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| **Presentation Title:** | **Cells** |
| **Visual Description and Reference Images:** | |
| I’d like it if we could have a few pictures of real cells. I went through shutterstock and couldn’t find any good pictures. I think its important to show some real cells prior to the abstract representations so that the learner has a context. | |
| **Script:** | |
| In the 1660’s, Anton van Leeuwenhoek used shards of glass from a neighboring glass blowing shop to gain the first view the microscopic world. He noted that even in a drop of lake water, oddly shaped “animalcules” played out the same fight for survival seen in every other environment of the world. Today we refer to these animalcules as cells. Cells come in many shapes and survive in diverse ways. Human cells cluster together and work as tissues. Tissues make organs, and organs come together to make organisms. | |

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| **Slide #:** | 2 | **Slide Title:** | Learning Objectives (objectives slide) | |
| **Visual Description and Reference Images:** | | | | |
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| **Key Bullet Points: (Learning Objectives for this presentation)** | | | | **Script:** |
| In this unit you will learn about:   * Organelles * The cell membrane * Transport across the cell membrane * The nucleus * DNA replication * Mitosis * Modern research and DNA | | | | In this unit you will learn about:   * Organelles * The cell membrane * Transport across the cell membrane * The nucleus * DNA replication * Mitosis * Modern research and DNA |

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| **Slide #:** | 3 | **Slide Title:** | Cells | |
| **Visual Description and Reference Images:** | | | | |
| This would be a good picture to have hot spots on. Too much text on the picture at the same time could be overwhelming, but revealing info at specific spots would drive the points well. Here is a reference…  <http://ajweinmann.wordpress.com/organelle/> | | | | |
| **Key Bullet Points:** | | | | **Script:** |
| * Nucleus- stores genetic material * Cytosol- fluid filled compartment of cell * Mitochondria- aerobically produce ATP * Ribosomes- Make proteins from RNA instructions * Smooth endoplasmic reticulum- compartmentalizes areas of cell for storage. * Rough endoplasmic reticulum- site of protein synthesis and modification * Golgi apparatus- packages materials in vesicles. * Lysosomes- contains lytic enzymes necessary for apoptosis | | | | Like the organs of the human body, organelles are the functioning parts of a cell that make it operate. Not all cells have the same types of organelles but most share common aspects:   * Nucleus- the nucleus stores the DNA which are the instructions for how to make all of the proteins necessary for functioning. The nucleus is surrounded by a nuclear envelope that protects the DNA and separates the chemical reaction of the nucleus from other parts of the cell. * Cytosol- the cytosol is the fluid filled compartment of the cell that contains the organelles. Though pictures often portray organelles floating a fluid medium, the truth is that organelles are suspended in fine cytoskeleton. This cytoskeleton is like a web that keeps organelles in place and gives molecules a framework to move upon. * Mitochondria- mitochondria aerobically produce ATP to fuel chemical reactions in the cell. * Ribosomes- organelles in the cell that receive RNA made in the nucleus n order to make new proteins. Some ribosomes are located on the rough endoplasmic reticulum. * Smooth endoplasmic reticulum- the smooth ER is constructed of the same material as the cell membrane. Folds and envaginations of this membrane allow the cell to compartmentalize materials like ions. * Rough endoplasmic reticulum- the rough ER is similar to the smooth ER but contains ribosomes. As ribosomes make proteins in this area, they are deposited into the compartmentalized region of the rough ER for modification. * Golgi apparatus- this area of the cell is a distribution center. Just as a warehouse receives materials and packages them in combinations, the Golgi receives proteins and materials from different parts of the cell and repackages them in combinations. The Golgi packs contents into spheres of membrane called vesicles. * Lysosome- the lysosome contains lytic enzymes that will initiate the process of apoptosis. Apoptosis is when a cell destroys itself. Apoptosis is necessary to destroy infected cells, to shape a developing tissue, or to heal an area of damage. |

