

Shallow Gene Pool – No Diving!

The Study of Cell Reproduction, DNA, and Genetics

Grade Level or Special Area: 7th Grade Science

Written by: Karen Eubanks, J. T. Hutchinson Junior High, Lubbock, TX

Length of Unit: 19 days

I. ABSTRACT

In this unit, students will be introduced to the two types of cell division and correlate the importance of these processes to genetics. Students will compare and contrast mitosis and meiosis and discuss their relevance to genetics. Each student will also demonstrate a basic understanding of DNA structure and function. Scientists that have greatly contributed to our knowledge of DNA will also be introduced. With classes having an emphasis on forensic science, students will solve a “crime” based on DNA “evidence.” By studying the work of Gregor Mendel, students will show a basic understanding of Mendelian Genetics.

II. OVERVIEW

A. Concept Objectives

1. Students discover that species can change through generations and that the instructions for traits are contained in the genetic material of the organisms. Students know the relationship between structure and function in living systems. (TEK 7.10)
2. Students know the relationship between structure and function in living systems. (TEK 7.9)
3. The student will learn how to use a variety of tools and methods to conduct science inquiry. (TEK 7.2)

B. Content from the *Core Knowledge Sequence*

1. Cell division, the basic process for growth and reproduction p. 176
 - a. Two types of cell division: mitosis (growth and asexual reproduction), meiosis (sexual reproduction)
 - b. Asexual reproduction: mitosis; diploid cells (as in amoeba)
 - c. Sexual reproduction: meiosis; haploid cells; combinations of traits
 - d. How change occurs from one generation to another; either mutation or mixing of traits through sexual reproduction
 - e. Why acquired characteristics are not transmitted
2. Modern understanding of chromosomes and genes p. 176
 - a. Double helix (twisted ladder) of DNA coding; how DNA makes new DNA
 - b. How DNA sequence makes proteins; one gene equals one protein
 - c. Genetic engineering
 - d. Modern researchers in genetics: Francis Crick, James Watson, Severo Ochoa, Barbara McClintock
3. Gregor Mendel’s experiments with purebred and hybrid peas p. 176
 - a. Dominant and recessive genes
 - b. Mendel’s statistical analysis led to understanding that inherited traits are controlled by genes (now known as DNA)

C. Skill Objectives

1. Students will identify that sexual reproduction results in more diverse offspring and asexual reproduction results in more uniform offspring. (TEKS: Science 7.10A)
2. Students will recognize that inherited traits of an individual are contained in genetic material. (TEKS: Science 7.10C)

3. Students will connect Grade 7 science concepts with the history of science and contributions of scientists. (TEKS: Science 7.3E)
4. Students will distinguish between dominant and recessive traits and recognize that inherited traits of an individual are contained in genetic material. (TEKS: Science 7.10C)
5. Students will make predictions about possible outcomes of various genetic combinations of inherited characteristics. (TEKS: Science 8.11C)
6. Students will collect, analyze, and record information to explain a phenomenon using tools including beakers, petri dishes, meter sticks, graduated cylinders, weather instruments, hot plates, dissecting equipment, test tubes, safety goggles, spring scales, balances, microscopes, telescopes, thermometers, calculators, field equipment, computers, computer probes, timing devices, magnets, and compasses. (TEKS: Science 7.3D)
7. Students will evaluate the impact of research on scientific thought, society, and the environment. (TEKS: Science 7.4A)

III. BACKGROUND KNOWLEDGE

A. For Teachers

1. *DNA: The Secret of Life* by James D. Watson, Andrew Berry
2. *The Cartoon Guide to Genetics* by Larry Gonick
3. “Genetic Science Learning Center” at the Eccles Institute of Human Genetics University of Utah <http://gslc.genetics.utah.edu/units/basics/>

B. For Students (Identify topics introduced in previous units or grade levels that provide students with necessary prior knowledge.)

1. Cell Structures and Processes (p.127)
2. Ratio, Percent, and Proportion (p. 148)

IV. RESOURCES

“Texas Science Grade 7” Glencoe/McGraw-Hill

V. LESSONS

Lesson One: Cell Reproduction - Mitosis (2 days)

A. *Daily Objectives*

1. Concept Objective(s)
 - a. Students discover that species can change through generations and that the instructions for traits are contained in the genetic material of the organisms.
 - b. Students understand the relationship between structure and function in living systems.
2. Lesson Content
 - a. Cell division, the basic process for growth and reproduction p. 176
 - i. Two types of cell division: mitosis (growth and asexual reproduction), meiosis (sexual reproduction).
 - ii. Asexual reproduction: mitosis; diploid cells (as in amoeba)
3. Skill Objective(s)
 - a. Students will identify that sexual reproduction results in more diverse offspring and asexual reproduction results in more uniform offspring. (TEKS: Science 7.10A)

B. *Materials*

1. Teacher – “Cell Reproduction – Mitosis” Power Point Notes
2. Teacher – Appendix 1a (Cell Reproduction – Cornell Notes, Answers), (class set)
3. Teacher – Appendices 1b (Mitosis coloring) and 1c (Mitosis Flip Book): (one/student)

4. Teacher – Computer
 5. Teacher – Computer projector (NOTE: For 3 and 4: Overhead transparencies of Appendices 1a thru 1d and overhead projector can be used.)
 6. Teacher – 14-21 Bottles/White glue (2-3 bottles/table)
 7. Teacher – 25 Scissors (1/student)
 8. Student – Note section in folder (notepaper)
 9. Student – Textbook: “Texas Science Grade 7” Glencoe/McGraw-Hill pp. 354-367 (Chapter 12. Section 1: Cell Division and Mitosis)
 10. Student – Pen or pencil
 11. Student – Colored pencils
- C. *Key Vocabulary*
1. mitosis – cell process in which the nucleus divides to form two nuclei identical to each other, and identical to the original nucleus, in a series of steps (prophase, metaphase, anaphase, and telophase).
 2. chromosome – structure in a cell’s nucleus that contains genetic material.
 3. asexual reproduction – a type of reproduction – fission, budding, and regeneration – in which a new organism is produced from one parent and has DNA identical to the parent organism.
 4. diploid – cell whose chromosomes occur in pairs; a complete set of chromosomes.
- D. *Procedures/Activities*
1. Individually, students will read pp. 354 to 358 in their textbook (Chapter 12. Section 1: Cell Division and Mitosis)
 2. Teacher will pass out Appendix 1a. In their lab groups, students will come up with the questions for answers 1 through 7 found on the handout. (20 minutes)
 3. Using “Cell Reproduction – Mitosis” notes, students will check and the class will discuss the questions students wrote down for questions 1 through 4.
 4. Students will copy statements 8 through 12 from Appendix 1a onto the answer side of their note pages. About one-half of a page should be left blank after each statement. (8 minutes)
 5. Teacher will pass out Appendix 1b. Each student will color the pictures showing an animal cell going through mitosis. All cell parts will be colored identically in each “phase” with special directions to color each chromosome (or sister chromatids) a different color. (For example one chromosome pair will be colored blue. This same shade of blue will be used in each diagram to color either sister chromatids or 2 chromosomes after anaphase).
 6. After coloring, each student will cut out the representative phases of mitosis (and interphase) and glue the pictures beside the appropriate “answers” that they wrote in their notes earlier (5 – 10 minutes).
 7. Colored diagrams and matching diagrams will be compared to teacher notes and discussed.
 8. Repeat steps 5 and 6 for the plant cell.
 9. Students will read pp. 359 and 360 and complete questions 14 through 20 on Appendix 1a in their lab groups
- E. *Assessment/Evaluation*
1. Using Appendix 1c, students will make a “Mitosis Flip Book.” Each page must be completed colored as completed earlier in notes and labeled with the correct phase of mitosis, interphase, or daughter cells.
 2. Cell Reproduction Test

Lesson Two: Mitosis – The Key to Growth Lab (2 days)

