ALABAMA SCIENCE

Student Assessment
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What is our Goal Today?

• Briefly discuss the *Alabama Course of Study: Science*, Bulletin 2005, No. 20
• Discuss the Alabama Science Assessment: Grades 5 and 7 development timeline
• Discuss eligible content for Grade 5
• Discuss eligible content for Grade 7
• Answer questions
A Curriculum Document:

- Containing the *Minimum Required Content* of a Subject Area for All Alabama Public Schools

- Specifying What Students Should *Know and Be Able to Do* in a Particular Subject Area by the End of Each Course and Grade Level (K-12)
Influence of No Child Left Behind on Alabama's Science Academic Content Standards

- Standards apply to all students.
- Standards are not repeated.
- Standards are clear and measurable at the state level.
- Mastery is expected at each grade level.
- Content standards are fewer in number.
- Bullets are related content that must be taught.
Interpreting the Content Standards

Content standards:

• Define *what* students should *know* and *be able to do* at the conclusion of a course or grade

• Identify *minimum* required content

Bullets:

• Contain *additional* related and *required* content

Examples:

• *Clarify* certain components of content standards and/or bullets

• Are *illustrative* but *not exhaustive*
Science for Every Student in Every Grade Every Day? Yes!!
WHY?
“As educators, we know we cannot wait until students are in the eleventh and twelfth grade to foster a love of science and mathematics; the love has to be nurtured and promoted throughout the K-12 experience.”

Jo Anne Vasquez, NSB Member
The Alabama Science Assessment: Grades 5 and 7

According to the *No Child Left Behind Act* of 2001, by the 2007 – 2008 school year, states must administer annual science assessments at least once in Grades 3 – 5, Grades 6 – 9, and Grades 10 – 12. In order to comply with this federal law, these assessments must be aligned with state academic content and achievement standards and involve multiple measures of higher-order thinking and understanding.
The Alabama Science Assessment: Grades 5 and 7

The Alabama Science Assessment: Grades 5 and 7 will measure students’ mastery of the Alabama Course of Study: Science, Bulletin 2005, No. 20. The Alabama Science Assessment: Grades 5 and 7 will be a criterion-referenced test. The assessment will have approximately 60 – 74 multiple-choice items.
Development Timeline

• December 11, 2003 – Resolution to Appoint the Science State Course of Study Committee

• January 13, 2005 – The State Board of Education Received Resolution for Adoption of Science State Course of Study

• February 10, 2005 – Resolution for Adoption of Science State Course of Study
Development Timeline

November 10, 2005 – Approved Recommendations of the State Textbook Committee for Adoption and Rejection of Textbooks for Science

January 2006 – Award State Contract to Develop the Grade 5 and Grade 7 Science Assessment

March 2006 – Test/Item Specifications Meeting for Grades 5 and 7
Development Timeline

• March 2006 – System Test Coordinators Provide Superintendent Recommendations for Teachers to Serve on Bias and Content Committees

• March – July 2006 – Item Development

• July 18 – 20, 2006 – Content and Bias Committee Reviews

• September 18 – 20, 2006 – Content and Bias Committee Reviews
When there were questions about test items, they were literally tested for accuracy.
Development Timeline

- April 16 – 24, 2007 – Item Pilot Administration


- July 2007 – Fall 2007 – Develop Item Specifications for Distribution to LEAs

- April 9 – 22, 2008 – Live Administration for Grades 5 and 7
What’s Assessed at Grade 7?

Life Science
Standard 1
Describe characteristics common to living things, including growth and development, reproduction, cellular organization, use of energy, exchange of gases, and response to the environment.
Characteristics of living things

- Are both complex and organized.
- Acquire and use both materials and energy.
- Exhibit some capacity to regulate their internal conditions (homeostasis).
- Show the capacity for growth.
- Respond to stimuli.
- Reproduce themselves.
- Have the capacity to evolve.
4. **Diagram 1** shows a frog's life cycle with two missing stages. **Diagram 2** shows the two stages that are missing from the frog's life cycle in diagram 1. They are labeled A and B.

Complete the frog's life cycle in **Diagram 1** by writing A in the empty circle where stage A belongs and B in the empty circle where stage B belongs.