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| **Slide #:** | 4 | **Slide Title:** | Cell Membrane | |
| **Visual Description and Reference Images:** | | | | |
| Macintosh HD:Users:phillipgreco:Desktop:stock-vector-structure-of-cell-membrane-fluid-mosaic-model-33892432.jpgThis picture is kind of crude but similar to what I would draw in class. I just taught this yesterday as I am writing this and what is fresh in my mind is that the students were a bit lost as to what they were looking at. This a portion of the outer cell membrane. It might be helpful to take the picture of the cell and have it zoom into a portion of the membrane to drive the point. This is another diagram that would benefit from hotspots. Here is a reference…  his would be a good picture to have hot spots on. Too much text on the picture at the same time could be overwhelming, but revealing info at specific spots would drive the points well. Here is a reference… <http://www.biology.arizona.edu/cell_bio/problem_sets/membranes/fluid_mosaic_model.html> | | | | |
| **Key Bullet Points:** | | | | **Script:** |
| * The cell membrane separates the inside and the outside of the cell. * The cell membrane is constructed of two layers of phospholipids. * Phospholipids are amphipathic molecules * Integral proteins allow the inside of the cell to interact with the outside in a controlled manner. * Glycolipids and glycoproteins are found on the outside of the cell and help identify ‘self versus non-self’ to the immune system. * The overall construction of the cell membrane is referred to as the fluid mosaic model. | | | | * The cell membrane protects the organelles within the cell and creates a controlled environment for the chemical reactions within. The cell membrane is constructed of amphipathic molecules called phospholipids. The hydrophilic portions of these molecules will orient toward each other creating an oily barrier separating the inside and the outside of a cell. The phospholipids create a double layer with their hydrophilic ends oriented to interact with the water on the inside or the outside of the cell. Because of this two-layer construction of the cell membrane is sometimes referred to as the phospholipid bilayer. * Imbedded within the phospholipid bilayer are molecules called integral proteins. Integral proteins play a role by allowing the inside and the outside of the cell to interact. Examples of integral proteins include channels, receptors, and enzymes. * Glycolipids and glycoproteins are molecules that extend from the cell membrane into the fluid outside of the cell. These molecules serve numerous functions. One example of glycoproteins in the human body is the ABO blood groups of erythrocytes. Cells of the immune system recognize these glycoproteins and use them as a means to assess whether the blood belongs to “self or non-self”. * The overall construction of the cell membrane is not static or rigid. The molecules that make up the cell membrane bob and bump into one another like a vast ocean phospholipids. This overall structure is referred to as the fluid mosaic model. |

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| **Slide #:** | 5 | **Slide Title:** | Membrane Transport | |
| **Visual Description and Reference Images:** | | | | |
| Macintosh HD:Users:phillipgreco:Desktop:transport types.jpggrabbed this from the internet. Is there any way we could get a render like this? Or maybe three different images that show these types of movement? | | | | |
| **Key Bullet Points:** | | | | **Script:** |
| * Membrane transport describes how substances pass through the cell membrane. * Simple diffusion is when substances pass through the membrane unhindered. These molecules are usually small or hydrophobic. * Facilitated diffusion allows substances to diffuse through specific channels or pores. * Active transport moves substances in directions that oppose diffusion. This process requires ATP. | | | | * In order to interact with their environment, cells must allow substances to pass through the cell membrane when needed. Membrane transport describes the different methods with which substances are able to pass through the cell membrane. * Simple diffusion is when substances freely move though the cell membrane. Some substances like oxygen and carbon dioxide are so small that the phospholipid bilayer cannot stop them from following their diffusion gradient. Molecules that are hydrophobic also have the ability to pass through the cell membrane by simple diffusion. * Facilitated diffusion allows substances to pass through specific channels or pores in order to enter or exit the cell. By allowing only specific substance entry at specific times, the cell membrane is capable of selective permeability. Selective permeability allows a cell membrane to perform dynamic functions like the action potential of a neuron. * Active transport is used to move substances against their diffusion gradient. If a substance is in equal concentrations on both sides of the membrane, ATP must be invested in the form of a pump to push molecules in a direction they would not normally flow. An example of active transport is seen after an action potential. The ions that moved to create the action potential event must be pumped back to their original positions so that another action potential can occur. |

