

The College at Brockport: State University of New York

Digital Commons @Brockport

Education and Human Development Master's
Theses

Education and Human Development

Summer 8-14-2016

Problem Based Learning and STEM Model design in a Secondary Biology Curriculum

Caleb Stewart

State University of New York College at Brockport, cstew5@u.brockport.edu

Follow this and additional works at: https://digitalcommons.brockport.edu/ehd_theses



Part of the [Education Commons](#)

To learn more about our programs visit: <http://www.brockport.edu/ehd/>

Repository Citation

Stewart, Caleb, "Problem Based Learning and STEM Model design in a Secondary Biology Curriculum" (2016). *Education and Human Development Master's Theses*. 686.

https://digitalcommons.brockport.edu/ehd_theses/686

This Thesis is brought to you for free and open access by the Education and Human Development at Digital Commons @Brockport. It has been accepted for inclusion in Education and Human Development Master's Theses by an authorized administrator of Digital Commons @Brockport. For more information, please contact ccowling@brockport.edu, digitalcommons@brockport.edu.

Problem Based Learning and STEM Model design in a Secondary Biology Curriculum

By:

Caleb Stewart

July, 2016

A culminating project submitted to the Department of Education and Human Development of
The College at Brockport, State University of New York in partial fulfillment of the
requirements for the degree of Master of Science in Education

Abstract

Education in the field of science is designed to prepare students to achieve success and understanding of the science that surrounds them and hopefully train them for a continued education and understanding of the scientific field. When educational content is demonstrated rather than discovered it inhibits a student's ability to become a lifelong learner and explorer of the sciences. Learning through demonstration also prevents students from experiencing the collaboration between science, technology, engineering and math (STEM). The following education plan models education that is designed around discovering how real world body systems function and collaborating to apply knowledge rather than repeat it. The literature review following will explain further benefits of real world discovery based education. Further review explains how problem based learning drives students to approach real world scientific problems in local communities with a scientific and systematic belief that their knowledge is applicable in a real world setting.

Table of Contents

Chapter 1: Introduction

Rationale	6
Significance of Project	7
Definition of Terms	9

Chapter 2: Literature Review

Overview	11
Benefits of Using Problem Based Learning	11
Implementation Strategies for Problem Based Learning	13
Issues with Implementing Problem Based Learning	16
Summary	18

Chapter 3: Capstone Project

Overview	21
Project Outline	21
Life Characteristics Unit Plans	23
References	124

Chapter 1 Introduction

The natural state of science is not the memorization of facts but instead the exploration of the surrounding community and occurring patterns. The trend of science education until recently was working toward a completely teacher driven education system. In this type of system the teacher presents scientific information and the students memorize the information. Due to this unengaging scientific delivery system there is a deficit between careers in the scientific fields and qualified college graduates to fill these positions (Bicer 2015). To combat the shortage of professionals in the fields of science, technology, engineering and math educate and innovate initiative was created by Barack Obama (Bicer 2015). The initiative promoted innovative ways of teaching students in science, technology, engineering and math (Bicer 2015). This program later was referred to as STEM and defined as to teaching and learning in the disciplines of science, technology, engineering and mathematics. (Bicer 2015).

STEM education is most effective when it is coupled with authentic education and has an aspect of community involvement (Bicer 2015). Authentic education is defined as learning knowledge and skills that's are useful in real life, link the classroom theories with real world practices, develop problem solving skills, and construct knowledge during the authentic activity learning process (Jalil 2013). One way that students can take part in authentic education is by participating in the completion of an engineering project. This authentic project will relate to a current issue in the local environment or industry.

When students are taking part in authentic learning environment plays a large role in engagement of the students in the authentic education (Jalil 2013). Due to the

importance of environment for STEM authentic education the ability to work in and with the community adds to the student's level of engagement (Willems 2012).

Community-School partnerships allow students to learn in a natural environment (situated learning), learn by seeing how what they learn is applicable in the real world (social constructivism), and allows them to have a more active role in the learning process (student centered instruction) (Willems 2012).

Despite the benefits of community based authentic education it is an under practiced style of educating students. The main limitation of community based STEM education is the issue of time (Tofel-Grehl 2014). Authentic education, STEM education, and community based education all demand more time than a typical teacher centered classroom can provide, that is the cost of deeper learning (Tofel-Grehl 2014). One of the most difficult aspects on the teacher side of STEM education is creating a lesson that will allow students to use grade appropriate relevant information to solve the problem at hand. Many times students use material beyond what they have learned in the classroom and then the activity becomes something that uses large quantities of time but cannot easily be tied back to the curriculum and therefore cannot easily be justified (Fantz 2013). Community based STEM education provides a deeper level of learning (Tofel-Grehl 2014). When the focus is on production of test scores and not on a student's experiences and deep understanding it is hard to justify the extra time that goes into community based authentic STEM education (Grehler 2015). To combat the limitations of community-based authentic STEM education (CASE) my project will focus on working with CASE curriculum in the background of a standard curriculum. The limitation of time will be combatted by using laboratory time to complete the extended length of an engineering

activity. The limitation of limited curriculum coverage will also be combated by using CASE in the background of that standard curriculum. Instead of having the CASE curriculum take away from the standard test based curriculum, the CASE curriculum will be used as a compliment. This complimentary education allows for both wide spread curriculum knowledge and a thorough deeper understanding for key curriculum knowledge.

Project Design

This project will be to develop the labs that focuses on community based authentic STEM education that covers 2 consecutive units and is revisited twice a week with the introduction of each of the three units for an 8th grade general science classroom.

2-LS4-1. Make observations of plants and animals to compare the diversity of life in different habitats.

2-LS2-2. Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants.

Each Lab will consist of:

- Title of lesson
- NYS and NGSS standards
- Rationale for integrating Community Based authentic STEM education

- Primary learning objectives
- List of materials
- Formal and Informal assessments
- Instructional strategies
- Possible problems with using Community based authentic STEM education

Plan for Lab #1

Title of Lesson	Interaction of Species
NYS/ NGSS	2-LS4-1, 2-LS2-2, 7.1a, 7.1b, 7.1c, 7.1d
Rationale	<p>Allowing students to observe and create models of species interacting in their natural habitat allows an authentic engaging way of learning that both involves observation and the nature of science</p>
Primary Learning Objectives	<ol style="list-style-type: none"> 1. Students will be able to observe and summarize two interactions of species observed. 2. Students will be able to describe the interaction between the two species as, mutual, commensal or parasitic

List of Materials	Each student will be required to bring a lab book to record observations, a set of binoculars and a magnifying glass will also be provided
Formal/Informal Assessment	Formal: following this lesson the students will have to build a prototype that explains how the two species they observed interacted and how the prototype represents the relationship between the two species Informal: Teacher will observe the students taking notes and ask inquiring questions to evaluate learning
Instructional strategies	Scaffolding, Chunking, student centered education
Possible problems	Field trip permission return rate, school budget, time, justification of activity

Significance of Project

The United States needs more students who are qualified in the areas of science, technology, engineering and math (Bicer 2015). Putting students in an environment and providing them the scaffolding they need to observe science in its natural state and create prototypes that represent these natural phenomenon increases engagement and therefore drives

interest in the STEM fields (Jalil 2013). With a greater interest in the STEM fields will come a greater rate of field ready STEM professionals in the next generation. Activities that require students to be engaged in their learning for the STEM fields is right in line with the engage and innovate initiative that is greatly supported by today's government (Bicer 2015).

This project is the creation of a complimentary curriculum that takes place during select laboratory designated periods. It allows the use of a standard test preparatory curriculum alongside a community-based authentic STEM education (CASE) curriculum. This allows students a broad understanding for the entire curriculum while allowing students to experience what science outside of the classroom is truly like. The limitations of both curriculums are combated by having collaboration of two separate curriculum styles in one designated classroom. To provide students with the experience and information they will need to fill the ever growing STEM job market this complimentary curriculum sets the perfect stage for success.

Definition of Terms

STEM education- STEM education refers to teaching and learning in the disciplines of science, technology, engineering and mathematics. (Bicer 2015)

Authentic Education- Learning knowledge and skills that's are useful in real life, link the classroom theories with real world practices, develop problem solving skills, and construct knowledge during the authentic activity learning process (Jalil 2013).

