity Sheet

elasticized cord

red beads

green beads

yellow beads

blue beads

1 lanyard hook

pencil

scissors

Procedure

- 1 - Match the appropriate colors of beads to the DNA sequence for each letter of their name
- 2 - Cut the elasticized cord into a 10 cm-long piece
- 3 - Knot one end of the cord in order to prevent the beads from sliding off
- 4 - String beads in order as they appear in the your name
- 5 - String the lanyard hook on the elasticized cord and secure it to the cord with a double knot.

**Appendix 6a
Slap Cards**

2

3

1

4

**Appendix 8a
Gender of Children**

The Gender of Children

Did you know that there is an equal probability that a child will be born female or male? When a family has more than one child, the gender of each child is an independent event that is not influenced by the gender of previously born children.

Did you know that there is an equal probability that a child will be born female or male? When a family has more than one child, the gender of each child is an independent event that is not influenced by the gender of previously born children.

Procedure:

1. Run a simulation to find the gender of each child in 10 families.
2. Each family will have 2 children
3. To find the gender of each child, toss a coin
4. Heads = male child
5. Tails = female child
6. Toss the coin for each child and then move to the next family.
7. Record your results in the table below, then answer the questions.
8. Make bar graphs using your table data. Each family will have 2 bar graphs: one for male children, one for female children.

Materials:

- Coin
- Graph paper
- Colored pencils

Family	Child 1	Child 2	Child 3
A			
B			
C			
D			
E			
F			
G			
H			
I			
J			

Answer the following questions:

1. How many families had three male children? Three female children?
2. How many of your families had the same order of male and female children?
3. How many different combinations of offspring are possible in this simulation?
4. Did anyone else in the class have exactly the same simulation results as you?
5. Why is the gender of each child an independent event?

**Appendix 9a
Genetic Traits**

**Genetic Traits
Lab**

You will observe several traits from your classmates. After collecting data, you will calculate the percentage of the traits in your classmates.

Procedures:

1. Get with your lab partner
2. Complete the column labeled “YOU” for the genetic traits listed
3. Your partner will help you with the genetic traits you cannot see
4. Complete the data table for yourself and your partner
5. Record the totals of each trait for the entire class
6. Calculate the percents for each

Trait	Description (Form)	You	Class Totals	Class Totals
Handedness	Left or Right			
Hairline	Straight or peaked			
Dimples	Yes or No			
Freckles	Present or Absent			
Hair Whorl	Clockwise or Counterclockwise			
Ear Lobe	Free or Attached			
Tongue	Roller or Non-roller			

Now, find the percent of each trait in the class and enter below.

Trait	Class Percents	Class Percents
Handedness	Left =	Right =
Hairline	Straight =	Peaked =
Dimples	Yes =	No =
Freckles	Present =	Absent =
Hair Whorl	Clockwise =	Counterclockwise =
Ear Lobe	Free =	Attached =
Tongue	Roller =	Non-roller =

Answer the following questions:

1. Do the percents of each trait add up to 100%? Why or why not?

2. What is the most common form of trait in your class?

3. Do any of the traits have evenly distributed forms in your class?

Appendix 10a
Egg Genetics

Egg Genetics

You will be choosing 4 eggs out of the basket and will figure out the genotypes of your “parent” eggs & you will do a Punnett Square for each egg to determine what offspring would be possible from such a cross. Your “offspring” will be inside the egg for you to look at after you figure your Punnett Square. You may eat your candy once the teacher has checked your work!

