Curricular Standards and Objectives

Driving Question: How can nanomedicine be used to improve disease treatment?

Core Objectives with Bloom's Taxonomy

Learners will be able to:

Understand the relative size of nano objects compared to objects that they can see (macroscale (Remember/Comprehend/Analyze)
Compare surface-area-to-volume ratios of different sized objects and explain it plays a role in human body. (Understand/Analyze/Apply)
Explain why properties of matter can change at the nanoscale. (Understand/Analyze/Apply)
Understand what self-assembly is and how it is important in many biological processes (Can in protein synthesis, DNA synthesis, etc.) (Remember/Understand/Analyze)
Evaluate models and tools essential in understanding nanomedicine. (Understand/Apply/Evaluate)
Understand the types of disease and how they are passed on at the molecular level. (Remember/Understand/Apply)
Evaluate information and create a specific model of how disease could be treated through nanotechnology. (Evaluate/Create)

List of Specific Discipline-Based Concepts/Standards (9th Grade Indiana Biology Standards)

SCI.B.1.1 2010	Describe the structure of the major categories of organic compounds that ma up living organisms in terms of their building blocks and the small number c chemical elements (i.e., carbon, hydrogen, nitrogen, oxygen, phosphorous a sulfur) from which they are composed.
SCI.B.1.2 2010	Understand that the shape of a molecule determines its role in the many diff types of cellular processes (e.g., metabolism, homeostasis, growth and development, and heredity) and understand that the majority of these proces involve proteins that act as enzymes.
SCI.B.2 2010 - Cellular Structure	Describe features that are common to all cells and contrast those with distin features that allow cells to carry out specific functions.
SCI.B.2.1 2010	Describe features common to all cells that are essential for growth and survi Explain their functions.
SCI.B.2.2 2010	Describe the structure of a cell membrane and explain how it regulates the transport of materials into and out of the cell and prevents harmful materials from entering the cell.
SCI.B.2.5 2010	Explain that cells use proteins to form structures (e.g., cilia, flagella), which allow them to carry out specific functions (e.g., movement, adhesion and absorption).
SCI.B.6 2010 - Cellular Reproduction	Explain the processes (i.e., mitosis and meiosis) by which new cells are forn from existing cells and how in multicellular organisms groups of cells coope to perform essential functions within the organisms. (B.6.1, B.6.2, B.6.3)Explain the cellular processes that occur to generate natural genetic variations between parents and offspring. (B.6.4, B.6.5)
SCI.B.6.1 2010	Describe the process of mitosis and explain that this process ordinarily resul daughter cells with a genetic make-up identical to the parent cells.
SCI.B.6.4 2010	Describe and model the process of meiosis and explain the relationship betw the genetic make-up of the parent cell and the daughter cells (i.e., gametes).

List of National Standards/ NGSS

HS-LS1-1.	Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of lif through systems of specialized cells.
HS-LS1-2.	Develop and use a model to illustrate the hierarchical organization of interact systems that provide specific functions within multicellular organisms.
HS-LS1-3.	Plan and conduct an investigation to provide evidence that feedback mechanis maintain homeostasis.
HS-LS1-6.	Construct and revise an explanation based on evidence for how carbon, hydrog and oxygen from sugar molecules may combine with other elements to form a acids and/or other large carbon-based molecules.
HS-LS3-1.	Ask questions to clarify relationships about the role of DNA and chromosome coding the instructions for characteristic traits passed from parents to offsprir
HS-LS3-2.	Make and defend a claim based on evidence that inheritable genetic variations result from: (1) new genetic combinations through meiosis, (2) viable error occurring during replication, and/or (3) mutations caused by environmental fac

List of Specific Nanoscience Objectives

Understand the relative size of nano objects compared to objects that they ca see (macroscale).
Compare surface-area-to-volume ratios of different sized objects and explai plays a role in the human body.
Explain why properties of matter can change at the nanoscale.
Understand what self-assembly is and how it is important in many biologica processes.
Evaluate models and tools essential in understanding nanomedicine.

21st Century Skills

Life and Career Skills	Display flexibility, self-direction, productivity and accountability,and leaders skills in a group setting.

Information, Media and Technology Skills	Construct a product using technology which is communicated clearly and purposefully, perform productive information searches.
Learning and Innovation Skills	Use critical thinking and problem solving in researching, designing and developing the final product.

Detailed description, with examples, of how these Indiana standards, objectives, and 21st century skills will be addressed in the unit and eventually tied to specific activities and assessments to show how students demonstrate mastery of them.

- The Indiana content standards, objectives, NGSS standards, and 21st century standards all play a role in the development of our unit. In the Indiana content standards as well as the NGSS are the standards that we are using as a guide to form our content objectives. Our objectives are in line with these standards. For example, one of our objectives is for learners to evaluate information and create a specific model of how disease could be treated through nanotechnology. Some of the content standards that will meet this objective include topics on genetics, heredity, and cell structure and function. By students making a model of a treatment they could use on the disease not only would they have to create the model, but they would have to know about the disease, how the disease works, transmission type and the science behind it. Some diseases would fit into the model of genetic transmission whereas a virus, cancer, or bacteria may involve proteins, DNA, or the process of mitosis or meiosis and mutation. Students will show mastery of the concepts of nanotechnology and disease transmission through their models and presentations. A rubric will be provided to show that students understand the concept of the overall project. The students will also have a post-assessment over nanotechnology to see if they have gained the concepts of surface-area to volume ratios, size and scale, and properties of nanosized objects.

Detailed plan for communicating these standards and objectives to students with sample materials.

- Standards and objectives will be posted on the whiteboard throughout the unit. During class the instructor will highlight the daily standards and objectives to begin each period. The standards and objectives will be placed on all activities/handouts so the students will know what's being emphasized in the activities.

Detailed plan for ensuring students are able to explain what and how they are learning.

- Throughout the unit, the students will be asked to explain what they are learning. Exit tickets will be used following most class periods. The exit tickets will cover material that was taught that period. Class discussions along with polls like "today's meet," will show the instructor what the students are learning and their misconceptions. Modeling sessions on whiteboards and then having class discussions on what was written will ensure they are learning the material.

References

Retrieved June 12, 2014, from www.p21.org/about-us/p21-framework/351-21st-century-standards

Next Generation Science Standards. (n.d.). Retrieved June 12, 2014, from http://www.nextgenscience.org

Standards | The Learning Connection. (n.d.). Retrieved June 12, 2014, from https://learningconnection.doe.in.gov/Standards/Standards.aspx?st=&sub=28&gl=41&c=00&stid=0

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