Chapter II: Literature Review

Community Based Authentic STEM Education

Overview

With increased pressure to keep up with other countries in the 21st century politicians have been stressing educational reforms to create the best possible students with the greatest post-grade school knowledge base. Due to lack of drive and success in the areas of science, technology, engineering and mathematics (STEM); an emphasis in promoting these subject areas was created. Funding is being provided to create STEM programs nationwide to increase students' knowledge and interest in these important subject areas (Kennedy 2014). Funding can only provide so much motivation for teachers and districts and this motivation for the STEM content areas commonly doesn't transfer to the student. In an effort to take the STEM curriculum and provide it to the students in an engaging and motivating way; articles in the area of authentic learning will be used to discuss the possibility of combining STEM education with authentic learning to provide students with the STEM curriculum in an engaging and practical manner. The research will be guided toward a middle school classroom where the combination and collaboration of interdisciplinary subject areas is a less extreme hurdle for both the students and educators. The literature review that follows will bring together aspects that will form a foundation for the suitability of creating a middle school authentic STEM project and the practicality of implementations.

Authentic STEM education

Introduction

Today's world requires everyone to have both a scientific and technological knowledge base (Bicer 2015). The global economy workforce is suffering a deficit between the number of STEM jobs needed and the available professionals to fill these positions (Kennedy 2014). With many job markets dwindling and careers in STEM heavily recruiting, effectively teaching science, technology, engineering and math is becoming increasingly important. Effective teaching in the STEM curriculum will have significant economic benefits. Due to the evident economic benefits from improved STEM education, funding is being provided from a broad number of sources to provide the students the instruction they need to excel in the field (Kennedy 2014).

Currently in the STEM secondary education fields there is a significant gap between the Asian nations and western nations (Kennedy 2014). While Asian countries account for twenty percent of the STEM market, only two percent of this field are represented by western nations. This has given the Asian nations a competitive edge over the United States and other western nations economically and technologically. To combat this gap students need to become literate in the STEM subject areas (Reeve 2015). This gap has sanctioned action by congress to reform k-12 education specifically in the STEM fields. Shortages in the STEM field have reached the presidential conferences and discussions. In Kennedy's article, "Engaging Students in Stem Education," she references from President Obama's science and technology advisors , "The advisors recommended improving federal coordination and leadership on STEM education; supporting the state-led movement to ensure that the nation adopts a common baseline for what a student learns in STEM; cultivating, recruiting, and rewarding STEM teachers that prepare and inspire students; create STEM-Related experiences that excite and interest students of all

backgrounds; support states and school districts in their effort to transform schools and in vibrant STEM learning environments” (Kennedy 2014, p. 248). The information provided by the advisors led the President to launch the *educate and innovate* program. This program emphasizes and supports the importance of STEM education in the k-12 setting (Bicer 2015). The program focuses on the k-12 in order to develop an early foundational interest in STEM that will lead to post-secondary careers in STEM fields and therefore narrow the economic and technological gaps between competitive countries (Bicer 2014).

Authentic education environments

Learning is not solely based on the information provided but the design of presentation and the environment where the information is provided. STEM education is most effective when presented in an authentic education setting. Authentic education is not solely rooted in an authentic design but in an authentic environment (Schumacher 2012). Authentic education is defined as learning knowledge and skills that’s are useful in real life, link the classroom theories with real world practices, develop problem solving skills, and construct knowledge during the authentic activity learning process (Jalil 2013). Authentic education environments are non-traditional educational settings where students are experiencing the STEM curriculum in its natural, authentic environment (Willems & Gonzalez-DeHass, 2012). There are a variety of aspects that support the concept of students learning in authentic non-traditional environments. These aspects include Epstein’s overlapping spheres, situated learning and constructivism (Willems 2012). Epstein’s theory of overlapping spheres emphasizes that students achieve the greatest success when they are able to cooperate not only in the classroom but also with in the community (Willems 2012). These environments allow students a more evident connection and meaning to the classroom material and real world application of that material (Willems 2012).

The authentic environments are also described when situated learning, social constructivism and learner centered instruction are being discussed. Situated learning also states that learning happens when a student is able to experience and interact with their environment (Willems 2012). From the view of social constructivism the emphasis is that students can interact and experience the information they are learning in the classroom in an authentic community. The importance of being able to experience the content of a classroom in an authentic environment is supported by Vygotsky's belief that the pathway of expertise is associated with the immersion in a specific social situation over a period of time (Willems 2012). Looking at a student centered education versus a teacher centered education, research shows that when the student has control of a larger portion of the education experiences and is able to learn actively rather than passively the student will have a greater level of success with the content (Willems 2012). In authentic learning environments the focus of the classroom is naturally taken off of the teacher placing the teacher in more of a supplementary role. Students are able to actively get involved in relevant and interdisciplinary activities using the teacher solely as a scaffold when necessary (Willems 2012). Authentic science environments break the constraints of school where there is one teacher and a classroom of learners and create an authentic situation where each person has a differentiated role that is just as important as the other roles in completion of the task (Adams 2012).

Strategies for effective implementation of Authentic STEM education

Educational Design Process (EDP)

Although authentic learning is an educational style designed around a more free form of discovering answers to questions it is difficult to solve a problem if the students do not have an organized sequence of steps to follow when solving a problem. Similarly to how scientists have a

sequence of steps to understand scientific phenomenon so do engineers. The engineer's version of the scientific method is referred to as the educational design process(EDP). EDP is also referred to as engineering design cycle (Billiar 2014). What differentiates and sets EDP above other systems such as the scientific method is that EDP encourages extensive research prior to choosing a specific hypothesis; Only after evaluation does the student decide on a method to evaluate through the remainder of the EDP process (Billiar 2014). Another benefit to the EDP process is that it is not simply represented as a one directional flow to the end, but instead a cyclic process where when the student reaches the revise aspect of the cycle, they begin to improve their process as they complete the cycle again. This cyclic nature of EDP allows students to learn the importance of optimization (Brophy 2008). Giving the students a structured framework allows the students to create authentic discoveries and solutions for problems but allows the students a framework to build off of and decreases dependency on a teacher. Creating a standard system for discover allows students to build from one discovery to the next as they begin to become more comfortable with the system of discovery and adapt the system to new problems with varying constraints (Billiar 2014). The steps of EDP are: 1) identify the problem, 2) research and rank objectives and restraints, 3) develop possible solutions, 4) select best solution within restraints, 5) construct a prototype, 6) test the solution, 7) communicate results, and 8) reassess and revise (Billiar 2014). In the Identify the problem stage of EDP the teacher identifies difficult topics for students to learn and sets the learning objectives (Billiar 2014). In stage 2 of EDP the teacher aids the student in the research and ranking of both learning objectives and constraints for proposed experiments (Billiar 2014). In stage three the teacher aids the students in coming up with multiple possible solutions to reach the learning objectives (Billiar 2014). In the selecting stage of EDP the teacher scaffolds as the student selects the

solution that best meets the learning objectives and has the fewest restraints (Billiar 2014). In the prototype stage the student creates a model that best fits their selected solution (Billiar 2014). In stage 6 the student will test their hypothesis by using their model to simulate a real world authentic situation (Billiar 2014). In the presentation stage the student gives deeper meaning to their findings by creating a cohesive presentation and sharing their findings with a scientific community of learners (Billiar 2014). In the final stage the student evaluates the weaknesses in their experiment and works toward refinement toward an ongoing goal of optimization (Billiar 2014). In Worcester a three year study with two thousand students was implemented to evaluate the success of using the EDP model in a middle school STEM classroom. The curriculum was 66.7% science, 13.3% technology/engineering and 6.7% special education. The representative teacher for the EDP study had his class using EDP to learn about the topic of biomedical engineering. Results from this experiment showed greater student enthusiasm and the EDP focused classroom was surveyed as either good or excellent with 96 percent of participating teachers (Billiar 2014).