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| **Slide #:** | 6 | **Slide Title:** | Vesicular transport | |
| **Visual Description and Reference Images:** | | | | |
| Is there any way we could do an animation like this?  <http://www.youtube.com/watch?v=XFxHWWOpHDI> | | | | |
| **Key Bullet Points:** | | | | **Script:** |
| * Vesicles store materials in a cell. * Vesicles are made of the same phospholipid bilayer as the cell membrane. * Exocytosis- When a vesicle binds to the cell membrane its contents diffuse into the extracellular environment. * Endocytosis- Some cells can perform this process in reverse to make vesicles. | | | | Another means by which substances are able to enter or exit a cell is by vesicular transport. Recall that vesicles are packaged proteins and substances generally made by the Golgi apparatus. A cell can release the contents of a vesicle into the extracellular fluid by having the vesicle merge with the cell membrane. This is possible because a vesicle is made of the same phospholipid bilayer as the cell membrane. Special proteins help the vesicle to blend with the cell membrane. This process can work in reverse as well, sometimes a substance can attach to the cell membrane and a vesicle is made to surround that substance.   * One example of vesicular transport is the release of a neurotransmitter. Neurotransmitters are stored in vesicles found in the axon terminal. When a nerve impulse (also called an action potential) reaches the axon terminal, vesicles merge with the cell membrane and release their contents into the synapse. The neurotransmitter can then diffuse to surrounding cells and have an effect on neighboring cells. * Neutrophils carry out a similar process in reverse. When a bacterium is recognized by surface receptors of the neutrophil the cell membrane extends to surround and engulf bacteria. As a result, the neutrophil contains the bacteria in a vesicle where it can be destroyed. |

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| **Slide #:** | 7 | **Slide Title:** | The Nucleus and DNA | |
| **Visual Description and Reference Images:** | | | | |
| A static image could lose the concept here. In class I show this video…  <http://www.youtube.com/watch?v=gbSIBhFwQ4s>  I think Rob and I will need to discuss how to bring this slide to life. | | | | |
| **Key Bullet Points:** | | | | **Script:** |
| * The nucleus contains DNA. * DNA is used by cells as instructions for how to make proteins. * DNA is made of strands of nucleic acids. * Strands of nucleic acids attach to corresponding strands to make double helix structures. * The double helix strand wraps around histone proteins that act as spools. * DNA and histones wrap in and around themselves to keep DNA compact and organized. * During cell division, DNA becomes visible in ‘clumps’ called chromatin. * Chromatin formed into X shaped duplicates are called chromosomes and are only visible during specific stages of mitosis. | | | | The nucleus is the region of the cell that contains DNA. In all organisms, DNA specifies how proteins are made. Proteins dictate the function of cells. Though different cells utilize different parts of the whole DNA library, all cells of the body contain the same genetic code.  DNA is constructed of four main nucleic acids that make long strands. These strands attach to a corresponding strands and twist to make the familiar double helix. The double helix strand wraps around proteins called histones that act much like spools for keeping the DNA organized. Numerous levels of coiling exist that serve to keep the DNA more compact and stable in the nucleus. At some points of the cell life cycle, the DNA will cluster into very compact bar structures known ad chromatin. Prior to cell division (mitosis), the chromatin duplicates itself creating X shaped chromosomes. This compact shape allows the DNA to be moved appropriately and results in two cells with identical DNA to the parent cell. |