Explain why you placed the letters A and B where you did.
SEXUAL AND ASEXUAL REPRODUCTION

Keep It Simple!!!
Composed of at Least One Cell
Use of Energy - to undergo life processes
Energy from the Sun is taken up by the plants, which absorb that energy in their chloroplasts.

Plants can reuse these products with the input of energy from the Sun.

In the process, they convert the highly ordered sugars into carbon dioxide and water, a disorganized form.

Animals use the sugars to produce their own "energy currency" through the mitochondria.

The energy source for animal life processes.
In nature, the materials needed by all organisms in an ecosystem are reused or recycled. Nitrogen, carbon, oxygen, and other nutrients move through ecosystems in a predictable pattern or cycle. These nutrient cycles in nature are called biogeochemical cycles.
OXYGEN CYCLE

Oxygen in air

Plants use CO₂ to make food

Carbon dioxide in air

Respiration

Carbon stored in plant tissues

Dead plants

Decomposers give off CO₂

Animal waste
Dead animals

Plants eaten by animals—carbon stored in animal tissues
**Carbon Cycle**

- **Carbon dioxide in the atmosphere**
  - Carbon is released into the atmosphere when fossil fuels are burned.
  - Carbon is released into the atmosphere during respiration.
  - Carbon dioxide is used in photosynthesis to produce carbohydrates.

- **Plants are eaten by animals**

- **Carbon dioxide in decaying matter and waste**

- **Carbon dioxide in fossil fuels (coal & oil)**

- **Decaying plants produce**
NITROGEN CYCLE

Nitrogen in the atmosphere

Nitrogen in plant and animal proteins

Nitrogen in decaying matter and waste (solid and liquid)

Nitrogen fixing bacteria convert (change) nitrogen found in the atmosphere into compounds that can be used by plants

Denitrifying bacteria produce nitrogen gas

Nitrogen compounds in soil

Ammonia

Nitrites

Nitrates
Tropism
• A plant's responses to gravity, moisture and light are called **tropisms**. Tropisms can be either negative - away from the stimulus; or positive - towards the stimulus.
These two plants were grown from cuttings so they are genetically identical. They are both the same age, but the one on the left has been kept in a dark place.
Originally, the pot was upright and the plant growth was vertical. After the pot was laid on its side, over time, the stem begin to grow upwards, instead of straight out of the pot (which would have been to the right here).
Stimulus: Hot pan
Response: Remove hand
Standard 2
Identify functions of organelles found in eukaryotic cells, including the nucleus, cell membrane, cell wall, mitochondria, chloroplasts, and vacuoles.
16. In the picture of a cell below, which label indicates the part of the cell that contains most of the cell’s genetic material?

A) 1  
B) 2  
C) 3  
D) 4
EUKARYOTIC CELL

Diagram of a eukaryotic cell showing various organelles and structures such as the nucleolus, nucleus, endocytotic vesicle, cytoplasm, smooth endoplasmic reticulum, Golgi apparatus, centriole, rough endoplasmic reticulum, vacuole, nuclear membrane, mitochondria, lysosome, and cell membrane.
The nucleus contains the genetic material necessary in controlling cellular activities.
The cell membrane regulates what substances enter and exit the cell and supports the contents of the cell.
The cell wall is the tough outer layer surrounding a plant and fungal cell giving it shape and support.
The mitochondria provides the cell with energy.
The chloroplasts change energy from the Sun into food through a process called photosynthesis. Chloroplasts contain the green pigment chlorophyll.
Vacuoles are organelles used to store food, water, and waste. They are common in both plant and animal cells.
### WHICH ONE IS BETTER?

**Organelle**
- **Cell Membrane**: Acts as the cell's gatekeeper.
- **Nucleus**: Acts as the cell's computer.
- **Mitochondrion**: Acts as the cell's power plant.
- **Endoplasmic Reticulum**: Acts as the cell's construction team.
- **Golgi Apparatus**: Acts as the cell's packing department.