Collaboration and Communication

Collaboration and communication are aspects that exist in the scientific community, to create a truly authentic education students need to experience both collaboration and communication. The setting where learning takes place has an effect on factors of communication and collaboration. “An informal science setting, like a robotics competition, affords the linguistic interaction and social structure similar to that of practicing science culture, like a laboratory” (Adams 2012 p. 412). When placed in authentic environments, students have the ability to collaborate with scientists in the field and engage in scientific conversations (Adams 2012). Collaborating and communicating with scientists in the field engages the student

in the learning experience and allows the student the ability to speak expertly on a topic allowing them to learn through immersion in an actual field (Adams 2012). Collaborations allows students of varying expertise and different fields the ability to feel as part of a community where all students are working together to achieve a common goal. This collaborative aspect of community not only motivates students but holds them accountable for their area of expertise and their portion of meeting the collective goal (Adams 2012). Collaborations allow the existence of mentorships in the field rather than teacher-student relationships, these mentorship type relationships are a great indicator of student's future interest in the given field (Adams 2012). Collaborating with scientists in the field and allowing students to collaborate and solve a problem in their local community is a great source of motivation (McConnell 2014). This type of collaboration creates a truly authentic learning platform because it allows students a way to apply their EDP to a current and local problem while collaborating with the local community (McConnell 2014). Collaboration and communication are foundational aspects in authentic STEM education because authentic education is designed to mimic the actual field of science (Strimel 2014). Scientists in the field need to have the basic skills of interdisciplinary collaboration and communication or they would not survive in the field. Learning information is not enough scientists need to learn how to work together and build on one another's work (Strimel 2014).

Drawbacks of Authentic STEM education

Time constraints

The most significant problem with authentic STEM education is that it is very time consuming for all parties involved. Teachers work hours every weekend to plan lessons in order to keep up with the workload (Tofel-Grehl 2014). Students during off school hours have to use

time to supplement foundational information that is relevant to their discovery that may not have been covered in previous courses. The students do about five hours of homework every night and some only get about two hours of sleep (Trofel-Grehl 2014).

Using authentic STEM education takes a lot of time to both plan and participate in. Along with taking a lot of time each student working on a different STEM project may be working at a different pace and need new material more frequently than other students in the class. Along with the time and effort spent during planning and the students spend engineering solutions extra time is also required by the teacher to gain professional development in the area of STEM education. The article by Robinson found that the amount of professional development a teacher has in the STEM area is a very good predictor of how successful the class will be when using the STEM design in the classroom (Robinson 2014).

Matching Curriculum

Despite clearly noticing deeper level thinking and problem solving students in the STEM programs were not doing significantly better on standardized tests (Gehler 2015). This was possibly due to a less teaching to the test style and more of a practical field style, but either way students were not learning the required content knowledge at any greater rate than students working in in a teacher centered classroom despite hours and hours of extra time exhibited (Gehler 2015).

Difficulties for students with special needs

It is especially difficult for students with disabilities to keep up with the pace of STEM education focused classes (Isreal 2013). One aspect that leaves students with disabilities behind is the complex language that is involved with STEM education. In a standard classroom students with disabilities have the time to sit down and learn the vocabulary but in a fast paced STEM classroom it can leave some students dwindling (Israel 2013).

Keeping up with the pace of the STEM curriculum is not solely a problem for special needs students, but also a problem in general engineering classroom. For example, Todd Fantz was engaging his students in engineering a T-shirt cannon for sporting events (Fantz 2013). Todd stated that the most difficult part of the process was convincing his students to use grade appropriate science and math before deciding on a design (Fantz 2013). Fantz found that the students would create a design or idea that they did not have the background knowledge to complete. What Fantz wanted the students to do was to take the grade appropriate information and apply it to the task at hand. Instead students created projects that required knowledge outside of the curriculum diminishing the relevance of the project for the class (Fantz 2013).

Summary

The creation of a gap between the Asian countries and western countries in the areas of science, technology, engineering and math have caused many political and educational debates on increasing the training, emphasis and funding for STEM education. Shortages in STEM career areas in the United States have also driven the promotion of STEM education. Colleges and universities are receiving fewer and fewer students in the STEM fields. STEM education can

be looked at a number of ways; one of the more supported and innovative ways for STEM to be used is in the area of authentic learning.

Authentic learning when coupled with STEM sets the stage to create the most motivated career ready student. Authentic learning is learning in an authentic science setting while working on solving real-world problems; as opposed to solving hypothetical problems in a classroom. Factors that greatly influence authentic STEM learning are environment, collaboration, communication and process. Collaboration and communication are important aspects in the authentic STEM curriculum because in real world engineering a job cannot get done without communication and collaboration with scientists in the same and varying fields of expertise. Environment is an important aspect of authentic STEM education primarily because it sets the stage for collaboration and communication between students and their peers, local scientists, community members and teachers. The environment of STEM education is also important because it allows the students to immerse themselves in their education, learning actively as a member of the science community versus a passive recipient of knowledge.

The process of STEM education is also a key aspect, students may feel freer to learn when they do not have a structured plan for discovery but providing the students with an engineering design process (EDP) template will allow them the most success with the least amount of pitfalls. EDP is a great process for students to learn due to its cyclic nature. The cyclic nature of EDP allows students to reflect and refine their work as they would do as a practicing scientist.

Despite the benefits to authentic STEM education there are some draw backs. The most significant draw back to STEM education is the amount of time required by all parties involved. Hours of time go in to planning and maintaining discovery by teachers. Hours of extra time go

into discover and supplementary education for students attempting to make a discover that involves knowledge that may not have been previously covered. Another problem is finding a problem that the students can solve where the bulk of the information the students are using is classroom relevant material. Even with collaboration across subject areas it is still difficult for students to have the full bulk of knowledge necessary to solve each problem and learn the desired content. This inability to cover the required content leads the students to achieving average standardized test scores despite demonstration of a deeper understanding.

Authentic STEM curriculum is a necessary and beneficial science curriculum. This curriculum requires large amount of time and planning but creates students that have greater problem solving skills. The effort put in will not be reflected on standardized tests but instead will be demonstrated in advanced problem solving skills and understanding of the Engineering design process.

Chapter III: Capstone Project

Overview

This project is a collection of lessons covering levels of organization and organ systems for use in the 8th grade science classroom. Each unit will incorporate authentic educational experiences that relate to or connect with the community. The project will allow students of all learning levels to interact with scientist, community members, and other students in an authentic cooperative environment. These lessons will allow students to see value in their learning and better retain what they learn.

Project Outline

This unit is a collection of 20 lesson plans that span 3 weeks of class. Each day of class will begin with a review to activate student's prior knowledge and to allow them to start the day with information they understand and build off that solid foundation. The foundational lesson plans will focus on the levels of organization, starting with cells and building up to cover organ body systems. Once we reach the topic of organ body systems, each day will start with reflecting on the previous lesson challenging students to recall what they learned in the previous lesson then apply that information to solve a real world issue that may be present. After warming up with previous lesson recall the students will get a quick overview of a new body system. In the overview the students will help me

uncover basic knowledge of the purpose of each body system and the main organs in each body system. Following this baseline information students will be tasked with creating a working model of the day's body system. This working model will contain all the major organs of the body system and be able to accurately demonstrate the purpose of the body system. For homework each night the students will have to research a malfunction in the day's body system, only to come to class the next day to observe a real life problem in the body system and have to postulate, what happened, why it is problematic and how it would be solved in a medical setting. The lessons will conclude with a final project and presentation where the students will be challenged to build a working model that incorporates two body systems, cause a malfunction and postulate causes to the malfunction. Each student will present this final project to the class after working in a cooperative group to plan and design the project and presentation.

DAY 1

TIME: 40 minutes

NYS SCIENCE STANDARDS:

- 5.1a, 5.1b, 5.1c, 5.1d, 5.1e, 5.1f, 5.1g

OBJECTIVES:

- Students will *recall* information of cell structures and functions.
- Students will *discover* parallels between organisms of varying complexity

MATERIALS:

- PowerPoint from Mentorschools.com edited (Slides 1-17)
- Characteristic of life notes
- Characteristics of life homework

INTRODUCTION:

- Share the image of the living/nonliving objects (without the labels) (**Slide 1**) have the students write down the name of each object on the first slide and state whether it is living or non-living.
- Ask the students to share their answers and ask follow up questions to see if there are any misconceptions.
 - What about that makes it a living organism?
 - This object also does that does that mean this object is also living?
- Explain that we are going to go through the 7 characteristics life and they need to follow along and fill in their work sheet as we progress.