A. *Daily Objectives*

1. Concept Objective(s)
 - a. The student will learn how to use a variety of tools and methods to conduct science inquiry.
 - b. Students understand the relationship between structure and function in living systems.
 2. Lesson Content
 - a. Cell division, the basic process for growth and reproduction p. 176
 - i Two types of cell division: mitosis (growth and asexual reproduction), meiosis (sexual reproduction).
 - ii Asexual reproduction: mitosis; diploid cells (as in amoeba)
 3. Skill Objective(s)
 - a. Students will collect, analyze, and record information to explain a phenomenon using tools including beakers, petri dishes, meter sticks, graduated cylinders, weather instruments, hot plates, dissecting equipment, test tubes, safety goggles, spring scales, balances, microscopes, telescopes, thermometers, calculators, field equipment, computers, computer probes, timing devices, magnets, and compasses. (TEKS: Science 7.3D)
- B. *Materials*
1. Teacher – 7 Microscopes (one/two students)
 2. Teacher – 7 Mitosis microscope slide sets: *Ascaris* , onion tip, whitefish blastula (one/two students)
 3. Teacher – Blank sheets of paper (two/student)
 4. Teacher – Appendix 2a (Student and Teacher Grading Rubric); (one/two students)
 5. Student – Mitosis notes and diagrams
 6. Student – Pencil
 7. Student – Colored pencils
- C. *Key Vocabulary*
1. mitosis – cell process in which the nucleus divides to form two nuclei identical to each other, and identical to the original nucleus, in a series of steps (prophase, metaphase, anaphase, and telophase).
 2. chromosome – structure in a cell’s nucleus that contains genetic material.
- D. *Procedures/Activities*
1. Working in partners in using the microscopes and slides, student groups will get 4 sheets of notebook paper, one microscope, and one set of mitosis slides (3 slides/set). Each person will make complete a set of drawings.
 2. Students will fold each paper into 6 sections. (One fold in half edge-to-edge or “hotdog” style and two folds dividing the “hotdog” into thirds.)
 3. At the bottom of each rectangle, write each of the following in order starting in the upper left corner, then working to the right and down: interphase, prophase, metaphase, anaphase, and telophase. One rectangular section will be left blank, the lower right corner. In this blank rectangle, they are to write down the name of the specimen that is found on the label located on one of the slides.
 4. Students place one of the three slides on the microscope stage. They are to locate and draw “one cell that is in one of the phases of mitosis or in interphase. Students will continue this until the have located, drawn, and labeled cells for each of the phases or interphase.
 5. Partners will repeat step four for their second slide source. Out of the three slides, students may choose which two they wish to draw and label.
 6. Partners can decide which set papers will be the one evaluated by their peers and by the teacher.
- E. *Assessment/Evaluation*

1. Using Appendix 2a, students will evaluate the work of another group (partnership). They will score give 1 to 50 points. The teacher will look at the work and provide a score of 1 to 50 points. The point total will be the grade given to the two group members.
2. Cell Reproduction Test

Lesson Three: Meiosis and Sexual Reproduction (2 days)

A. *Daily Objectives*

1. Objective(s)
 - a. Students discover that species can change through generations and that the instructions for traits are contained in the genetic material of the organisms
 - b. Students know the relationship between structure and function in living systems.
2. Lesson Content
 - a. Cell division, the basic process for growth and reproduction p. 176
 - i. Two types of cell division: mitosis (growth and asexual reproduction), meiosis (sexual reproduction)
 - ii. Sexual reproduction: meiosis; haploid cells; combinations of traits
 - iii. How change occurs from one generation to another; either mutation or mixing of traits through sexual reproduction
3. Skill Objective(s)
 - a. Students will identify that sexual reproduction results in more diverse offspring and asexual reproduction results in more uniform offspring. (TEKS: Science 7.10A)
 - b. Students will recognize that inherited traits of an individual are contained in genetic material. (TEKS: Science 7.10C)

B. *Materials*

1. Teacher – Appendix 1a (Cell Reproduction – Cornell Notes, Answers), (class set)
2. Teacher – Appendix 3a (Meiosis Coloring), 3b (“Cell Reproduction” Video Questions), and 3c (Colored Phases of Meiosis), (one/student)
3. Teacher – 3” x 5” index cards (8/student)
4. Teacher – 14-21 bottles of glue (1 - 3/lab)
5. Teacher – 25 scissors (1/student)
6. Teacher – Computer
7. Teacher – Computer projector (NOTE: For 3 and 4: An overhead transparency of meiosis notes and overhead projector can be used.)
8. Teacher – “Sexual Reproduction and Meiosis” Power Point Notes
9. Teacher – Video: “Cell Division”
10. Student – Textbook: “Texas Science Grade 7” Glencoe/McGraw-Hill pp. 362 to 367 (Chapter 12. Section 2: Sexual Reproduction and Meiosis)
11. Student – Pencil
12. Student – Colored pencils

C. *Key Vocabulary*

1. sexual reproduction – a type of reproduction in which two sex cells, usually an egg and a sperm, join to form a zygote, which will develop into a new organism with a unique identity.
2. sperm – haploid sex cells formed in the male reproductive organs.
3. egg - haploid sex cell formed in the female reproductive organs.
4. fertilization - in sexual reproduction, the joining of a sperm and egg.
5. zygote – new diploid cell formed when a sperm fertilizes an egg; will divide by mitosis and develop into a new organism.
6. diploid - cell whose chromosomes occur in pairs.
7. haploid – cell that has only one of each type of chromosome.

8. meiosis - reproductive process that produces four haploid sex cells from one diploid cell and ensures offspring will have the same number of chromosomes as the parent organisms
 9. gametes – sex cells, reproductive cells, haploid
- D. *Procedures/Activities*
1. Individually, students will read pp. 362 to 365 in their textbook (Chapter 12. Section 2: Sexual Reproduction and Meiosis). Finish Appendix 1a.
 2. Students will pick up Appendix 3a from the materials table.
 3. Using the diagrams on pp. 364 and 365 as a guide, the each student will:
 - a. color the cell that is going through meiosis exactly as shown on the meiosis diagrams.
 - b. label the diagrams with the following terms: sister chromatids, spindle fibers, nuclear membrane, unduplicated chromosomes. Also, the students will label each of the phases of meiosis for each picture.
 4. Using “Cell Reproduction – Mitosis” notes, a few notations will be added to these diagrams,
 5. Students will watch the video “Cell Division” and complete the Appendix 3b, individually, as they are viewing the video.
 6. Class discussion on how crossing over causes recombination of genetic material and polysomy.
- E. *Assessment/Evaluation*
1. Pass out Appendix 3c.
 - a. cut out each phase of meiosis
 - b. glue pictures onto a 3” x 5” index cards. (Phase names are not to be put on at this time).
 - c. Students will have about 10 minutes to practice placing the cards in the correct order and doing so quickly.
 - d. Students will compete against each other for prizes as to who can place the cards in order the quickest.
 2. Working in groups, students will complete Appendix 3d, a Venn diagram, comparing and contrasting mitosis and meiosis.
 3. Cell Reproduction Test

Lesson Four: DNA – The Code of Life (2 days)

A. *Daily Objectives*

1. Objective(s)
 - a. Students discover that species can change through generations and that the instructions for traits are contained in the genetic material of the organisms.
 - b. Students know the relationship between structure and function in living systems.
2. Lesson Content
 - a. Modern understanding of chromosomes and genes p. 176
 - i. Double helix (twisted ladder) of DNA coding; how DNA makes new DNA
 - ii. Modern researchers in genetics: Francis Crick, James Watson, Severo Ochoa, Barbara McClintock
3. Skill Objective(s)
 - a. Students will recognize that inherited traits of an individual are contained in genetic material. (TEKS: Science 7.10C)
 - b. Students will connect Grade 7 science concepts with the history of science and contributions of scientists. (TEKS: Science 7.3E)
 - c. Students will evaluate the impact of research on scientific thought, society, and the environment. (TEKS: Science 7.4A)