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| **Slide #:** | 8 | **Slide Title:** | The Language of DNA | |
| **Visual Description and Reference Images:** | | | | |
| A static image here would be okay. Depending on what is made for the previous slide, it may make more sense to make slide and extension of slide 7.  Macintosh HD:Users:phillipgreco:Desktop:stock-photo-dna-61775431.jpg | | | | |
| **Key Bullet Points:** | | | | **Script:** |
| * DNA is contructed of the nucleic acids adenine(A), guanine (G), cytosine (C), and thymine (T). * Triplets of nucleic acids specify which particular amino acid is to be used in the construction of a protein. * A strand of triplets that specifies how to make a protein is called a gene. * Combinations of genes are usually needed to make visible traits. | | | | Recall that proteins dictate cell function and DNA is the instructions for how those proteins are made. The most basic level of protein complexity involves sequences of amino acids that will then fold on themselves to create complex three dimensional shapes capable of action within the cell.  The manner in which these instructions are read parallels the manner in which you are reading this information. DNA has four nucleic acids: adenine, thymine, guanine, and cytosine. These four nucleic acids are like the letters of the alphabet. Nucleic acids are put together in combinations of three called triplets that are much like the words of a sentence. A specific sequence of triplets specifies an instruction, much like specific words in sequence make a sentence. The specific instructions for how to make a protein are called a gene. Usually combinations of genes are required to make different proteins that will result in an overall effect. For example, a person’s height is the combination of numerous genes relative to not only development, but also nutrition, growth, and metabolism. This concept is known as polygene inheritance. All of the characteristics of an organism are the product of instructions in a person’s DNA. The collective group of genetic material within the nucleus is called the genome. |

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| **Slide #:** | 9 | **Slide Title:** | Double Strand Configuration | |
| **Visual Description and Reference Images:** | | | | |
| On this slide, I think dynamic text should be used. If the students see the following sequence in one color:  ATGCGCAATGC  …we could have the matching strand line up with dashed lines inbetween matching pairs…  TACGCGTTACG | | | | |
| **Key Bullet Points:** | | | | **Script:** |
| * The double helix configuration of DNA ensures stability of the genetic code. * Small changes in a gene can result in major pathophysiologies. * A phase shift occurs when nucleic acids are omitted. Consider the following example:   + *Normal sentence: Anatomy And Physiology Is Fun.*   + *Phase shift by removing a: AntomyA ndP hysiologyI sF un.* * When opposing DNA strands pair up:   + Adenine always pair to thymine.   + Cytosine always pair guanine. * Corresponding strands are like an internal checking mechanism that ensures genetic code remains unchanged. | | | | DNA has a double helix configuration. Two strands of DNA that are read in opposite directions attach to each other to encourage stability within the human genome. Consider this configuration to be like the buttons of shirt. As long as the correct sequence of buttons fit the correct sequence of holes, the shirt looks uniform and correct on the body. If the buttons are not placed in the proper sequence, a chaotic appearance will result that could cause social stigma. A corresponding DNA strand ensures that gene sequences are always laid out in the same way.  To emphasize the importance of DNA always remaining in the same sequence, consider sickle cell anemia. This disorder results from a single missing nucleic acid. As a result of the missing nucleic acid, the triplets in a specific gene are read incorrectly. The gene that is affected relates to proteins that dictate the shape of a red blood cell. When the shape of red blood cells changes, the mechanical way in which they flow through small vessels is affected. As a result, their ability to deliver oxygen to tissues is severely compromised. A missing nucleic acid and the change in reading pattern that results is known as a phase shift. An example of a phase shift can be seen below:   * *Normal sentence: Anatomy And Physiology Is Fun.* * *Phase shift by removing one letter: AntomyA ndP hysiologyI sF un.*   The manner in which strands are matched follows a simple rule. Adenine (A) will always match thymine (T) on an opposing strand and vice versa. Guanine (G) will always match thymine (T) an opposing strand and vice versa. Consider the following DNA sequence:  ATGCGCAATGC  The matching DNA sequence on the opposing strand would be…  TACGCGTTACG |