LESSON/ACTIVITY:

- Pass out the Characteristics of life work sheet
- Remind the students that all living things will have these 7 characteristics of life and if something doesn't have one of these then it cannot be a living organism.
- Bring up the cells slide (slide 3) as a quick informal assessment of their cell knowledge ask the students what they know about cells or cell parts and keep notes on this on the board.
- Pose the questions: Who can name something that is made of cells? What are two types of cells?
- Bring up slide 4 talk about how single celled organisms although they are only one cell still have the ability to carry out all 7 characteristics of life.
- Bring up slide 5 pose the question: are all cells the same? Why do you think all these cells look so different from one another?
- Guide the students to the fact that although they are all cells they all have different functions that contribute to life and that is why they are so different.

- Bring up slide 6: Tell the students that all living things use energy then pose the question: What is the process of a plant using the sun light to store energy?
- Pose the question: If plants get their energy from the sun where do animals or consumers get their energy from?
- Bring up slide 7: talk to the students that photosynthesis is the process of using sunlight to create energy and discuss how that energy is transferred to consumers when they consume plants.
- Pose question: Without plants could consumers survive? How would they get energy without plants?
- Bring up slide 8.
- Pose the question: has anybody ever heard about or seen a plant react to the sun?
- Discuss how plants will adjust to face the sun and increase their ability to produce energy for themselves.
- Bring up slide 9 pose question: Does anyone have any other examples of responses to stimuli that I haven't mentioned yet?
- Bring up slide 10 pose question: Does anyone know the difference between sexual and asexual reproduction?
- Discuss that sexual is between two organisms and asexual is one organism multiplying.
- Bring up slide 11 Here are some examples of asexual reproduction
- Bring up slide 12 show students what asexual reproduction looks like.
- Bring up slide 13 Ask the students at what age do humans stop growing and developing? Inform them that a human never stops growing and developing, just because a human may not be getting taller does not mean growth is not taking place.
- Bring up slide 14 why is adaption tough to observe? Explain that adaption takes a long time to be completed.
- Bring up slide 15 show some adaptations. Pose question: Why would the adaptation of white fur be beneficial for an arctic fox?
- Bring up slide 16 Explain how all living things have a genetic code that dictates the characteristics they carry and express.

CLOSURE:

- Bring up slide 17 and have students volunteer answers about which picture demonstrates what characteristic of living organisms. Explain that for homework students will be identifying living and non-living organisms.

ASSESSMENT:

- The students' ability to *recall* information regarding cell structure and function were assessed as they answered questions about the design of the cell.
- The students' ability to *discover* parallels was assessed by their ability to identify the same characteristics for multiple organisms.

Characteristics of Life Worksheet 1

Name: _____

Directions: During the Power Point please fill in each characteristic and its definition

1. Responds to Environment (adapt)

Definition: Living things will make changes in response to a stimulus in their environment.

How does Halia (Mr. Stewart's dog) show this characteristic?

2. Growth and Development

Definition: Cells grow and divide allowing an organism to grow and increase complexity

How does Halia (Mr. Stewart's dog) show this characteristic?

3. Has genetic Material

Definition: All living things have genetic material that code for expressed and unexpressed traits

How does Halia (Mr. Stewart's dog) show this characteristic?

4. Reproduce

Definition: All living things reproduce in one of the following ways:

Asexual reproduction - Producing offspring without the use of gametes.

Sexual reproduction - Producing offspring by the joining of sex cells

How does Halia (Mr. Stewart's dog) show this characteristic?

5. Composed of Cells

Definition:

How does Halia (Mr. Stewart's dog) show this characteristic?

6. Use Energy

Definition: All living things are composed of one or more cell

How does Halia (Mr. Stewart's dog) show this characteristic?

7. Made of cells

Definition: all living things are made up of one or more cell

Characteristics of Life Homework 1

Name: _____

Directions: For 2 different plants and 2 different animals, briefly say how they meet the 6 characteristics of life.

1. ___ Responds to Environment _____

Plant 1:

Plant 2:

Animal 1:

Animal 2:

2. _____ Growth and Development _____

Plant 1:

Plant 2:

Animal 1:

Animal 2:

3. _____ Has cells _____

Plant 1:

Plant 2:

Animal 1:

Animal 2:

4. _____ Reproduce _____

Plant 1:

Plant 2:

Animal 1:

Animal 2:

5. _____ Has genetic Material _____

Plant 1:

Plant 2:

Animal 1:

Animal 2:

6. _____ Composed of Cells _____

Plant 1:

Plant 2:

Animal 1:

Animal 2:

7. _____ Use Energy _____

Plant 1:

Plant 2:

Animal 1:

Animal 2:

DAY 2

TIME: 40 minutes

NYS SCIENCE STANDARDS:

- 5.1a, 5.1b, 5.1c, 5.1d, 5.1e, 5.1f, 5.1g

OBJECTIVES:

- Students will *research* information of life functions.
- Students will *discover* parallels between organisms of varying complexity
- Students will *design* a representation of a life function

MATERIALS:

INTRODUCTION:

- Pose the question: How does Goldie (the goldfish) carry out the seven characteristics of life?
- Allow students to give answers and ask follow up questions: Where does the food she eats get its energy? Why are gills a useful adaptation for Goldie? Is Goldie made of one cell or many cells?
- Using 18 total Popsicle sticks. 6 green (numbered 1-6), 6 red (numbered 1-6) and 6 blue (numbered 1-6) the students will be separated in to groups.

LESSON/ACTIVITY

- Inform the students that they need to join in a group with their partners that share the same color popsicle stick.
- The green group will be our plant group, the blue group will be our animal group and the red group will be our fungi group.
- Then further break down the assignments by the characteristic of life.
- 1 will be cells, 2 will be growth and development, 3 will be energy, 4 will be responding to stimulus, 5 will be reproduction and 6 will be adaptation.
- Bring out the laptop cart and tell each student that they will need a laptop and that they will need one worksheet 2.
- Tell the students: On worksheet 2 put your name, whether you are plant, animal or fungi and state which characteristic of life you have been assigned.
- For the rest of the class every student is going to serve as a researcher that is working on becoming an expert for their designated characteristic of life as it is carried out by their designated category of organisms.
- Students will be directed to log on and guided to the library server where they will use biology based data bases to search for journal articles on their new expertise.
- I will show an example to students of a good source and demonstrate how to summarize an extensive article down to the key important factors on the worksheet.

- I will read key parts of the journal article to the students, showing them the diagrams in the article so they know how to skim through a journal article to the information that is most helpful.
- I will have students volunteer to read the captions under diagrams 1-5. When the students are done reading I will explain the diagrams as they pertain to the mechanism of responding to stimuli.
- Students for the remainder of the class will be given the task of finding two articles on their topic reading them and summarizing the main points for their two articles.
- I will circulate aiding the students and guiding them towards articles that will help them with their final project of creating a model of how their system functions in their organism.
- Article title: Biofilms, flagella, and mechanosensing of surfaces by bacteria By Robert Belas

CLOSURE

- Finding 2 quality journal articles, reading them and summarizing them takes a good amount of time so students will be asked to complete the remainder of the assignment for homework.
- Students are encouraged to get help from parents and siblings, this will aid in scientific conversations and using vocabulary terms, I want to encourage students when they return home to use their vocabulary and discuss what they learned.

ASSESSMENT:

- Students will be assessed on *researching* information of life functions by my rotation and good questioning as they research.
- Students will be assessed on *discovering* parallels between organisms of varying complexity by the answers that they complete on the home work sheet provided.
- Students will be assessed on *designing* a representation of a life function by the diagrams they create for class/home work.