B. *Materials*

1. Teacher – “DNA and Protein Synthesis” Power Point Notes; “DNA: The Code of Life”
 2. Teacher – Appendix 4a (DNA – Cornell Note Questions) (class set)
 3. Teacher – Appendix 4b (DNA Replication – Coloring) (one/ student)
 4. Teacher – Appendix 4c (Unfolding the Mysteries of DNA) (teacher directions)
 5. Teacher – Computer
 6. Teacher - Computer projector (NOTE: For 3 and 4: An overhead transparency of meiosis notes and overhead projector can be used.)
 7. Students – Note section in folder (notepaper) and several loose sheets
 8. Students – pen or pencil
 9. Textbook: “Texas Science Grade 7” Glencoe/McGraw-Hill pp. 368 to 370 (Chapter 12. Section 3: DNA)
 10. Students – colored pencils
- C. *Key Vocabulary*
1. DNA – deoxyribonucleic acid, which is the genetic material of all organisms, made up of two twisted strands of sugar-phosphate molecules and nitrogen bases.
 2. gene – section of DNA on a chromosome that contains instructions for making specific proteins.
 3. mutation – any permanent change in a gene or chromosome of a cell; may be beneficial, harmful, or have little effect on an organism.
- D. *Procedures/Activities*
1. Pass out Appendix 4a. Students will copy down *What is DNA?* questions onto the correct side of their Cornell note pages. (10 minutes)
 2. Students will answer the questions as they read pp. 368-371 in the textbook. (20 to 30 minutes.)
 3. Using “DNA: The Code of Life” notes, students and teacher will discuss the answers.
 4. Students will color, step-by-step, Appendix 4b.
 5. Review DNA replication.
- E. *Assessment/Evaluation*
1. To simulate DNA replication students will complete the activity found on Appendix 4c. Students will work individually as they follow oral directions from the teacher.
 2. DNA and Protein Synthesis Test

Lesson Five: DNA Extraction Lab (1 day)

- A. *Daily Objectives*
1. Objective(s)
 - a. Students know the relationship between structure and function in living systems.
 - b. The student will learn how to use a variety of tools and methods to conduct science inquiry.
 2. Lesson Content
 - a. Modern understanding of chromosomes and genes p. 176
 3. Skill Objective(s)
 - a. Students will recognize that inherited traits of an individual are contained in genetic material. (TEKS: Science 7.10C)
 - b. Students will collect, analyze, and record information to explain a phenomenon using tools including beakers, petri dishes, meter sticks, graduated cylinders, weather instruments, hot plates, dissecting equipment, test tubes, safety goggles, spring scales, balances, microscopes, telescopes, thermometers, calculators, field equipment, computers, computer probes, timing devices, magnets, and compasses. (TEKS: Science 7.3D)
- B. *Materials*
1. Teacher – Blender

2. Teacher – Split peas, bananas, broccoli, chicken liver, sweetbreads, and yeast
 3. Teacher – liquid detergent
 4. Teacher – graduated cylinder
 5. Teacher – strainer
 6. Teacher – test tubes (two/lab table)
 7. Teacher – meat tenderizer
 8. Teacher – “ How to Extract DNA from Anything Living” lab sheets (lab is at: <http://gslc.genetics.utah.edu/units/activities/extraction/>) (one/student)
 9. Teacher – 70 – 90% isopropyl or ethyl alcohol
 10. Teacher – wooden sticks: skewers or long toothpicks (two/lab table)
 11. Students – Pencil
- C. *Key Vocabulary*
1. enzyme - proteins that help chemical reactions happen more quickly.
- D. *Procedures/Activities*
1. Each lab table will prepare one sample from the list of materials from which DNA can be extracted shown here: peas, bananas, broccoli, chicken liver, spinach, calf thymus (sweetbreads), and yeast
 2. Each group will extract DNA from the material given to them by the teacher using directions from the above web page.
- E. *Assessment/Evaluation*
1. Class discussion on which substance worked best for extracting DNA. This class discussion will include the importance of the meat tenderizer and the detergent.

Lesson Six: Protein Synthesis (4 days)

- A. *Daily Objectives*
1. Objective(s)
 - a. Students discover that species can change through generations and that the instructions for traits are contained in the genetic material of the organisms.
 - b. Students know the relationship between structure and function in living systems.
 2. Lesson Content
 - a. Modern understanding of chromosomes and genes p. 176
 - i. How DNA sequence makes proteins; one gene equals one protein
 3. Skill Objective(s)
 - a. Students will recognize that inherited traits of an individual are contained in genetic material. (TEKS: Science 7.10C)
- B. *Materials*
1. Teacher – “DNA and Protein Synthesis” Power Point Notes; “Protein Synthesis”
 2. Teacher – Appendix 4c (Unfolding the Mysteries of DNA), (teacher copy)
 3. Teacher – Appendix 4a (class set)
 4. Teacher – Appendix 6a (Codon/Amino Acid Chart) (class set)
 5. Teacher – Appendix 6b (From DNA to Protein) (one/student)
 6. Teacher – Computer
 7. Teacher - Computer projector (NOTE: For 3 and 4: An overhead transparency of transcription and translation notes and overhead projector can be used.)
 8. Teacher – 14-21 Bottles/White glue (2-3 bottles/table)
 9. Teacher – 25 Scissors (one/student)
 10. Students – Note section in folder (notepaper) and several loose sheets
 11. Students – pen or pencil
 12. Students - Textbook: “Texas Science Grade 7” Glencoe/McGraw-Hill pp. 370 to 371 (Chapter 12. Section 3: DNA)
 13. Students – colored pencils

C. *Key vocabulary*

1. protein synthesis – process in which a cell makes proteins; the type of protein produced is determined by the genetic code found on DNA.
2. RNA - nucleic acid, which carries codes for making proteins from the nucleus to the ribosomes.
3. transcription – process by which the code for a protein is transferred from DNA to mRNA.
4. translation – the process whereby genetic information coded in messenger RNA directs the formation of a specific protein at a ribosome in the cytoplasm

D. *Procedures/Activities*

1. Pass out Appendix 4a. Students will copy down *Genes* questions onto the correct side of their Cornell note pages. (10 minutes)
2. Students will answer the questions as they read pp. 370-371 in the textbook. (12 minutes.)
3. Using “Protein Synthesis” notes, students and teacher will discuss the answers.
4. Animation of transcription, translation, and protein synthesis at Nobel e Museum: <http://www.nobel.se/chemistry/educational/dna/navigation.html> also transcription animation at http://wps.prenhall.com/wps/media/objects/487/498999/CDA13_2/CDA13_2c/CDA13_2c.htm
5. To simulate transcription, translation and protein synthesis, students will complete the activity found on Appendix 4c using folded sheets. Students will work individually on simulating transcription and translation with folded sheets of paper. Oral directions will be given by the teacher. When students are ready to identify the amino acids coded for by codons, they are to use Appendix 6a.

E. *Assessment/Evaluation*

1. Working individually, students will complete Appendix 6b to show basic comprehension of translation, transcription, and protein synthesis.
2. DNA and Protein Synthesis Test

Lesson Seven: Introduction to Genetics (3 days)

A. *Daily Objectives*

1. Objective(s)
 - a. Students discover that species can change through generations and that the instructions for traits are contained in the genetic material of the organisms.
 - b. Students know the relationship between structure and function in living systems
2. Lesson Content
 - a. Gregor Mendel’s experiments with purebred and hybrid peas p. 176
 - i. Dominant and recessive genes
 - ii. Mendel’s statistical analysis led to understanding that inherited traits are controlled by genes (now known as DNA)
3. Skill Objective(s)
 - a. Students will recognize that inherited traits of an individual are contained in genetic material. (TEKS: Science 7.10C)
 - b. Students will connect Grade 7 science concepts with the history of science and contributions of scientists. (TEKS: Science 7.3E)

B. *Materials*

1. Teacher – “Heredity” Power Point Notes
2. Teacher – Appendices 7a (Genetics Vocabulary), 7b (Law of Dominance and Segregation), and 7c (Heterozygous vs. Homozygous) (one per student)
3. Teacher – blank sheet of paper (one/two students)