<table>
<thead>
<tr>
<th>ORGANELLE</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nucleus</td>
<td>Controls Cellular Activities</td>
</tr>
<tr>
<td>Cell Membrane</td>
<td>Regulates what Substances Enter and Exit the Cell</td>
</tr>
<tr>
<td>Cell Wall</td>
<td>Provides Shape and Support for Plants</td>
</tr>
<tr>
<td>Mitochondria</td>
<td>Provides the Cell with Energy</td>
</tr>
<tr>
<td>Chloroplast</td>
<td>Converts Sunlight to Energy through Photosynthesis</td>
</tr>
<tr>
<td>Vacuole</td>
<td>Stores Food, Water, and Waste</td>
</tr>
</tbody>
</table>
Standard 3
Relate major tissues and organs of the skeletal, circulatory, reproductive, muscular, respiratory, nervous, and digestive systems to their functions.
SKELETAL SYSTEM
BONES
CARTILAGE
JOINTS
Bones
Cartilage
Joints

elbow = hinged joint
vertebrae = cartilagenous joints
hip = ball and socket joint
ribs and vertebrae = semi-mobile joints
• Protection
• Shape
• Movement
THE CIRCULATORY SYSTEM

Blood Circulation
Principal Veins and Arteries

- Internal Jugular Vein
- Common Carotid Artery
- Subclavian Vein
- Subclavian Artery
- Superior Vena Cava
- Axillary Artery
- Pulmonary Vein
- Brachial Artery
- Inferior Vena Cava
- Hepatic Vein
- Portal vein
- Radial Artery
- Ulnar Artery
- Superior Mesenteric Artery
- Common Iliac Artery
- Internal Iliac Artery
- External Iliac Artery
- Femoral Artery
- Great Saphenous Vein
- Femoral Vein
- Pulmonary Artery
- Axillary Vein
- Common Hepatic Artery
- Cephalic Vein
- Basilic Vein
- Splenic Artery
- Splenic Vein
- Cubital Vein
- Radial Vein
- Renal Artery
- Renal Vein
- Abdominal Aorta
- Median Vein of Forearm
THE CIRCULATORY SYSTEM
CIRCULATORY SYSTEM

• Pumps blood through the body taking oxygen and nutrients to body cells.
• Picks up needed materials from the lungs and digestive system and carries them to the body.
• Carries waste products to where they can be eliminated.
• Helps fight disease and injury by carrying the substances that will heal you.
Red blood cells carry oxygen to cells and carbon dioxide away from cells.
White blood cells protect the body against invading organisms.
Blood plasma is the liquid component of blood, in which the blood cells are suspended.
Platelets are clotting agents in the blood.
The circulatory system carries oxygen, carbon dioxide, wastes, and nutrients throughout the body.
Reproduction is a characteristic of all living systems; because no individual organism lives forever, reproduction is essential to the continuation of every species.

*National Science Education Standards*
TESTES - Produce Sperm
OVARIES - Develop Eggs
UTERUS - Supports the Development of a Fertilized Egg
The reproductive system allows for the production of offspring and the continuation of life.
MUSCULAR SYSTEM

Too Much Information
Students should know the 3 types of muscles and the functions of the muscular system.

- Cardiac muscle cell
- Skeletal muscle cell
- Smooth muscle cell
• Cardiac Muscle - Found in the Heart

• Skeletal Muscle - Attached to Bones

• Smooth Muscle - Found in the Digestive System
FUNCTIONS OF THE MUSCULAR SYSTEM

• Supports and Enables the Body to Move
• Produces Heat
• Gives the Body Shape
RESPIRATORY SYSTEM
Students should know all components of the respiratory system.
Grade 7 students should know the workings of all parts of the respiratory system.

- Lungs
- Trachea
- Alveoli
- Diaphragm
- Nose
The lungs are the site for exchange of oxygen and carbon dioxide.
The trachea is the airway that connects the nasal passages to the lungs.
Alveoli are tiny air sacs in the lungs.
The diaphragm is a muscle that assists in breathing by contracting and relaxing.
The nose helps clean air before it enters the lungs.
The respiratory system provides the body with oxygen and removes carbon dioxide from the blood.
The brain is the organ that controls body activities.
The spinal cord is the bundle of nerves running from the brain down the center of the backbone.
NERVES

Nerves are comprised of neurons that conduct information.
The nervous system gathers information, interprets information, and responds to information.
DIGESTIVE SYSTEM

Sink your teeth into The Human Digestive System!
The mouth is where the digestion process begins.
The esophagus is the pathway for food from the mouth to the stomach.
The stomach is where food is stored and partially digested.
The small intestine is where most digestion takes place and nutrients are absorbed.
In the large intestine, excess water is reabsorbed and waste materials are compacted.
The digestive system breaks down food, either chemically or physically, and processes it for use by the body and excretes waste products.
44. Look at the picture above, which shows some of the organs that can be found inside the human body. What is the main job of the organ labeled 1?