RESOURCES:

- Article title: Biofilms, flagella, and mechanosensing of surfaces by bacteria By Robert Belas

Characteristics of Life homework sheet 2

Name: _____

Organism: _____ Bacteria _____

Characteristic Of life: _____ Responding to stimuli _____

Journal Article 1: Article title: Biofilms, flagella, and mechanosensing of surfaces by bacteria By Robert Belas

Journal article 2:

How does your organism achieve this characteristic of life:

The bacteria in order to thrive wants to inhabit a host organism. To find a host organism the bacteria moves in its designated area until it is able to sense another organism and discreet it's biofilm to begin preparing to attach to the host organism. In order for the bacteria to do this it must first sense that it is next to another organism then respond by excreting its biofilm. The tool that bacteria uses to sense that it is near something is the same tool it uses for mobility. The flagella of the bacteria is powered by a protein pump mechanism that keeps the flagella moving. The pump has a negative feedback system. When the pump isn't pumping there is a feedback of protein on one side of the protein pump and the mechanism shuts down. This happens because the flagella is stuck against something and no longer spinning. This knowledge that the flagella is stuck on something sends the signal to start discretion biofilm. It is through this mechanism that bacteria sense and responds to a stimuli.

Create a diagram that shows this characteristic of life or include a picture of a diagram:

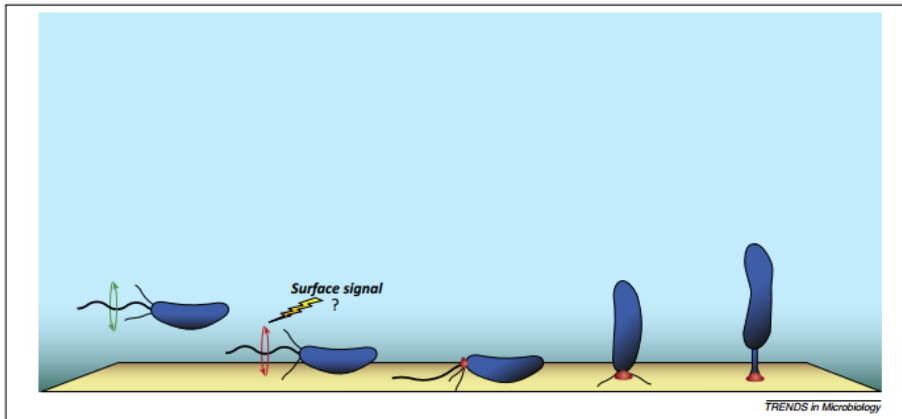


Figure 4. Flagellar mechanosensing in *Caulobacter crescentus* involves inhibition of flagellar rotation, resulting in just-in-time production of the holdfast polysaccharide adhesin. From left to right: swimming swarmer cells possess a single flagellum and polar pili. As a cell nears a surface, surface contact results in the rapid pili-dependent arrest of flagellum rotation and concurrent stimulation of polar holdfast adhesive polysaccharide (depicted here as a red cone) and ultimately the formation of a stalk cell. Green circular arrows indicate rotating flagellum; red circular arrows indicate rotation is inhibited. Adapted from Kirkpatrick and Viollier [62].

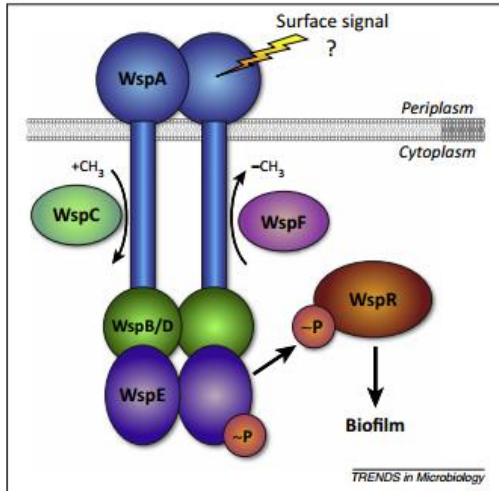


Figure 2. *Pseudomonas aeruginosa* Wsp surface-sensing system. WspA is predicted to be a membrane-bound methyl-accepting chemotaxis protein that detects an unknown signal when grown on a surface. WspB and WspD are CheW-like proteins, WspE is a CheA-like histidine kinase, WspC is a CheR-like methyltransferase, and WspF is a CheB-like methyl-erasure. Detection of surface growth by WspA results in phosphorylation of WspR, increased synthesis of c-di-GMP, and triggers biofilm formation. Adapted from Huangyutitham, Guvener, and Harwood [25].

How does your organism's mechanism of this characteristic compare to other organisms?

Similar to a mammal the bacteria responded to its surroundings by sensing something using an outside appendix and having a chemical signal sent to another aspect of the organism that reacts in a beneficial manner. For example when a mammals skin receptors are signaled they send neurotransmitters to dendrite which sends an electrical system down the cell body and to the axon where the signal is passed to the next neuron.

DAY 3

TIME: 40 minutes

NYS SCIENCE STANDARDS:

- 5.1a, 5.1b, 5.1c, 5.1d, 5.1e, 5.1f, 5.1g

OBJECTIVES:

- *Verbalize* scientific expertise on designated characteristic of life
- *Plan* a unique working model based on their research
- *Collaborate* with local scientist to discuss the key features that could go into a working model

MATERIALS:

- Local scientists
- Model Planning worksheet
- Laptop cart
- Materials for building models: toilet paper rolls, marbles, Styrofoam balls, pipe cleaners, straws, chop sticks, twine, beakers, graduated cylinders, rubber stoppers.

INTRODUCTION:

- Introduce 3 local scientists Zoologist to join group assigned to animals, Botanist for the group assigned to plants and a microbiologist for the group assigned to fungi.
- If I cannot get local scientists my past-classmates and professors from Grove City College who are in the field have volunteered to cooperate via skype with my students.
- The local scientists will give quick introduction with their name, where they work, what their area of expertise is and give one unique fact about themselves.

LESSON/ACTIVITY:

- Have the students get in their same groups from yesterday. One group for plants, one group for animals and one group for fungi. The groups will then be paired with their local scientist.
- In the groups the students will go around and talk about what characteristic of life they researched and give the summary of what they discovered including mechanism of life, diagram of the mechanism and how it compares to different organisms.
- The students will then be given the task to create a working model to represent their characteristic of life.
- Students will be instructed to use the worksheet to plan the design of their working model.
- On the worksheet students will have to write out the plan for their working model, they will have to plan what materials they will use and explain what each material will represent in the working model.

- The local scientists will begin working with student number 1 and work their way to student number 6, I will also be working around and helping students plan their models along with the local scientists.
- When each student is done they have to submit their model design to me and I will approve the model or have the students revise what they are making.
- When I have approved the students model they can began planning their presentation. They will use the information from the articles to write out what they want to say while they are demonstrating their model to the classroom.
- If the students' model can be completed with pre-purchased materials in the classroom the students will be allowed to begin building their model with the help of both the teacher and the local scientist.

CLOSURE:

- Let the students know that if they have not completed their model plan they need to complete their model plan for homework and email me all the materials they will need to complete their model plan. This will allow me to purchase the materials they need for their model the night before and allow them to build as soon as they come in on day 4.

ASSESSMENT:

- Students will be assessed on *Verbalizing* scientific expertise on designated characteristic of life through observation by both me and the local scientist
- Students will be assessed on *Planning* a unique working model based on their research by the materials they turn in on their model planning worksheet.
- Students will be assessed on *Collaborating* with local scientist to discuss the key features that could go into a working model by observation by me and the local scientists.

Characteristic of life Model Plan

Name: _____

Type of Organism: _____

Characteristic of Life: _____

Local Scientist: _____

Explain what the model will represent.

Does your model have a working mechanism? How does the mechanism work?

How will what is represented in the model help the organism achieve the characteristic of life you were assigned?

Discuss how your organism compares to other organisms in regard to the same characteristic of life.

List all materials and what they will represent in the model:

DAY 4

TIME: 40 minutes

NYS SCIENCE STANDARDS:

- 5.1a, 5.1b, 5.1c, 5.1d, 5.1e, 5.1f, 5.1g

OBJECTIVES:

- Students will *create* a working model that represents a characteristic of life
- Student will *compare* their organisms life function to that of another organism
- Student will *collaborate* with fellow students to as experts on their own organism and students of other organisms.