4. Teacher – pennies (one/person)
 5. Teacher – blank sheet of paper (one/two students)
 6. Teacher – Appendix 7d (Making Ugly Babies) (class set: one/two students)
 7. Teacher – Computer
 8. Teacher - Computer projector (NOTE: For 3 and 4: An overhead transparency of meiosis notes and overhead projector can be used.)
 9. Students – Note section in folder (notepaper)
 10. Students – pen or pencil
 11. Students - Textbook: “Texas Science Grade 7” Glencoe/McGraw-Hill pp. 384 to 387 (Chapter 13. Section 1: Genetics)
 12. Students – colored pencils
- C. *Key Vocabulary*
1. genetics – study of heredity, or the passing on of traits from an organism to its offspring
 2. dominant – trait that is expressed when two different genes for the same trait are present; “stronger” of two traits.
 3. recessive – trait that seems to disappear when two different genes for the same trait are present; “weaker” of two traits
 4. phenotype – physical appearance
 5. genotype – gene makeup of an organism
 6. homozygous (purebred) – both genes are identical
 7. heterozygous (hybrid) – contains two different genes for a trait; or that combines traits of two different but related species
 8. allele – each member of a gene pair that determines a specific trait
 9. traits – physical characteristics
- D. *Procedures/Activities*
1. Students will read pp. 384 to 389 in text. (20 minutes)
 2. Pass out Appendix 7a, to each student. Students will write the vocabulary words into the note section of their folder. (Some of the words are repeats from earlier lessons, but this can be considered review.)
 3. As teacher places “Heredity” notes on the screen, students will add definitions to the words they previously wrote down in their notes. Additional notes can also be taken by the students.
 4. Class discussion over the work of Gregor Mendel – the Father of Modern Genetics. This discussion will give the students the background for studying complete dominance in monohybrid crosses. One source of inspiration for the discussion will be e
 5. Pass out Appendix 7b. Using this sheet as a guided practice, students will increase the depth of their knowledge regarding complete dominance. At this time, they will also be introduced to Punnett Squares. Students will work individually, but with the guidance of the teacher.
 6. To increase understanding of distinguishing between heterozygous and homozygous, students will complete Appendix 7c. In this simple exercise, students will work individually on their recognition skills using these two terms.
- E. *Assessment/Evaluation*
1. Working in partners, one “mother” and one “father,” students will complete Appendix 7d
 2. Genetics Test

Lesson Eight: Predicting Genetic Outcomes (3 days)

A. *Daily Objectives*

1. Objective(s)
 - a. Students discover that species can change through generations and that the instructions for traits are contained in the genetic material of the organisms.

2. Lesson Content
 - a. Cell division, the basic process for growth and reproduction p. 176
 - i. How change occurs from one generation to another; either mutation or mixing of traits through sexual reproduction
 - ii. Why acquired characteristics are not transmitted
 - iii. Gregor Mendel's experiments with purebred and hybrid peas p. 176
 - iv. Dominant and recessive genes
 3. Skill Objective(s)
 - a. Students will recognize that inherited traits of an individual are contained in genetic material. (TEKS: Science 7.10C)
 - b. Students will connect Grade 7 science concepts with the history of science and contributions of scientists. (TEKS: Science 7.3E)
 - c. Students will distinguish between dominant and recessive traits and recognize that inherited traits of an individual are contained in genetic material. (TEKS: Science 7.10C)
 - d. Students will make predictions about possible outcomes of various genetic combinations of inherited characteristics. (TEKS: Science 8.11C)
- B. *Materials*
1. Teacher – “Heredity” Power Point Notes Teacher – “Baby Steps Through the Punnett Square” (these pages can be found at <http://www.borg.com/~lubehawk/psquare.htm>) (class set)
 2. Teacher – Appendices 8a (Punnett Squares: Guided Practice) and 8b (Punnett Squares – The Real Thing) (one/student)
 3. Teacher – Appendix 8c (Reebop/Marshmellow Meiosis) (one/two students)
 4. Teacher – Computer
 5. Teacher - Computer projector (NOTE: For 3 and 4: An overhead transparency of meiosis notes and overhead projector can be used.)
 6. Teacher - 14 sets of pink (mom chromosomes)
 7. Teacher - 14 sets of green (dad chromosomes)
 8. Teacher – Large marshmallows
 9. Teacher – Small, colored marshmallows
 10. Teacher – Toothpicks
 11. Teacher – 14 each: blue and green markers
 12. Teacher – Small nails
 13. Teacher – Brads
 14. Teacher – Red and blue pipe cleaners
 15. Students – Note section in folder (notepaper)
 16. Students –pencil
 17. Students - Textbook: “Texas Science Grade 7” Glencoe/McGraw-Hill pp. 387 to 389 (Chapter 13. Section 1: Genetics)
- C. *Key Vocabulary* - Covered in Lesson Seven
- D. *Procedures/Activities*
1. Class discussion on how predictions on genetic outcomes can be made. Tool used is the Punnett Square.
 2. Pass out “Baby Steps Through the Punnett Square”.
 3. Students will read the pages individually, reviewing how to fill in Punnett Squares.
 4. Pass out Appendix 8a. Working as a class, students will complete the sample crosses.
 5. Pass out Appendix 8b. Students will complete this worksheet individually.
- E. *Assessment/Evaluation*
1. Appendix 8c – In groups of two, students will create a “Reebop.” This appearance of the creature will determined by the random choice of chromosomes, one from each of the

- parent. This activity does include complete and incomplete dominance, so a brief discussion on incomplete dominance should proceed the activity.
2. Genetics Test

VI. CULMINATING ACTIVITY

At the conclusion of this unit, students will complete a lab in which they will identify a hypothetical “criminal” based on DNA evidence. Students will be using electrophoresis to “run” DNA and using their results to identify the criminal. These electrophoresis uses are part of the biotechnology labs provided by the Texas Tech/Howard Hughes Medical Institute Program.

VII. HANDOUTS/WORKSHEETS

- A. Lesson One: Cell Reproduction - Mitosis
 1. Appendix 1a (Cell Reproduction – Cornell Notes, Answers)
 2. Appendix 1b (Mitosis coloring)
 3. Appendix 1c (Mitosis Flip Book)
- B. Lesson Two: Mitosis Lab - No Appendices
- C. Lesson Three: Meiosis and Sexual Reproduction
 1. Appendix 1a (Cell Reproduction – Cornell Notes, Answers)
 2. Appendix 3a (Meiosis Coloring)
 3. Appendix 3b (“Cell Reproduction” Video Questions)
 4. Appendix 3c (Colored Phases of Meiosis)
- D. Lesson Four: DNA – The Code of Life
 1. Appendix 4a (DNA – Cornell Note Questions)
 2. Appendix 4b (DNA Replication – Coloring)
 3. Appendix 4c (Unfolding the Mysteries of DNA)
- E. Lesson Five: DNA Extraction Lab
 1. “How to Extract DNA from Anything Living” lab sheets (lab is at: <http://gslc.genetics.utah.edu/units/activities/extraction/>)
- F. Lesson Six: Protein Synthesis
 1. Appendix 4c (Unfolding the Mysteries of DNA)
 2. Appendix 4a (DNA – Cornell Note Questions)
 3. Appendix 6a (Codon/Amino Acid Chart)
 4. Appendix 6b (From DNA to Protein)
- G. Lesson Seven: Introduction to Genetics
 1. Appendix 7a (Genetics Vocabulary)
 2. Appendix 7b (Law of Dominance and Segregation)
 3. Appendix 7c (Heterozygous vs. Homozygous)
 4. Appendix 7d (Making Ugly Babies)
- H. Lesson Eight: Predicting Genetic Outcomes
 1. Appendix 8a (Punnett Squares: Guided Practice)
 2. Appendix 8b (Punnett Squares – The Real Thing) (one/student)
 3. Appendix 8c (Reebop/Marshmellow Meiosis)

VIII. BIBLIOGRAPHY

- A. Books
 1. Biggs, Alton Lucy Daniel, Edward Paul Ortleb *Merrill Life Science* Westerville, Ohio: Glencoe Division of Macmillan/McGraw-Hill, 1994, ISBN 0-02-826399-5
 2. Freifelder, David David Hartl, and Leon Snyder *Basic Genetics*. Portola Valley, California: Jones and Bartlett Publishers, 1987, ISBN 0-86720-090-1
- B. Internet Resources