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| **Slide #:** | 10 | **Slide Title:** | DNA Replication | |
| **Visual Description and Reference Images:** | | | | |
| Once again, this is an area where Rob and I will need to coordinate. This is the video I show in class…  <http://www.youtube.com/watch?v=4jtmOZaIvS0>  <http://www.youtube.com/watch?v=teV62zrm2P0> | | | | |
| **Key Bullet Points:** | | | | **Script:** |
| * A cell must duplicate its DNA in order to divide. * DNA must be copied exactly to avoid pathophysiologies. * Helicase breaks the hydrogen bonds between matching strands. * DNA polymerase places corresponding nucleic acids to each of the original strands. * One strand is replicated as the helicase dissociates the two strands. Another must do so in segments called Okazaki fragments. * Semiconservative replication describes the process in which each daughter cell has an original strand and a newly made matching strand. | | | | What we perceive as growth and healing often involves cells of a tissue replicating themselves. In this process, a ‘parent cell’ duplicates its entire DNA, splits the duplicates equally between two separate parts, and then divides into two clones of the original called ‘daughter cells’.  For this process to occur, the DNA must be copied exactly. To minimize errors in this process, the nucleus undergoes a process known as semiconservative replication. The double strands of DNA are separated and a new opposing strand is made for each of the original strands. This process is called semiconservative because the daughter cells each receive one of the original strands and one newly made matching strand.  The reason this process is initiated within the nucleus is not completely understood. Current theories suggest chemical cues or the size of a cell triggers DNA replication. At some point a molecule called helicase moves through strands of DNA and separates the matching strands. On each of the opposing strands, a protein called DNA polymerase reads the genetic sequence and matches A to T, T to A, C to G, and G to C as it moves along each strand.  Because strands of DNA must be read in a specific direction, one DNA polymerase molecule can follow the helicase and perform replication. The other strand must constantly be read in segments. These segments of replication are called Okazaki fragments. |

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| **Slide #:** | 11 | **Slide Title:** | Mitosis | |
| **Visual Description and Reference Images:** | | | | |
| I require my students to go to this site and the next after I lecture on the topic. In class I draw static images of each phase with a description off to the side. An animation is necessary to see how it all comes together, though.  <http://www.biology.arizona.edu/cell_bio/tutorials/cell_cycle/cells3.html>  <http://www.cellsalive.com/mitosis.htm> | | | | |
| **Key Bullet Points:** | | | | **Script:** |
| * Mitosis ensures that all DNA will be properly dived between the two new daughter cells to be formed. * Interphase-   + Normal functioning cell   + DNA is replicated * Prophase-   + Nuclear envelope disappears   + Chromatin becomes visible   + Centrosomes move to opposite poles * Metaphase-   + Chromosomes visible on the equator of the cell   + Mitotic spindle visible * Anaphase-   + Chromosomes pulled in half by mitotic spindle to opposite poles. * Telophase-   + Nuclear envelope created around two new nuclei.   + Cytokenisis- cell division | | | | Once the DNA has been replicated, a cell is ready to divide. The process of cell division is referred to as mitosis and describes the combined effort of ensuring DNA is properly separated and whole cell division.   * Interphase is the phase of a cell’s life in which we might normally think if it. Consider interphase to be ‘business as usual’ for the cell. * Prophase is the beginning of mitosis. In this phase the nuclear envelope disappears and DNA becomes visible to a microscope in clusters called chromatin. Two organelles called centrosomes move to opposite poles of the cell. * Metaphase is when the chromatin condensed into X shaped chromosomes (paired chromatin bar bodies). The centrosomes are now on opposite poles of the cell and the chromosomes line up on the equator between the two poles. The mitotic spindle, a threaded network extending from each centrosome to the center of each chromosome become visible. * Anaphase is when the mitotic spindle physically pulls each chromosome in half. The halves are pulled to opposite poles of the cell. * Telophase is similar to prophase in reverse. The nuclear envelope forms around the two new nuclei and the chromatin begins to dissolve within. Telophase ends with the process of cell division called cytokenisis. During this process the equator that formerly held the chromosomes pinches on itself and separates the original cell into two duplicates. After this process is complete two newly formed daughter cells will be interphase and the process can repeat itself.   Note that the phases outlined above are ways that we perceive the changes to the cell as it goes through mitosis. To the cell however, this is a uniform cascade of events. |