A) Carrying air  
B) Carrying food  
C) Carrying blood  
D) Carrying messages from the brain
185. In the human body the digestion of proteins takes place primarily in which two organs?

A) Mouth and stomach  
B) Stomach and small intestine  
C) Liver and gall bladder  
D) Pancreas and large intestine
Standard 4
Describe organisms in the six-kingdom classification system by their characteristics.

Diagram:
- **PLANTAE** (Multicellular, eukaryotic)
- **ANIMALIA** (Multicellular, eukaryotic)
- **FUNGI** (Multicellular, eukaryotic)
- **PROTISTA** (Eukaryotic, unicellular and multicellular)
- **EUBACTERIA** (Unicellular, prokaryotic)
- **ARCHAEBACTERIA** (Unicellular, prokaryotic)
THERE USED TO BE ONLY 5 KINGDOMS

1. Monera
2. Protista
3. Fungi
4. Plantae
5. Animalia

This kingdom has now been divided into 2 – archaebacteria & eubacteria
THE NEW 6 KINGDOM CLASSIFICATION SYSTEM

6 Kingdoms

- Archaebacteria
- Eubacteria
- Protista
- Fungi
- Plantae
- Animalia

\{ \text{Prokaryotes} \}

\{ \text{Eukaryotes} \}
Archaebacteria

• The prefix "ARCHEA" means ANCIENT. They are considered ancient because they probably resemble the FIRST FORMS of LIFE on Earth.

• Live in very harsh environments
Archaebacteria can live where no other organism can survive. They live in extreme environments, such as acidic hot springs, near undersea volcanic vents, and highly salty water.
Eubacteria

It is the eubacteria that most people are talking about when they say bacteria, because they live in more neutral conditions.
Major characteristics of the Eubacteria include:
• all eubacteria are unicellular
• are microscopic
• some can make their own food (autotrophs) while others rely on external sources of nutrition (heterotrophs)
Protista

Protists include many widely ranging microbes, including slime molds, protozoa, and primitive algae.
Protists

- There are animal-like, fungus-like, and plant-like protists
- Some are beneficial
- Some protists cause diseases
Protists Locomotion

• 3 types of movement:
  – Pseudopod (false foot)
  – Flagella/cilia
  – Contractile vacuoles
Protists Nutrition

Protists can be autotrophs or heterotrophs
Fungi

- The Kingdom Fungi includes some of the most important organisms.

- By breaking down dead organic material, they continue the cycle of nutrients through ecosystems.
Fungi

- All fungi are eukaryotic
- They may be unicellular or multicellular
- All fungi have a cell wall
Fungi

• Fungi can be very helpful and delicious
• Many antibacterial drugs are derived from fungi
Plants

All plants are multicellular autotrophs that have a cell wall.
Three Features Distinguish Plants from Animals

• Plants have chlorophyll, a green pigment necessary for photosynthesis.
• Their cell walls are made sturdy by a material called cellulose.
• Plants are fixed in one place (they don’t move).
Animalia

All animals are multicellular heterotrophs that lack a cell wall and are capable of movement at some point in their lives.
The animal kingdom is divided into invertebrates and vertebrates. To be an animal requires that an organism eat its food and reproduce mainly by sexual means. Organs are much more developed in the Animal Kingdom than the other kingdoms.
Students should be able to list all 6 kingdoms and their characteristics.