MATERIALS:

- Materials requested for building working models
- Laptop cart
- Rubric for presentation

INTRODUCTION:

- Ask the students to write out the 7 characteristics of life
- Have student's volunteer answers and explain what each characteristic of life is.
- Ask follow up questions like: water can move in a stream is water a living thing?
- How can plants be a living thing if they can't move? (hoping a student corrects me)

LESSON/ACTIVITY:

- Ask the students to get in groups with the other students who share their characteristic of life. I will designate space in the room for the ones to sit, twos to sit....
- While with the members of the same characteristic of life I want each student to take turns explaining how their organism carries out that characteristic of life while the other two students take notes on the characteristic of life.
- After all three students have shared about their organism I want everyone to go back to their original groups (animal, plant and fungi)
- In these original groups the students from each characteristic of life will share about the characteristic of life traits from all 3 organism groups in a jigsaw type manner until all student have a complete puzzle with information from every member of every group.
- When this activity is completed the students should have all the information they need to both complete the working model and prepare for the presentation.
- Students will be given time to work on their model, I will call the students up one organism group at a time to collect the box of materials they requested to create their model.
- As the students work I will circulate and ask students about their project and help fix any pitfalls that students may be experiencing.

CLOSURE:

- Students will be asked to pack up their models and any materials they need to take with them to finish the model.
- Students will be provided the rubric that I will be grading them on the next day so that they are able to plan their presentation in a way that will allow them to get all the necessary points.

ASSESSMENT:

- Students will be assessed on *creating* a working model that represents a characteristic of life by the finished project that they present.
- Student will be assessed on *comparing* their organism's life function to that of another organism using a rubric after their presentation.
- Student will be assessed on *collaborating* with fellow students to as experts on their own organism and students of other organisms by observations and by their completed jigsaw.

Jigsaw	Animal	Plant	Fungi
Cells			
Respond to stimuli			
Growth			
Reproduction			
Adaption			
Acquiring energy			

Characteristics of Life homework 4

Directions: I want you to focus on completing your model and preparing to present so this is just the rubric I will be using tomorrow.

5	4	3	2	1
Student has functional model and demonstrates designated life function	Student's model is not functional/student is unable to completely demonstrate function	Students model is incomplete or student does not know how the model would function	Student model is complete but contains errors and missing functional aspect	No Model
Student fully explains the life function of their organism	Student explains life function to a semi-complete level	Students life function is incomplete missing key attributes	Student explains life function with inaccurate information	Cannot describe life function
Student fully explains how their organism life function varies from the same function of another organism	Student explains what is unique about their organism but is unable to touch on other organisms	Student explains unique features of their organism but description of other organisms is incorrect and inaccurate	Student cannot explain what is unique about their organism	Student does not address unique nature of organism
Student is able to field and answer questions with clear logical answers	Student is able to partially answer questions given	Student is unable to answer questions completely and appears unprepared	Student answers questions with some inaccurate information	Student doesn't try to answer questions

DAY 5

TIME: 40 minutes

NYS SCIENCE STANDARDS:

- 5.1a, 5.1b, 5.1c, 5.1d, 5.1e, 5.1f, 5.1g

OBJECTIVES:

- Students will *present* their working model that represents the characteristic of life for their assigned organism.
- Students will *answer* questions presented by fellow students as experts of their topic.

MATERIALS:

- Rubric
- Student Grading Sheet
-

INTRODUCTION:

- For the introduction I will explain the order that students will be presenting and which students will be asking questions to the presenter.
- The order will start with green (plants) number 1 (cells), next will be blue (animal) number 1 (cell) and then Red (fungi) number 1 (cell). This will repeat for numbers 2-6.
- The students that will pose the questions to each presenter are the two students from the other organisms and one number ahead of the presenter. Ex. If the presenter is Blue (animal) number 1 (cell), then the two students asking questions will be red (fungi) number 2 (growth) and Green (plant) number 2 (growth).
- This pattern will allow the students to have clear expectations of when they are presenting, allowing them to prepare.
- This system will also insure that every student asks a question and that every presenter gets asked two questions.

LESSON/ACTIVITY:

- Explain to the students that as other students present that they need to take notes on the designated sheet (presentation sheet 1). The sheet is that same as the jigsaw the students filled out the other day. Filling this sheet out while students are presenting will give the students a more well-rounded understanding of each organism's characteristic of life.
- The two students who are asking questions of the presenter will also be grading the presenter along with me to have the presenter earn a collective grade.
- As I grade the presentations I will write down the questions presented by each student and the answers given by each presenter.
- The format of each presentation will start with a student setting up and presenting
- When the student is done presenting the two designated students will ask their quality non-yes/no questions.
- After the questions have been answered for the initial two questions. The questioning will open up to the rest of the class.

- Following all questioning the next student should be set up and ready to present, optimizing presentation time and decreasing transition time.
- Any students who are unable to present will be able to present during the laboratory period.

ASSESSMENT:

- The students' ability to *present and answer questions* will be assessed by me and their fellow students using the designated rubric.
- The scores between the students and me will be averaged and a grade will be given to the students.

Characteristics of Life presentation rubric

Presenter: _____ Grader: _____

5	4	3	2	1
Student has functional model and demonstrates designated life function	Student's model is not functional/student is unable to completely demonstrate function	Students model is incomplete or student does not know how the model would function	Student model is complete but contains errors and missing functional aspect	No Model
Student fully explains the life function of their organism	Student explains life function to a semi-complete level	Students life function is incomplete missing key attributes	Student explains life function with inaccurate information	Cannot describe life function
Student fully explains how their organism life function varies from the same function of another organism	Student explains what is unique about their organism but is unable to touch on other organisms	Student explains unique features of their organism but description of other organisms is incorrect and inaccurate	Student cannot explain what is unique about their organism	Student does not address unique nature of organism
Student is able to field and answer questions with clear logical answers	Student is able to partially answer questions given	Student is unable to answer questions completely and appears unprepared	Student answers questions with some inaccurate information	Student doesn't try to answer questions

Question 1:

Answer 1:

Question 2:

Answer 2:

Presentation worksheet 1	Animal	Plant	Fungi
Cells			
Respond to stimuli			
Growth			
Reproduction			
Adaption			
Acquiring energy			

DAY 1

TIME: 40 minutes

NYS SCIENCE STANDARDS:

- 1.2A, 1.2B, 1.2C

OBJECTIVES:

- Students will *recall* information on the digestive system and its function
- Students will *plan* the construction of an accurate representation for the digestive system
- Students will *problem solve* to create solutions that occur in the digestive system.

MATERIALS:

- Body Systems PowerPoint (Slides 2-6)
- Digestive system notes
- Digestive system homework
- PVC, Rubber tubing, rubber glove, chip clips, pantyhose, balloons, funnel

PREPARATION:

- Using a ring stand as the foundation screw on a ring and in the ring attach the funnel (mouth) to the ring.
- From the bottom of the funnel attach the clear tubing and have a rubber glove attached to the other side of the tubing. Use electrical tape to seal the attached area.
- Have another section of rubber tubing (Small intestine) that will lead to the pantyhose (large intestine) and place a beaker under the pantyhose. Place sandwich clips (sphincters) at each attachment sight.
- Attached below is what the set up will look like.

- **INTRODUCTION:**

- Ask the students as a warm up to write down as many organ systems as they can without using the book.
- Students will write down a variety of things and I will have them volunteer their answers.
- I am expecting to get answers that not only are organ systems but organs themselves.
- When a student volunteers an organ instead of an organ system I will pose a question similar to, “The stomach is an organ, does anyone know what organ system the stomach belongs to?”
- Once we have warmed the students up to organs, and organ systems we will begin the lesson.