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| **Slide #:** | 12 | **Slide Title:** | Current Research and DNA | |
| **Visual Description and Reference Images:** | | | | |
| Macintosh HD:Users:phillipgreco:Desktop:stock-vector-dna-with-medical-sign-vector-illustration-abstract-background-9888538.jpgThis unit is pretty animation heavy so this could be an area to go light. Do I recall that we can use images from Google commons?...  <http://commons.wikimedia.org/wiki/File:Gene_therapy.jpg> | | | | |
| **Key Bullet Points:** | | | | **Script:** |
| * Genes and environmental factors do not function independently. * Gene therapy inserts DNA to treat genetic disorders. * Artificially created viruses have successfully been used to introduce DNA in specific cells and tissues. * Research in Parkinson’s disease, HIV infection, and transplanted tissue rejection have benefited from gene therapy. | | | | Though the discovery of DNA and the manner in which it determines how our bodies operate is a relatively recent discovery, humans have always had an intuitive understanding that traits belonging to parents are transferred to offspring in some way. Though the public often discusses the “nature versus nurture” controversy, in biology we know the two to work together. We often say that genes cock the gun, but the environment pulls the trigger.  Some pathophysiologies have been identified as problems relating to genes. One strategy in treating these pathophysiologies is called gene therapy. Gene therapy is usually an attempt to artificially insert a sequence of DNA into a group of cells. The hope is that replacing the missing or faulty genetic code can treat the disease relating to nonfunctioning genes. While the concept is simple, the manner in which this is done is not so simple. One strategy to deliver DNA into cells has been to use artificially created viruses. Viruses normally insert their viral genetic material in the process of infection. Manufacturing a virus to hold therapeutic genetic material however, presents the possibility for targeted delivery to problem areas of the body.  Gene therapy has made enormous strides in the last few decades. Some of the problems that might benefit from gene therapy are Parkinson’s disease, HIV infection, and transplanted tissue rejection. |

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| **Slide #:** | 13 | **Slide Title:** | Check Your Understanding (2nd to last slide) |
| **Visual Description and Reference Images:** | | | |
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| **Questions/Answers:** | | | |
| 1. Click on a mitochondrion in this picture:Macintosh HD:Users:phillipgreco:Desktop:stock-photo-animal-cell-cut-away-scientifically-correct-d-illustration-45754267.jpg (answer: blue beans) 2. Click on the nucleolus in this picture. (answer: yellow ball in center) 3. Click on a portion of this cell membrane that is hydrophobic:Macintosh HD:Users:phillipgreco:Desktop:stock-vector-structure-of-cell-membrane-fluid-mosaic-model-33892432.jpg(answer would be the areas in red) 4. Click on an integral protein in this picture (answer is areas in green) 5. Match the organelle with its function:    1. Nucleus- stores the genetic material of the cell    2. Smooth endoplasmic reticulum- folds of membrane that store ions    3. Ribosomes- create proteins from RNA instructions    4. Lysozomes- contain enzymes that will lead to apoptosis 6. If a molecule is passing from high to low concentration, but requires a channel to pass through the cell membrane, this is an example of:    1. Simple diffusion    2. **Facilitated diffusion**    3. Active transport    4. Vesicular transport 7. If an ion like sodium were at equal concentrations on the inside and outside of a cell, which method would be needed to move the sodium out of the cell?    1. Simple diffusion    2. Facilitated diffusion    3. **Active transport**    4. Vesicular transport 8. In which of the following phases would you see chromosomes lined up on the equator of a cell?    1. Interphase    2. Prophase    3. **Metaphase**    4. Anaphase    5. Telophase 9. In which of the following phases is genetic material pulled to opposite poles of the cell?    1. Interphase    2. Prophase    3. Metaphase    4. **Anaphase**    5. Telophase 10. During DNA replication, which molecule breaks the hydrogen bonds holding a double helix together?     1. Histone     2. Chromatin     3. DNA polymerase     4. **Helicase** 11. If one side of DNA contains the triplet ATC, enter the triplet that would be found on the matching DNA strand. (student must enter TAG). 12. If one side of DNA contains the triplet GTA, enter the triplet that would be found on the matching DNA strand. (student must enter CAT). | | | |

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| **Slide #:** |  | **Slide Title:** | Summary (last slide, review of learning objectives) | |
| **Visual Description and Reference Images:** | | | | |
|  | | | | |
| **Key Bullet Points:** | | | | **Script:** |
| In this unit you learned about:   * Organelles * The fluid mosaic model * Membrane transport * The nucleus * DNA replication * Mitosis * Gene therapy | | | | In this unit you learned about:   * Organelles * The fluid mosaic model * Membrane transport * The nucleus * DNA replication * Mitosis * Gene therapy |