<table>
<thead>
<tr>
<th>Kingdom</th>
<th>General Characteristics</th>
<th>Cell Wall</th>
<th>Representative Organisms</th>
</tr>
</thead>
</table>
| Eubacteria | • simple organisms lacking nuclei  
             • either ___________ or ___________  
             • all can reproduce ___________  
             • live nearly ___________ | • ___________ | • ___________  
|           |                        |           | • cyanobacteria          |
| Archaea | • ___________  
         • heterotrophs  
         • live in ________ lakes, ________ springs, animal ________ | • ___________ | • methanogens  
|         |                        |           | • extreme ___________    
|         |                        |           | • extreme ___________    |
| Protista | • most are ___________ celled; some are ___________; some are ___________;  
           • some are autotrophs, some ___________; some both  
           • live in ___________ or moist ___________ | • absent | • algae  
|         |                        |           | • ___________            |
| Fungi   | • most are ___________  
         • all are ___________  
         • reproduce ___________ and ___________  
         • most are ___________ | • ___________ | • ___________  
|         |                        |           | • yeasts  
|         |                        |           | • ________ molds         |
| Plantae | • all are ___________  
          • all are ___________  
          • reproduce ___________ and ___________  
          • most are ___________ | • present | • ___________  
|         |                        |           | • ___________            
|         |                        |           | • conifers              
|         |                        |           | • ________ plants       |
| Animalia | • all are ___________  
           • all are ___________  
           • most reproduce ___________  
           • live in ___________ and ___________ habitats | • ___________ | • sponges  
|        |                        |           | • ___________            
|        |                        |           | • loysters              |
|        |                        |           | • ___________            |
Standard 5

Identify major differences between plants and animals, including internal structures, external structures, methods of locomotion, methods of reproduction, and stages of development.
42. Look at the animals pictured above. (Note: pictures not drawn to scale.)

Which three of the animals pictured above reproduce by laying eggs?

A) Bird, gorilla, grasshopper
B) Gorilla, grasshopper, frog
C) Fox, frog, dolphin
D) Bird, grasshopper, frog
Major Differences Between Plants and Animals

Internal Structures

- **Cell walls** - In plants but not animals.
- **Cell vacuoles** - Major feature of plant cells but not animal cells.
- **Chloroplasts** - Found only in plants.
71. Viet and Andrea were using a microscope to look at a slide of some cells. They looked at some interesting cells that Viet thought were plant cells. Andrea thought they looked more like animal cells. If you looked at these same cells, how could you tell whether they were plant cells or animal cells?
Major Differences Between Plants and Animals

External Structures

• Plants - Their cell walls are made sturdy by a material called cellulose.

• Animals - Animals can be classified by their skeletal system.
  ➢ Invertebrates have a hard external skeleton made of chitin known as an exoskeleton.
  ➢ Vertebrates have a hard internal skeleton made of bone.
Major Differences Between Plants and Animals

Methods of Locomotion

- Plants - Sessile - dispersed by seeds
- Animals - Self-mobile
Major Differences Between Plants and Animals

Methods of Reproduction

Plants
- Sexual and Asexual

Animals
- Sexual
Major Differences Between Plants and Animals
Stages of Development
Stages of Development
Standard 6

Describe evidence of species variation due to climate, changing landforms, interspecies interaction, and genetic mutation.
Species Variation - Climate

The arctic fox goes through two color phases: white and grayish brown. During the winter the arctic fox is white with black at the tip of its tail; it's a grayish brown in the summer.
Species Variation - Climate
Snowshoe Hare

Distinguishing Features - Overall coloration: Winter - varying degrees of white; tips of ears, black. Summer - rust or dark brown with a blackish mid-back line and grayish sides. Belly, whitish; face, legs and throat, cinnamon; ears, brown with black tips, edged in white; tail, black above and white below.
Species Variation - Changing Landforms

• Two squirrel species exist on opposite sides of the Grand Canyon. The canyon prevents gene flow between the two species. Small populations may become isolated from their parent populations when they travel to a new location.
• For many centuries two populations of squirrels have been isolated by the Grand Canyon, one population on the north rim and one on the south. They have now evolved into two different species.
Species Variation - Interspecies Interaction

- A female mosquito blood feeding. Mosquitoes serve as intermediate hosts of other parasites such as the dog and cat heartworm and Plasmodium species causing malaria in humans and birds.

- Fleas are common parasites of dogs and cats. They bite their hosts and feed on blood.
Mutualism is an interaction between two or more species, where both species benefit.
Species Variation - Interspecies Interaction

Commensalism refers to a relationship between two living organisms, where one organism benefits and the other is neither harmed nor helped.