1. Cold Spring Harbor Laboratory *DNA From the Beginning*, July 4, 2003
<http://www.dnafb.org/dnafb/>
 2. Electronic Scholarly Publishing *Genetics in Context*, July 4, 2003
<http://www.esp.org/timeline/>
 3. Genetic Science Learning Center at the Eccles Institute of Genetics *How to Extract DNA from Anything Living*, March 16, 2003
<http://gslc.genetics.utah.edu/units/activities/extraction/>
 4. GlaxoSmithKline Genetics *Chromosomes and Genetics*, June 16, 2004
<http://genetics.gsk.com/chromosomes.htm>
 5. Hallick, Richard B. *Introduction to DNA Structure* July 4, 2003
http://www.blc.arizona.edu/Molecular_Graphics/DNA_Structure/DNA_Tutorial.HTML
 6. Hallick, Richard B. *Introduction to DNA Structure* July 4, 2003
http://www.blc.arizona.edu/Molecular_Graphics/DNA_Structure/DNA_Tutorial.HTML
 7. Johnson, Jerry G. *Chapter 8, Cell Reproduction* June 16, 2004
<http://www.sirinet.net/~jgjohnso/index.html>
 8. Lubey, Steve. *Lubey's Biohelp! – Baby Steps Through the Punnett Square*, March 26, 2002 <http://www.borg.com/~lubehawk/psquare.htm>
 9. Lubey, Steve. *Lubey's Biohelp! - Mendel's Genetic Laws*. June 17, 2004
<http://www.borg.com/~lubehawk/mendel.htm>
 10. Melcher, Ulrich Department of Biochemistry & Molecular Biology, *Mitosis and Meiosis* July 4, 2003 <http://opbs.okstate.edu/~melcher/MG/MGW1/MG1361.html>
 11. Nobel e Museum. June 17, 2004
<http://www.nobel.se/chemistry/educational/dna/navigation.html>
 12. Nova Online *How Cells Divide: Mitosis vs. Meiosis*, July 4, 2003
<http://www.pbs.org/wgbh/nova/miracle/divide.html#>
 13. Pearson Education/Prentice Hall, March 24, 2003
http://wps.prenhall.com/wps/media/objects/487/498999/CDA13_2/CDA13_2c/CDA13_2c.htm
 14. Rubistar <http://rubistar.4teachers.org/index.php>
 15. The University of Arizona, *The Biology Project “Cell Biology”* July 4, 2003
http://www.biology.arizona.edu/cell_bio/cell_bio.html
 16. Utah State Office of Education. *Mitosis or Meiosis*. July 4, 2003
<http://www.usoe.k12.ut.us/curr/science/sciber00/7th/genetics/sciber/animatin.htm>
 17. WGBH Educational Foundation *A Science Odyssey, You Try It: DNA Workshop* July 4, 2003 <http://www.pbs.org/wgbh/aso/tryit/dna/#>
 18. Yvette Petty *Welcome to the Tutorial on DNA Structure, Replication, Transcription and Protein Synthesis*, March 14, 2002 <http://www.ncc.gmu.edu/dna/index.htm>
- C. Magazines
1. Gess-Newsome, J. (1989). *Unfolding the mysteries of DNA*. *The Science Teacher*, 56(6), 74-75.
 2. Soderberg, P. (1992) *Marshmallow Meiosis*. *The Science Teacher*, 59(8)28-31.
- D. Videos and CD-ROMs
1. Discovery Channel School Science Collections, *Genetics*, 1999, ISBN 1-56331-865-2
 2. Discovery Channel School Assignment Discovery, *Discover Magazine Genetics*, 1997, ISBN 1-56331-640-4
 3. Rainbow Educational Media, *Cell Division*,

Appendix 1a Cell Reproduction Notes

Below, you will find the “answers” for the Cornell notes for Chapter 12, Cell Reproduction. As directed by the teacher, write down these answers in the right hand column of your notes and then the read the appropriate pages to design questions for these answers.

Section 1: Cell Division and Mitosis - pages 354 to 360

The Cell Cycle

1. begins with the cell’s formation, followed by growth and development, and then death
2. TEACHER NOTES: copy Figure 2, page 355 into the answer section of your notes
3. period of growth and development in eukaryotic cells; many cells make a copy of their hereditary material at this time
4. TEACHER NOTES: copy Figure 3, page 356 into the answer section of your notes

Mitosis

5. process in which the nucleus divides to form two identical nuclei
6. prophase, metaphase, anaphase, and telophase (PMAT)
7. structure in the nucleus that contains hereditary material
8. time in which 1) chromosomes duplicate, 2) they condense and become visible, 3) they appear thick and double stranded, 3) centromeres hold the sister chromatids (double stranded chromosomes) together
9. phase in which the nucleolus and nuclear membrane disappears, spindle fibers appear
10. phase in which the sister chromatids line up in the middle of the cell
11. phase in which the centromeres divide and individual chromatids move to the poles
12. phase in which 1) spindle fibers disappear, 2) chromosomes uncoil, 3) 2 nuclear membranes appear, 5) 2 nucleoli appear
13. after the nucleus has divided
14. each new nucleus produced by mitosis is identical to the original; same number and type of chromosomes
15. allows growth and replaces worn out or damaged cells

Asexual Reproduction

16. process by which an organism produces others of its same kind
17. type of reproduction in which a new organism (or more than 1) is produced from 1 parent
18. how prokaryotic cells (bacteria) reproduce
19. the formation of a new organism on the body of an adult, this will eventually break off of the adult (example: hydra)
20. process that uses cell division that replaces lost body parts

Section 2: Sexual Reproduction and Meiosis – pages 362 to365

Sexual Reproduction

1. type of reproduction in which a new organism is formed when 2 cells, one from each parent, come together

2. reproductive cells (TEACHER NOTES: The question for this answer will be given to you by your teacher.)
3. male gametes (reproductive cells)
4. female gametes
5. the joining of a sperm and egg
6. cell that is formed by fertilization
7. body cells (somatic cells) and gametes (sex cells)
8. cells with pairs of chromosomes
9. cells that have single set of chromosomes

Meiosis and Sex Cells

10. process that produces sex cells
11. 2

Appendix 3b

CLOZE EVALUATION QUESTIONS

CELL DIVISION

NAME _____

DIRECTIONS: Select the answer, from the four choices given, by circling the correct letter.