Chart

- PP = purple
- pp = pink
- Pp = orange
- BB = blue
- bb = yellow
- Bb = green

Offspring _____

Offspring _____

Offspring _____

Offspring _____

Appendix 12a Step by Step Instructions

1. Open up Microsoft PowerPoint
2. Create slides as needed including a title slide and a resource slide
 - a. Click on the new slide icon on the toolbar or insert on the menu bar and then click on new slide
 - b. There are several slide styles to choose from pick the one that best fitting your needs
3. Use titles for each slide to information your audience of the slide topic
4. Each slide should include enough information to explain the topic
5. Using Clip art or pictures from a file
 - a. Click on the Insert menu, pictures, clip art/from a file
 - i. Select the picture desired
 - ii. Place in the location and resize if necessary
6. Background if desired
 - i. Format menu, backgrounds
 - ii. Or right click backgrounds
7. Draw tools
 - a. Group
 - b. Order - helps organize how objects appear in our work example in front of or in back of another objects
 - i. Bring to Front
 - ii. Send to Back
 - iii. Bring Forward
 - iv. Send Backward
 - c. Nudge – use arrows (with ctrl it moves more gradually)
 - d. Rotate and flip – How to **rotate** an object/clip art – this works with other programs like Word and Excel
 - i. Select the object
 - ii. Then click on the draw drop box
 - iii. Select rotate or flip
 - iv. Then you can choose from
 - v. Free rotate
 1. Allows you to clip and drag the object in any direction
 - vi. Rotate right
 - vii. Rotate left
 - viii. Flip horizontal
 - ix. Flip vertical
 - e. Using AutoShapes line tools and other shapes
 - i. click and drag on the lines chart to float
 1. Line – creates straight lines
 2. Curve – creates curved lines
 3. Freeform – creates straight and curved line by using a combination of left button clicks and dragging. To end shape double click
 4. scribble – creates by using a pencil like tool while holding down the left mouse button

- 8. Slide Show tools
 - a. Custom Animation
 - i. All items (text, graphics, etc.) on slides can be animated (show movement)
 - ii. Click on Slide Show on menu bar and then custom animation
 - iii. When the sidebar appear select the item on slide to be animated and then choose the animation effect
 - b. Slide Transition
 - i. This feature will give a transition effect in-between each slide
 - ii. Click on Slide Show on menu bar and then slide transition
 - iii. When the sidebar appears select the transition
 - c. Timing
 - i. Slide transition or mouse click
 - 1. Set timing by going to slide show, slide transition
 - 2. choose the amount of time needed for each slide
 - 3. or simply click on the mouse or keyboard arrows to advance to the next slide as you present

Appendix 12b
Rubric
Multimedia Project : Reflection

Teacher Name: **Mrs. Gonzalez**

Student Name: _____

CATEGORY	4	3	2	1
Content	Covers topic in-depth with details and examples. Subject knowledge is excellent.	Includes essential knowledge about the topic. Subject knowledge appears to be good.	Includes essential information about the topic but there are 1-2 factual errors.	Content is minimal OR there are several factual errors.
Mechanics	No misspellings or grammatical errors.	Three or fewer misspellings and/or mechanical errors.	Four misspellings and/or grammatical errors.	More than 4 errors in spelling or grammar.
Sources	Source information collected for all graphics, facts and quotes. All documented in desired format.	Source information collected for all graphics, facts and quotes. Most documented in desired format.	Source information collected for graphics, facts and quotes, but not documented in desired format.	Very little or no source information was collected.
Attractiveness and Originality	Makes excellent use of font, color, graphics, effects, etc. to enhance the presentation. Product shows a large amount of original thought. Ideas are creative and inventive.	Makes good use of font, color, graphics, effects, etc. to enhance to presentation. Product shows some original thought. Work shows new ideas and insights.	Makes use of font, color, graphics, effects, etc. but occasionally these detract from the presentation content. Uses other people's ideas (giving them credit), but there is little evidence of original thinking.	Use of font, color, graphics, effects etc. but these often distract from the presentation content. Uses other people's ideas, but does not give them credit.
Organization	Content is well organized using headings and or bulleted lists to group related material.	Uses headings or bulleted lists to organize, but the overall organization of topics appears flawed.	Content is logically organized for the most part.	There was no clear or logical organizational structure, just lots of facts.
Total				