The Cattle Egret forages in pastures and fields among livestock such as cattle and horses, feeding on the insects stirred up by the movement of the grazing animals. The egrets benefit from the arrangement, but the livestock, generally, do not.
Species Variation - Genetic Mutation

• Genetic mutation leads to diversity within a species which can lead to speciation.
• Speciation is the evolutionary process by which new biological species arise.

![Diagram showing species variation through genetic mutation](image)
Standard 7
Describe biotic and abiotic factors in the environment.

The biotic components of a grassland ecosystem are the living organisms that exist in the ecosystem.
The living parts of an ecosystem are called biotic factors. All of these organisms have an effect on the others. An organism must get food, shelter, water, and other things in order to live, grow, and reproduce from the area that it lives in. An organism depends on other biotic factors for food, shelter, protection, and reproduction.
Students must be able to list and recognize biotic factors in an environment.
Nonliving things that we find in an ecosystem are called abiotic factors. Abiotic factors have an effect on the type and number of organisms living in an ecosystem. Examples of abiotic factors are soil, water, temperature, and sunlight.
Students must be able to list and recognize abiotic factors in an environment.
Standard 8
Describe the function of chromosomes.
Chromosomes control cell processes and determine traits of an organism.
Chromosomes!

Click on any chromosome below to see a list of selected traits and disorders associated with that chromosome.
Chromosomes!
Standard 9
Identify the process of chromosome reduction in the production of sperm and egg cells during meiosis.
• Each species has a specific number of chromosomes in each cell in its body. Human beings, for example, have 46 chromosomes in each body cell while in their reproductive cells (the egg and the sperm) there are only half that number (23).

• In this way, when the sperm and egg unite, the full number of 46 will be made up again.
• Chromosome Reduction
• Sperm and Egg Cells
• Meiosis

KEEP IT SIMPLE
• Students need to know the terms **haploid** and **diploid**.

• Students need to know that egg and sperm cells have half the number (**haploid**) of chromosomes as their parent cell (**diploid**).
<table>
<thead>
<tr>
<th>Animal</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barley</td>
<td>14</td>
</tr>
<tr>
<td>Tomato</td>
<td>24</td>
</tr>
<tr>
<td>Mouse</td>
<td>40</td>
</tr>
<tr>
<td>Striped Skunk</td>
<td>50</td>
</tr>
<tr>
<td>Mink</td>
<td>30</td>
</tr>
<tr>
<td>Dog</td>
<td>78</td>
</tr>
<tr>
<td>Fox</td>
<td>34</td>
</tr>
<tr>
<td>Pig</td>
<td>38</td>
</tr>
<tr>
<td>Donkey</td>
<td>62</td>
</tr>
<tr>
<td>Cow</td>
<td>60</td>
</tr>
<tr>
<td>Gorilla</td>
<td>48</td>
</tr>
<tr>
<td>Gypsy Moth</td>
<td>62</td>
</tr>
</tbody>
</table>
Standard 10
Identify differences between deoxyribonucleic acid (DNA) and ribonucleic acid (RNA).
DNA is double-stranded, contains deoxyribose sugars, and contains the base thymine.

RNA is single-stranded, contains ribose sugars, and predominantly uses uracil instead of thymine present in DNA.
Interactive Activity can be found by visiting http://learn.genetics.utah.edu/units/basics/builddna/ on the web.
So, what is DNA, anyway?

DNA is a long fiber, like a hair, only thinner and longer (except for Crystal Gayle's hair). It is made from two strands that stick together with a slight twist.

Proteins attach to the DNA and help the strands coil up into a chromosome when the cell gets ready to divide.

The DNA is organized into stretches of genes, stretches where proteins attach to coil the DNA into chromosomes, stretches that "turn a gene on" and "turn a gene off", and large stretches whose purpose is not yet known to scientists.
The DNA is organized into stretches of genes, stretches where proteins attach to coil the DNA into chromosomes, stretches that "turn a gene on" and "turn a gene off", and large stretches whose purpose is not yet known to scientists.