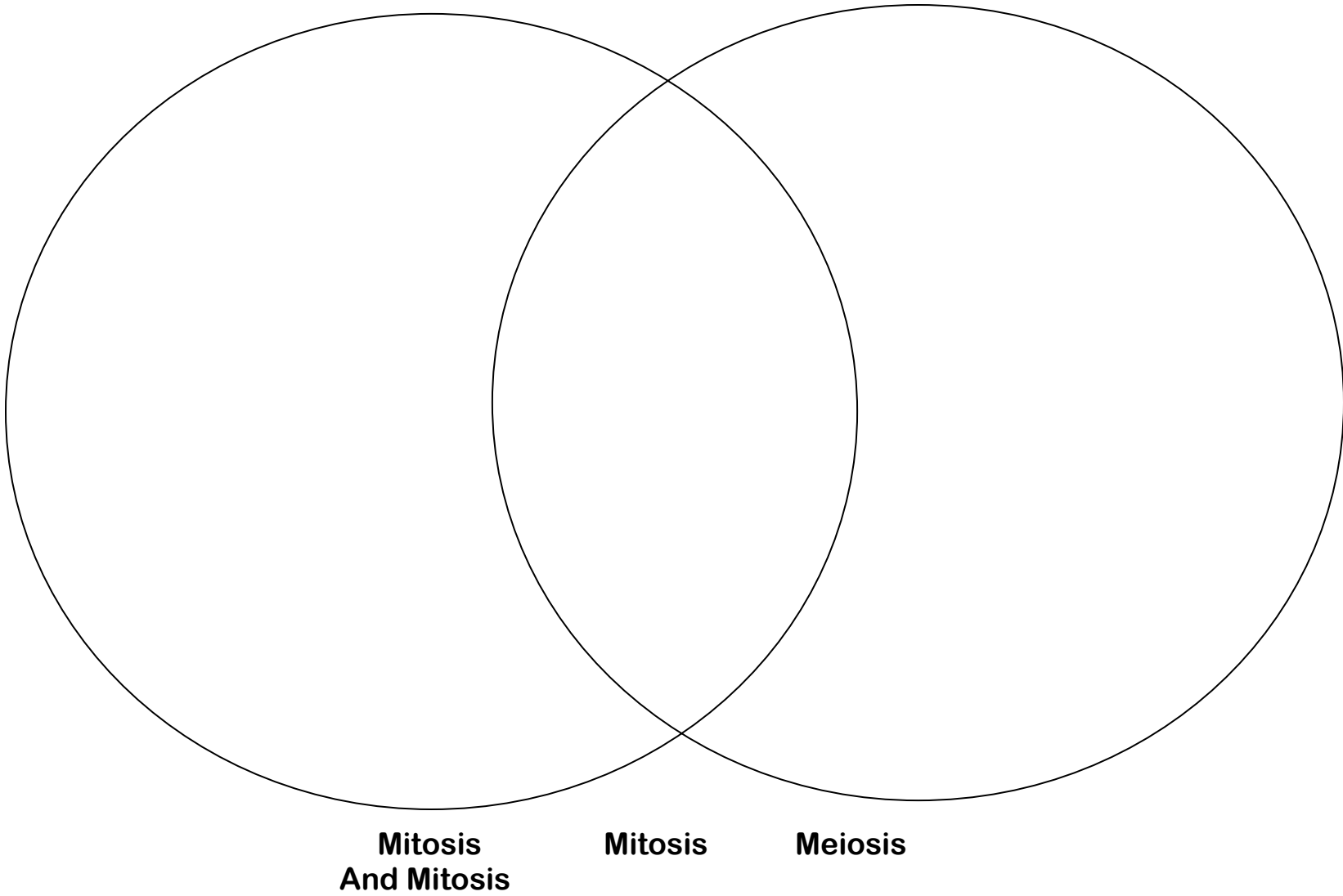
1. Living things on earth share certain similarities and differences. Basic structures common to both plants and animals are _____. These are the building blocks of life and they have distinct parts within them.
 1. A. air and oxygen
 - B. cells
 - C. water and bacteria
 - D. tissues
2. Both plants and animals are made of a variety of cells. However, some living things remain single-celled throughout their lives. One such organism is the _____. This organism is able to reproduce by cell division.
 2. A. hydra
 - B. bacterium
 - C. worm
 - D. ant
3. The process by which one or more of the same organism is produced is known as reproduction. One of two types is known as _____ because only one parent is needed. Bacteria reproduce in this way and some types can produce over a billion new bacteria in fewer than twelve hours.
 3. A. dividing
 - B. splitting
 - C. sexual reproduction
 - D. asexual reproduction
4. For most kinds of life, producing new offspring requires two parents, a father and a mother. This manner of reproduction is called _____. In this process each of the two different sexes supplies special cells for the reproduction process to take place.
 4. A. sexual reproduction
 - B. unification
 - C. asexual reproduction
 - D. conjunction
5. In sexual reproduction, sex cells from each parent join. From the male parent will come the _____, or the male sex cell. This specialized cell is produced in large numbers when the male creature is properly developed and ready.
 5. A. egg cell
 - B. sperm cell
 - C. flagellum
 - D. zygote
6. The other cell essential for sexual reproduction to occur is provided by the female parent. This is called the _____ and is larger than the male sex cell. It takes only one male and one female cell to unite for the process of new life to begin. This essential life process is common to all animal life forms.
 6. A. zygote
 - B. sperm cell
 - C. egg cell
 - D. flagellum
7. When the sperm and egg cells combine, they form a single new cell. This is called the _____ and it will divide to form two cells. These in turn divide to form four and the cell division process will continue. After awhile the cells start to differ from one another in order to carry out specialized jobs.
 7. A. sperm cell
 - B. egg cell
 - C. flagellum
 - D. zygote
8. There are structures within the cells that provide a plan or blueprint for what type of organism will develop. These are called _____ and are found within the nuclei of the cells. Each species has a specific number of these and they are inherited from the parents.
 8. A. chromosomes
 - B. genes
 - C. vacuoles
 - D. chloroplasts
9. Within the chromosomes are hereditary units that determine the specific physical characteristics of the organism. These _____ determine the color of our eyes, skin and hair. They determine face shapes and features, and are the reasons we resemble our parents.
 9. A. flagella
 - B. genes
 - C. vacuoles
 - D. cytoplasm
10. The process of cell division and specialization is a complex series of events. Cell division, or _____, insures that each chromosome makes an exact copy of itself. The result is that each new cell gets a complete set of chromosomes and genetic instructions.
 10. A. separation
 - B. meiosis
 - C. mitosis
 - D. replication

RAINBOW® EDUCATIONAL MEDIA

Toll free: 1-800-331-4047

This form may be reproduced without permission from Rainbow Educational Media.

**Appendix 3d
Mitosis vs. Meiosis**



Appendix 4a

DNA Notes

Below, you will find the “questions” for the Cornell notes for Chapter 12, Cell Reproduction. As directed by the teacher, write down these questions in the left hand column of your notes and then read the appropriate pages to answer these questions.

Section 3: DNA - pages 368 to 371

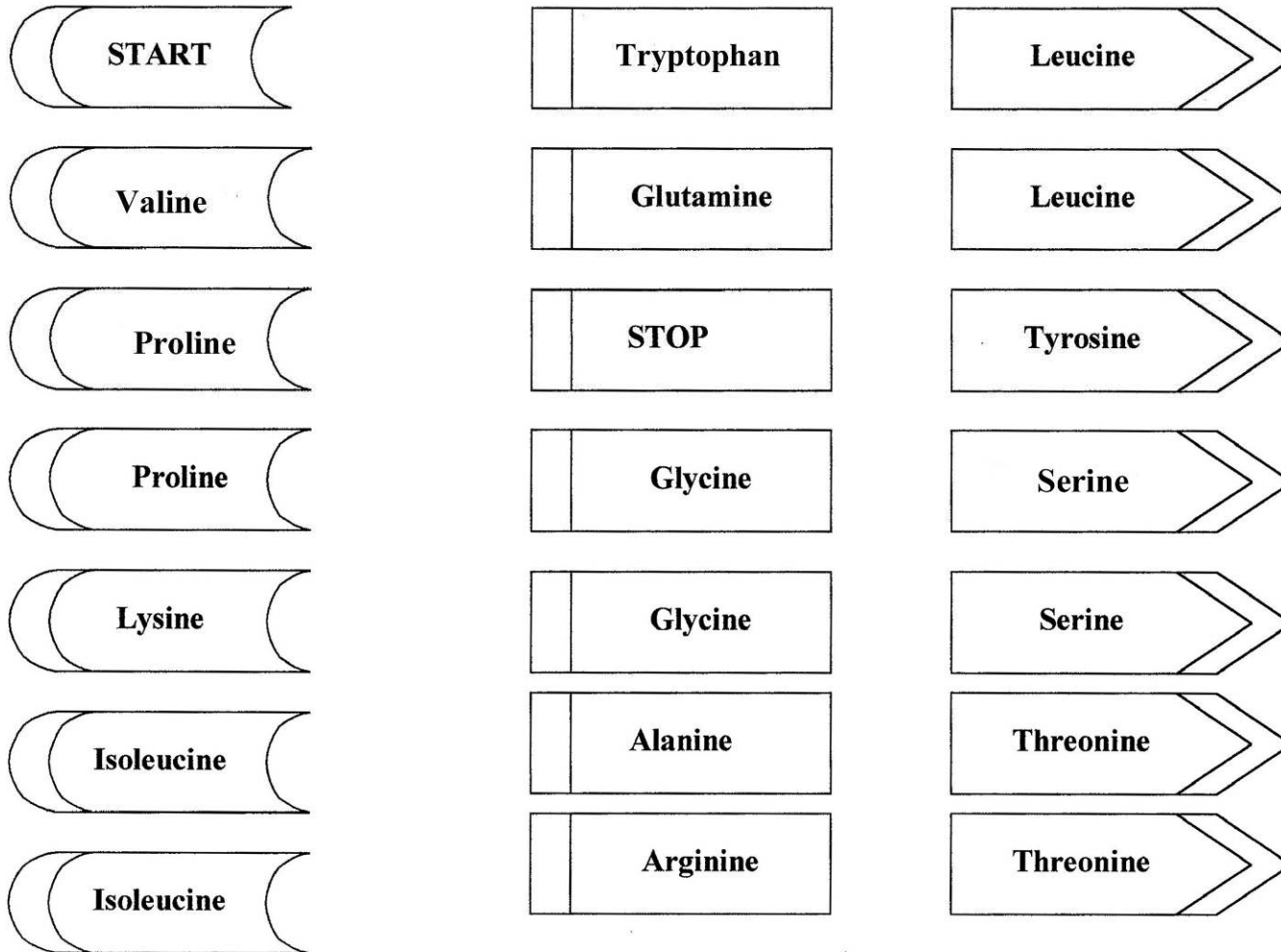
What is DNA?