LESSON/ACTIVITY:

- Pass out the Digestive system notes and have the students fill in the notes as we work through them
- Start on slide 2 with the students and discuss the levels of organization giving extra attention to the fact that organ systems are made up of organs, organs are made of tissues and tissues are made up of cells.
- Pose question: So are organ systems made up of cells? Let the students know that although organ systems are directly made up of organs they are also made up of cells and tissues.
- Pose question: What is homeostasis? Pulling of students previous knowledge they should be able to recall what homeostasis is.
- Call on student and have the student read slide 4 for the class, while the student is reading I will circulate to make sure students are taking down their notes on the digestive system.
- For slide 5 I will have another student read the content to the class as I circulate and check in on the students.
- Bring up slide 6 and go through labeling each part of the digestive system. For each part of the digestive system I will not just tell them what organ we are labelling, but instead I will ask them what organ it is that I am pointing to.
- Pose the question: What organ is this? Can anyone say what this organ does without looking back in your notes?
- After completely labeling the diagram the students will be prompted to plan a model of the digestive system using two pieces of tubing, 1 rubber glove, 4 chip clips, 1 funnel, 1 spoon electrical tape and pantyhose.
- I will prompt the students to think about the function of the organ when they are trying to figure out what piece of material they want to use for what organ.
- I will give the students 10 minutes to work on this, at the end of the ten minutes I will ask the students what material they chose for each organ.
- I will then bring out the model I created showing the students.
- As I go through the demonstration I will explain that I chose the funnel and the spoon for the mouth because it allowed me to mechanically break up the food. While saying this I will be demonstrating as I crush cereal and juice with the spoon in the funnel.
- I will show the students that the chip clip acts as a sphincter and will not allow food to the esophagus until the sphincter is relaxed.
- As the mixture passes through the first tube (esophagus) I will state that the tube was a good semi rigid form of transport from the mouth to the stomach.
- When the food is in the glove (stomach) I will inform the students that the glove provided a good opportunity to further churning and digest the food.
- Pose question: What else is in the stomach that helps digest the food? Why do you think that I couldn't include acid in the rubber glove (stomach)?
- Discuss how acid would break down the glove like it breaks down the food. This is why the stomach acid is such an important part in the process.
- Pose question: What is the purpose of the small intestine?
- Explain that although nutrients are absorbed in the small intestine it is not something we are capable of simulating.

- Pose question: What is the purpose of the large intestine?
- Then I will demonstrate using the pantyhose that liquid can be reabsorbed while the solid waste is left behind.
- When reabsorption of water is finished, I will open the last chip clip (anal sphincter) and let the students see as the solid waste is removed.

CLOSURE:

- Explain to the students that for homework they have to do 2 things.
- They have to complete an empty diagram of the digestive system without notes.
- They have to look up and come to class with one digestive malfunction and cures for the malfunction. Print and bring the page containing the malfunction to class the following day.

ASSESSMENT:

- Students will be assessed on *recalling* information on the digestive system and its function by my classroom questions and by the homework diagram that they will label.
- Students will be assessed on *planning* the construction of an accurate representation for the digestive system by the worksheet that they completed in class, creating a digestive system.
- Students will be assessed on *problem solving* to create solutions that occur in the digestive system by aiding me in fixing a malfunction that will be present in model for a warm up.

REFERENCES:

- colleen_snow.azschool.org/teacher/files/.../humanbodysystems.pptx
- https://en.wikibooks.org/wiki/IB_Biology_Practical_Investigations/Human_Health_and_Physiology/Model_Digestive_System

Digestive System Worksheet

Name: _____

Remember, the human body is organized in several levels, from the simplest to the most complex. . .

Cells – the basic unit of life

Tissues – clusters of cells performing a similar function

Organs – made of tissues that perform one specific function

Organ Systems – groups of organs that perform a specific purpose in the human body

***The purpose of the 11 organ systems is for the human body to maintain **homeostasis**.

Purpose of Digestive System: to convert food particles into simpler micro molecules that can be **absorbed** into the **bloodstream** and used by the body

Major Organs and their Functions:

Mouth – to chew and grind up food-- saliva also begins the chemical breakdown

Esophagus – pipe connecting mouth to stomach

Stomach – secretes an extraordinarily strong acid (pH = 2) that leads to breakdown of food-- once the food is broken down in the stomach and mixed with digestive juices, it is called **chyme**

Pancreas – produces the hormone insulin that regulates blood sugar levels-- also help neutralize stomach acid

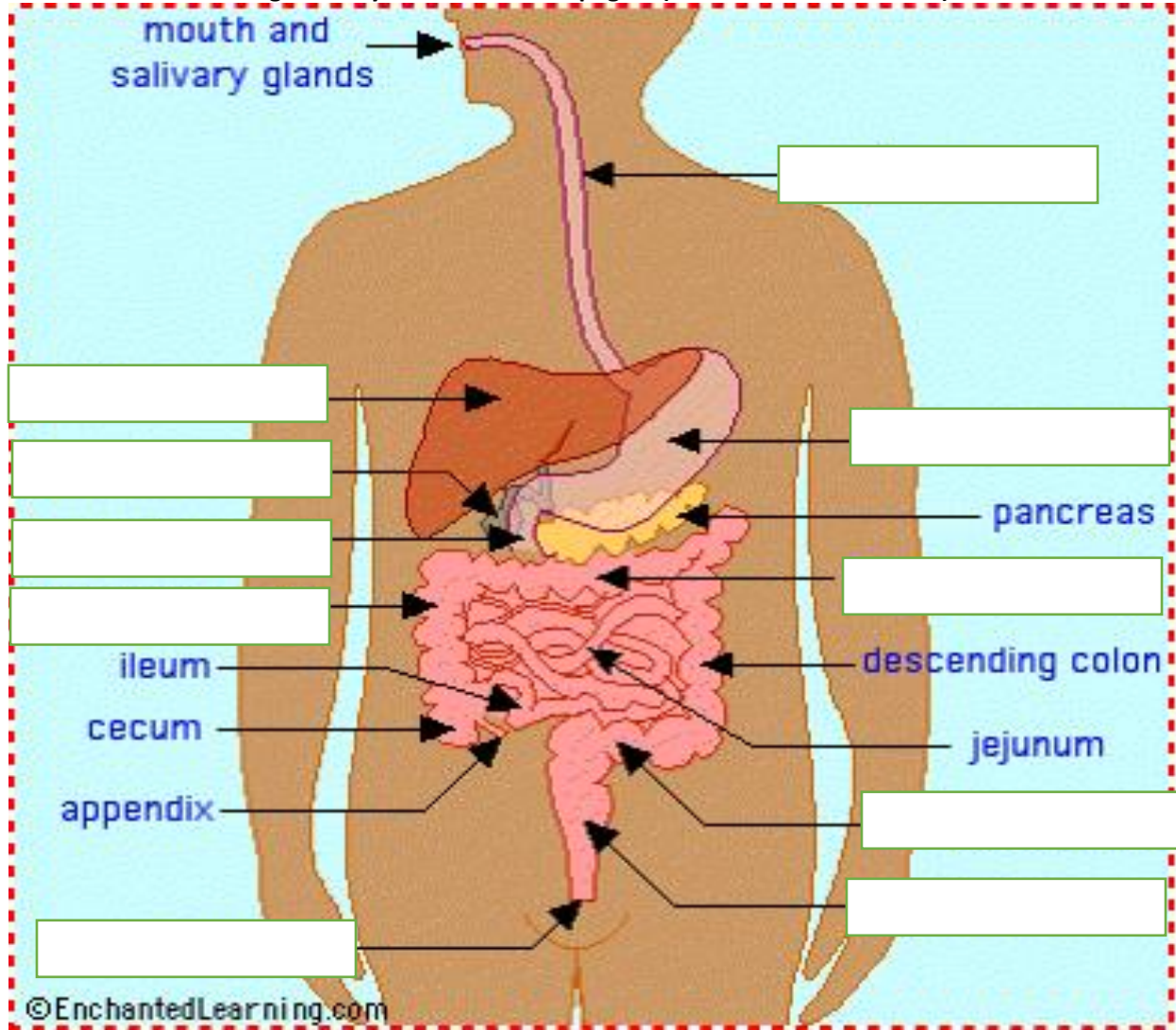
Liver – produces bile, which breaks down fats in foods

Gallbladder – pouch-like organ that stores bile for future use

Small Intestine – after digestion is complete, the chyme enters the small intestine where it is absorbed into the bloodstream-- the chyme is propelled along by folded surfaces called villi, on the intestine

Large Intestine – removes water from the chyme and gets the waste ready for excretion

Digestive System Worksheet page 2 (also used as Homework)