The genes carry the instructions for making all the thousands of proteins that are found in a cell. The proteins in a cell determine what that cell will look like and what jobs that cell will do. The genes also determine how the many different cells of a body will be arranged. In these ways, DNA controls how many fingers you have, where your legs are placed on your body, and the color of your eyes.
Standard 11

Identify Mendel’s Laws of Genetics.

Look at the family of jigsaw puzzles below. Can you see how some of the child's genes are derived from one parent and some from the other parent?
Father of Genetics

- Monk and teacher.
- Experimented with purebred tall and short peas.
- Discovered some of the basic laws of heredity.
- Studied seven purebred traits in peas.
- Called the stronger hereditary factor dominant.
- Called the weaker hereditary factor recessive.
- Presentation to the Science Society in 1866 went unnoticed.
- He died in 1884 with his work still unnoticed.
- His work rediscovered in 1900.
- Known as the “Father of Genetics”.
Dominant Traits RULE

• Strong Hereditary traits cover weak traits.
• Mendel called stronger traits – DOMINANT
  – recessive
• Mendel called weaker traits
  – recessive

• Dominant traits are represented by capital letters (T) while recessive traits are represented by lower case letters (t). Try and follow the diagram on the next slide while keeping the DOMINANT and recessive letters in mind. (TT) (tt)
Gene Control of Characteristics

• All characteristics are controlled by a minimum of 2 genes.

• Different genes that control the same feature are called ALLELES.
EYE COLOR

- Possible alleles – blue, brown, green, hazel, etc.
- Each color needs its own gene.
- It is possible to have pairs of different alleles.
- Alleles are usually given a letter.
Genotype and Phenotype

• Genotype is the letter or term used to describe the allele of an individual gene or pair of genes.

• Phenotype – is how the gene (or pair) shows itself, how it appears.
Dominance and Recessiveness

• Some alleles for a feature are able to mask the influence of other (weaker) genes when they are paired.
• The stronger gene is **DOMINANT** and is represented by a capital letter (e.g., H).
• The masked gene is **RECESSIVE** and is shown as lower case of the same letter (e.g., h).
Gene Diagram – Flower Color

Genotype of alleles:
- \( R \) = red flower
- \( r \) = yellow flower

All genes occur in pairs - so 2 alleles affect a characteristic - possible combinations are:

<table>
<thead>
<tr>
<th>Genotype</th>
<th>RR</th>
<th>Rr</th>
<th>rr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phenotype</td>
<td>RED</td>
<td>RED</td>
<td>YELLOW</td>
</tr>
</tbody>
</table>
Gene Diagram – Flower Color

Parent

Male

RR

Female

rr

Gamete

R

R

r

r

Offspring

Genotype

Rr

Rr

Rr

All red
Punnett Square

Another method of showing crosses

USE THE PUNNETT SQUARE
Gamete genotypes are inserted

Bb black fur male

bb white fur female

What are the crosses?

<table>
<thead>
<tr>
<th></th>
<th>B</th>
<th>b</th>
</tr>
</thead>
<tbody>
<tr>
<td>b</td>
<td>Bb</td>
<td>bb</td>
</tr>
<tr>
<td>b</td>
<td>Bb</td>
<td>bb</td>
</tr>
</tbody>
</table>

2 white fur and 2 black fur offspring

50:50 chance with these parents
Mendel's Law of Segregation

Mendel’s Law of Segregation states that the alleles for a trait separate when gametes are formed. These allele pairs are then randomly united at fertilization. Mendel arrived at this conclusion by performing monohybrid crosses. These were cross-pollination experiments with pea plants that differed in one trait, for example pod color.
Mendel's Law of Independent Assortment

Mendel’s Law of Independent Assortment states that the alleles for different traits are distributed to sex cells and offspring independently of one another.
Mendel’s Law of Dominance

Mendel's law of dominance states that when an organism has two different alleles for a trait, the allele that is expressed, overshadowing the expression of the other allele, is said to be dominant. The gene whose expression is overshadowed is said to be recessive.
“As educators, we know we cannot wait until students are in the eleventh and twelfth grade to foster a love of science and mathematics; the love has to be nurtured and promoted throughout the K-12 experience.”

Jo Anne Vasquez, NSB Member
Questions?