21. What stores the code for hereditary material?
22. What do the letters DNA stand for?
23. What are the large molecules found in the nuclei of cells?
24. What was the discovery of Rosalind Franklin?
25. What was the discovery of James Watson and Francis Crick?
26. What two types of molecules make up the “sides” of a DNA molecule?
27. What make up the “rungs” of a DNA molecule?
28. List the four types of nitrogen bases.
29. What was the discovery of Edwin Chargaff? (TEACHER NOTE: This is in the notes without credit being given to Chargaff. Write this question in your notes and the answer will be given to you by your teacher.)
30. What base does adenine always pair with?
31. What base does guanine always pair with?
32. Give the three steps used when DNA makes a copy of itself. (Replication)

Genes

33. The characteristics that appear depend on the kinds of ____ your cell makes.
34. What stores the instructions for making these proteins?
35. What is a gene?
36. A chromosome contains ____ of genes.
37. What units make up proteins?
38. What determines the order of the amino acids?
39. On what cell organelle are proteins made?
40. What do the letters RNA stand for?
41. Give three ways RNA is different from DNA.
42. What are the three types of RNA?
43. What is the function of mRNA?
44. What is the function of tRNA?

Amino Acid Cut-out Sheet



Appendix 6b – Activity Sheets

DNA

T A C A C C C C G A A C A G C T C A T A A

mRNA

tRNA

DNA

C C G G G C A A T T G T C A T T A T A C T

mRNA

tRNA

Protein 1

Name: _____ Class: _____ Date: _____

Appendix 6b – Activity Sheets

DNA _____
T A C A C C A T G G A A T T T G T T G G T

mRNA _____

tRNA _____

DNA _____
T G A A G C A A T G G G A C T C T T A A T

mRNA _____

tRNA _____

Protein 2

Name: _____ Class: _____ Date:

Appendix 6b – Activity Sheets

DNA _____
T A C G A G T G G G T T A G C A T A T T T

mRNA _____

tRNA _____

DNA _____
C C G A A T C G G T G T G G G T C T A C T

mRNA _____

tRNA _____

Protein 3

Name: _____ Class: _____ Date: _____

Appendix 6b – Activity Sheets

DNA

T A C T A T C A T T G T A A T G G C C C G

mRNA

tRNA

DNA

A C C C C G A A C A G C T C A A C T T C T

mRNA

tRNA _____

Protein 4

Name: _____ Class: _____ Date:

Appendix 7a Genetics Vocabulary

Copy the following list of vocabulary words into your note section of your folder. The title for this section of notes is "Genetics." Remember to write these in the some form of a question (short form is acceptable) in the left hand column of your Cornell notes. Yes, some of the words we have covered before. Consider this part a brief review. After completing this, go back through the pages you just read and back through previous notes to find a short definition for these words. Write the definitions in the right hand column of your notes.

1. genetics
2. deoxyribonucleic acid
3. chromosomes
4. genes
5. dominant
6. recessive
7. phenotype
8. genotype
9. homozygous
10. heterozygous
11. hybrid
12. allele
13. diploid
14. haploid
15. gametes
16. traits
17. mitosis
18. meiosis
19. ribonucleic acid

Appendix 7a

Genetics Vocabulary Teacher's Notes

1. genetics – study of heredity, or the passing on of traits from an organism to its offspring
2. deoxyribonucleic acid – (DNA) molecule that stores and passes on genetic information from one generation to the next
3. chromosomes – structures found in the nucleus of every eukaryotic cell, contains the code for proteins
4. genes – units of heredity; segments of DNA on chromosomes
5. dominant – trait that is expressed when two different genes for the same trait are present; “stronger” of the two traits
6. recessive - trait that disappears when two different genes for the same trait are present; “weaker” of the two traits
7. phenotype – physical appearance
8. genotype – gene makeup of an organism
9. homozygous – both genes are identical
10. heterozygous – contains two different forms of the gene, dominant gene is expressed
11. hybrid – organism that has two different genes for a trait, or that combines traits of two different but related species
12. allele – each member of a gene pair that determines a specific trait.
13. diploid – cells that contain complete sets of chromosomes
14. haploid - cells that contain complete sets of chromosomes
15. gametes – reproductive cells; haploid
16. traits – physical characteristics (example: brown hair, blonde hair, freckles)
17. mitosis – cell process in which the nucleus divides to form two nuclei identical to each other
18. meiosis - reproductive process that produces four haploid cells from one diploid cell
19. ribonucleic acid – nucleic acid that “reads” the genetic information carried by DNA and guides protein synthesis

Appendix 7c

Homozygous versus Heterozygous

From the list of genotypes below, circle the homozygous genotypes.

bb HhXxdd HH Ss RR rr Rr TTtt Tt

Nnww Pp Bbhh SS NN XX BB Ww DD xx

BbDdss nn WW dd PP Gggg pp GG Yy

From the list of genotypes below, circle the heterozygous genotypes.

Gggg pp dd HH Ss Nnww Pp TTtt Tt

Bbhh SS RR rr Rr NN XX BbDdss nn

BB Ww DD xx GG YyPP bb HhXx WW dd

Homozygous versus Heterozygous

From the list of genotypes below, circle the homozygous genotypes.

bb HhXxdd HH Ss RR rr Rr TTtt Tt

Nnww Pp Bbhh SS NN XX BB Ww DD xx

BbDdss nn WW dd PP Gggg pp GG Yy

From the list of genotypes below, circle the heterozygous genotypes.

Gggg pp dd HH Ss Nnww Pp TTtt Tt

Bbhh SS RR rr Rr NN XX BbDdss nn

BB Ww DD xx GG YyPP bb HhXx WW dd



Appendix 7d

GENETICS: You are a Unique Person “MAKING UGLY BABIES”



Guiding Question: Why do I look like both of my parents?

Objectives:

1. Determine dominant and recessive alleles.
2. Relate the law of probability to the study of genetics.
3. Explain the difference between phenotype and genotype.
4. Explain how traits are passed from one generation to the next generation.
5. Explain the difference between dominant and recessive traits.

Materials:

1. Pencil
2. Characteristics handout
3. Coins (1 per person)
4. Cup (1 per partnership)
5. Plain paper
6. Birth announcement handout

PROCEDURE AND ACTIVITY

INTRODUCTION

1. Look around the room. Is anyone else here just like you? Every person you know or ever will know is unique.
2. Many of our traits, or characteristics, are inherited from our parents.
3. Today, we are going to identify some genetic or inherited traits. By “tossing” the coins, we will decide which trait our adopted babies will have.



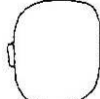









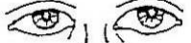
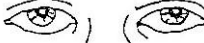
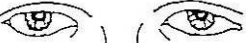


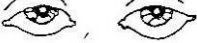






ACTIVITY

1. Place the two coins (one from each partner) into the cup. Place your hand on top of the cup and shake it vigorously. If both coins either come up heads or both come up tails, then your baby will be a girl. If one of the coins comes up heads and the other comes up tails, then it will be a boy. Come up with a name for the baby and fill in the top of the Birth Announcement and the first two sentences, being sure to circle the appropriate sex.
2. To determine what your baby will look like, you will shake the cup many more times. Go down the characteristics handout and shake the coins for each trait. If both coins land on heads, the dominant trait will be exhibited. If one coin lands on heads and one coin lands on tails, the hybrid trait will be exhibited. If both coins land on tails, the recessive trait will be exhibited. As you complete each coin toss, write the appearance of the trait on Chart 1.
3. After recording all of your traits, draw a picture of your baby on the plain sheet of paper.

Chart 1

TRAIT	GENOTYPE	PHENOTYPE
Sex		
Shape of face		
Cleft of chin		
Hair texture		
Widow's peak		
Spacing of eyes		
Shape of eyes		
Position of eyes		
Size of eyes		
Bone Structure		
Size of feet		
Color of eyes		
Length of eyelashes		
Shape of eyebrows		
Size of nose		
Shape of lips		
Size of ears		
Size of mouth		
Freckles		
Dimples		
Color of hair		
Ability to roll tongue		

Appendix 7d Characteristic Chart

Traits	Dominant (both heads)	Hybrid (one head, one tail)	Recessive (both tails)
Length of eyelashes	 Round (RR)	 Round (Rr)	 Square (rr)
Cleft in chin	 Absent (CC)	 Absent (Cc)	 Present (cc)
Hair texture	 Curly (HH)	 Wavy (Hh)	 Straight (hh)
Widow's peak	 Present (WW)	 Present (Ww)	 Absent (ww)
Spacing of eyes	 Close together (EE)	 Normal distance (Ee)	 Far apart (ee)
Shape of eyes	 Almond (AA)	 Almond (Aa)	 Round (aa)
Position of eyes	 Straight (SS)	 Straight (Ss)	 Slant upwards (ss)
Size of eyes	 Large (LL)	 Medium (Ll)	 Small (ll)
Bone Structure	Fine (BB)	Medium (Bb)	Heavy (bb)
Size of Feet	Large (FF)	Medium (Ff)	Small (ff)
Color of eyes	Brown (BB)	Green (Bb)	Blue (bb)

Appendix 7d

ANNOUNCING THE BIRTH
OF

This is to announce the birth of _____,
a delightful little **boy/girl**. The proud guardians are
_____ and _____.

This baby has the most beautiful **brown/red/blond** hair which will
grow to be quite **curly/wavy/straight**. Naturally, **he/she can/**
cannot roll **his/her** tongue. **He/She** will be a welcomed addition to
the family **with/without** **his/her** widow's peak, **fine/medium/**
heavy bone structure and **large/medium/small** feet.

_____ will have **round/**
square face with **a cleft/no cleft** in the chin. This **brown/green/**
blue eyed baby **girl/boy** will have large/**medium/small**, **almond/**
round shaped eyes which will be **straight across/slant upward** and
close together/normal distance/far apart. **With/Without** **his/her**
freckles peppered across **his/her** **large/medium/small** nose and
dimpled/not dimpled face there is no doubt this cute little bundle of
joy is bound for fame and fortune.

The **large/normal/small** ears will frame the smiling **large/**
medium/small mouth which has **thick/normal/thin** lips. His/her
eyes will be accentuated with **long/short** eyelashes shaded by
bushy/fine eyebrows that **are/are not** connected

Appendix 8a Punnett Squares – Guided Practice

Using your “Baby Steps Through the Punnett Square” notes and any other resources you have, complete the following four genetic problems. Complete only one “answer” at a time. The teacher will then ask students how they completed the parts of the problem. You are to compare your work with the answer as it is presented. Be sure to follow the steps as you were directed by your teacher. Each answer should be in the same form as you see below:

Parent Genotype Cross

Genotype:

Phenotype:

Problems:

There are two colors of seed coats in peas. Green is the dominant color (G), while white seed coats are recessive (g). Use this information to complete problems #1 and #2.

1. ♂ Homozygous dominant x ♀ Homozygous recessive

2. ♂ Heterozygous x ♀ Homozygous recessive

Peas can come in two forms. Peas can be round (which you are probably most familiar with), but they can also be wrinkled. Round peas (R) are dominant over wrinkled peas (r). Use this information to complete problems #3 and #4.

3. ♂ Homozygous dominant x ♀ Homozygous recessive

4. ♂ Heterozygous x ♀ Heterozygous

Appendix 8b

Punnett Squares Worksheet

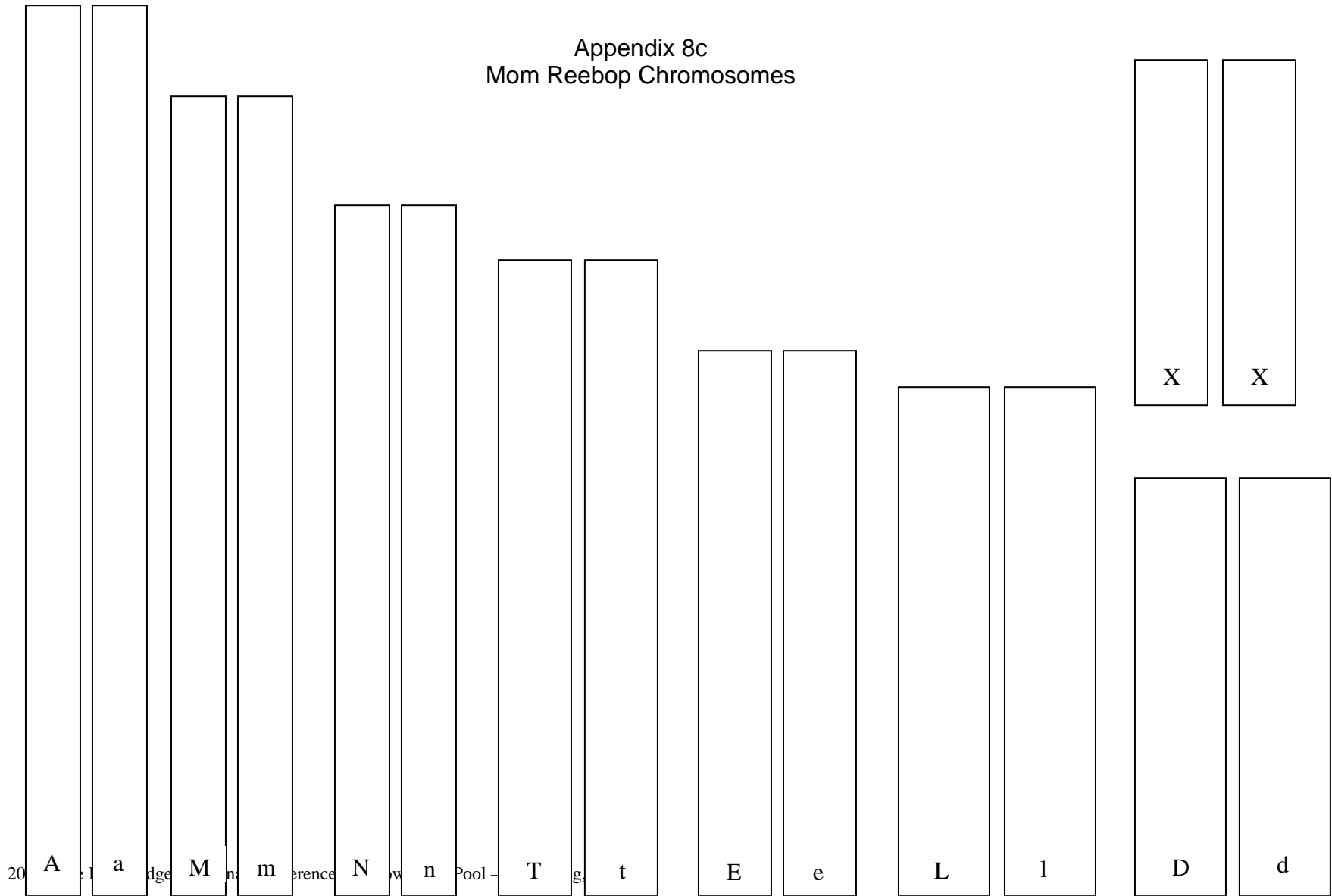
Problem #1: In a certain species of mouse, pointed ears (E) are dominant over round ears (e). Using a Punnett square, predict the genotypes and phenotypes of a cross between two heterozygous mice.

Work space:

Problem #2: In a certain species of dog, a black nose (B) is dominant over a pink nose (b). Predict the genotypes and phenotypes of a cross between a homozygous dominant male and homozygous recessive female.

Workspace:

Appendix 8c
Mom Reebop Chromosomes



Appendix 8c
Dad Reebop Chromosomes