<http://www.enchantedlearning.com/subjects/anatomy/digestive/>

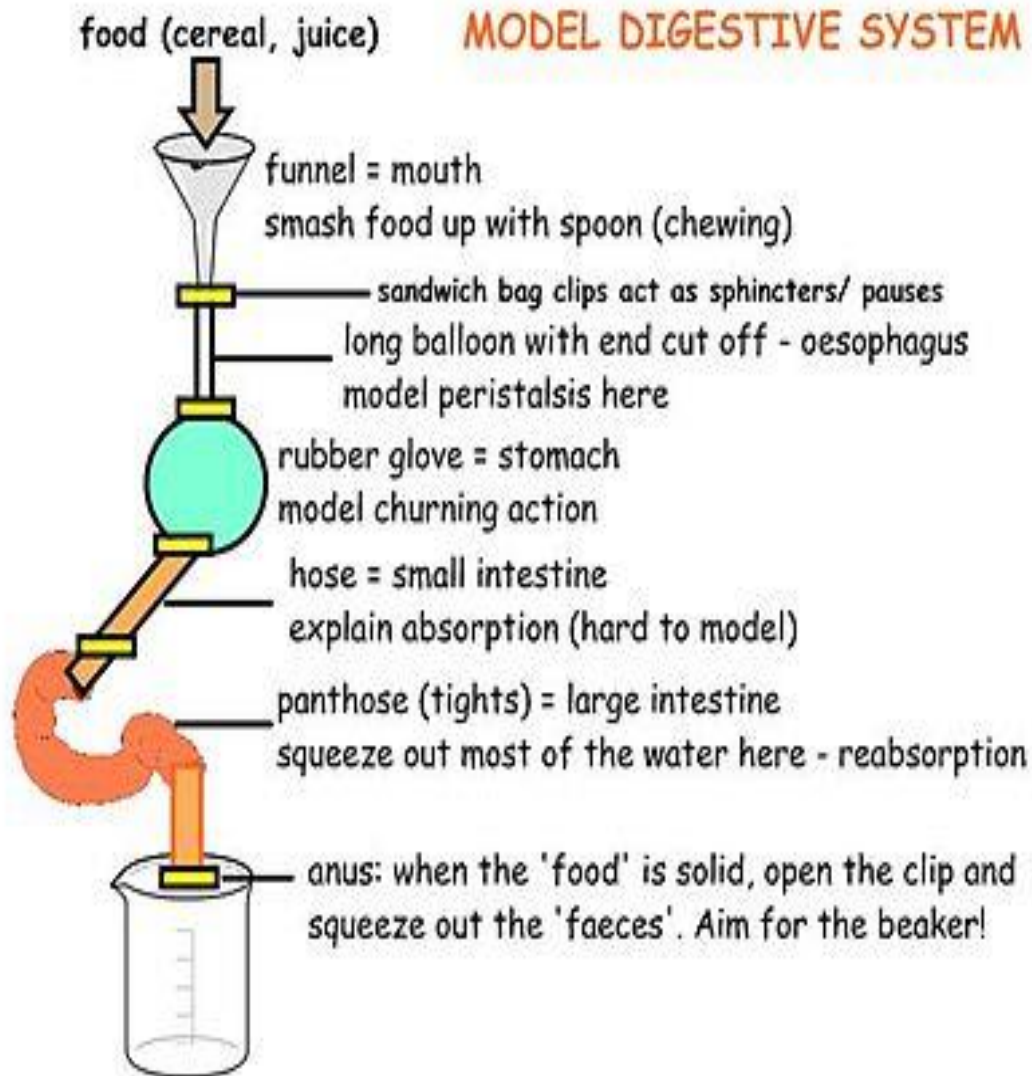
Digestive system model plan

Name: _____

Directions: Using the information that you will only have 2 pieces of tubing, a rubber glove, a funnel, a spoon, 4 chip clips, electrical tape and pantyhose; create a plan to make a model of a digestive system. Draw and label the materials and what digestive organ they represent.

(Students won't see the model I will use but I will include a picture)

https://en.wikibooks.org/wiki/IB_Biology_Practical_Investigations/Human_Health_and_Physiology/Model_Digestive_System



DAY 2

TIME: 40 minutes

NYS SCIENCE STANDARDS:

- 1.2a, 1.2 b, 1.2e, 1.2j

OBJECTIVES:

- Students will *recall* information on the digestive system and its function
- Students will *plan* the construction of an accurate representation for the excretory system
- Students will *problem solve* to create solutions that occur in the excretory system.

MATERIALS:

- Body Systems PowerPoint (Slides 7-8)
- Digestive system set up
- Excretory system notes
- Excretory system homework
- 3 pieces of tubing, 12 coffee filter, a funnel, a rubber stopper, a spoon, 2 water bottles, yellow food coloring, and molding clay
-

PREPARATION:

- Using 3 ring stand as the foundation. Line up all 3 stands in a row.
- On the two outside stands screw in 2 rings at the top and at the same height. These rings will hold the water bottles that will serve as the kidneys.
- On the middle ring stand put a ring halfway up the stand. This will hold the funnel that will act as the bladder.
- Attached to the bottom of the two water bottles add 2 pieces of tubing (ureters) sealing them water tight with the clay and having them lead into the funnel beneath.
- Place 6 coffee filters (nephrons) bunched up in each of the water bottles.
- Coming from the bottom of the funnel have the third piece of tubing coming out, this will serve as the urethra and use the stopper to pinch the tube, and this will act as the sphincter.
- Take a beaker full of water and add a couple drops of yellow food coloring, this will serve as the urine.

INTRODUCTION:

- Ask students to volunteer their digestive system malfunctions. Ask each student to briefly mention what their malfunction was and what the cure for the malfunction was.
- If a student does not mention ulcers, then I will bring it up by saying, “Has anyone ever heard of an ulcer and know what an ulcer is?”
- I will then bring the students back to the model we set up the previous day.
- Pose question: remember how I said yesterday that although there was stomach acid we cannot put acid through our model?
- I will then take 2 molar HCL and run it through the model in the hood and make sure the students are not in the area of the model but can still see the model.
- Pose question: What is happening to the rubber glove? Hope a student mentions that the acid is eating away at it?
- Pose question: What does the glove represent? Do you think that the acid in the stomach could eat away at the stomach itself?
- State that the acid can eat away at the stomach and that is what an ulcer is.
- Pose question: Does anyone know a cure or at least some relief for an ulcer or maybe even heart burn?
- If someone doesn't bring up antacids, I will mention them and say that they keep the solution from becoming too acidic. I will then mix the antacid with the 2 molar solution then run the demonstration again and have the students observe that the wearing away of the glove is much slower or non-existent.

LESSON/ACTIVITY:

- Pass out the Excretory system notes and have the students fill in the notes as we work through them
- Start on slide 6, so the students cannot already see the purpose of the excretory system.
- Pose the question: Does anyone know the purpose of the excretory system?
- Have a student volunteer to read slide 7 and allow time for all students to fill in their notes.
- When the students are done with their notes ask for a volunteer.
- This student with the help of the class will write a flow chart of where the urea goes from the bloodstream to the toilet.
- Make statement: Student A is going to write out a flow chart of each organ the urea passes through in the excretory system, if he/she needs help he/she will ask for help and he/she will call on someone raising their hand to help.
- Statement: Please copy this flow chart on the back of your note sheet.
- For slide 8 I will have another student read the content to the class as I circulate and check in on the students.
- Bring up slide 8 and go through labeling each part of the digestive system. For each part of the digestive system I will not just tell them what organ we are labelling, but instead I will ask them what organ it is that I am pointing to.
- Pose the question: What organ is this? Can anyone say what this organ does without looking back in your notes?
- After completely labeling the diagram the students will be prompted to plan a model of the excretory system using 3 pieces of tubing, 12 coffee filter, a funnel, a rubber stopper, a spoon, 2 water bottles, yellow food coloring, and molding clay
- I will prompt the students to think about the function of the organ when they are trying to figure out what piece of material they want to use for what organ.
- I will give the students 10 minutes to work on this, at the end of the ten minutes I will ask the students what material they chose for each organ.
- I will then bring out the model I created showing the students.
- As I go through the demonstration I will explain that I chose the water bottles stuffed with coffee filters for the kidneys because the kidney is the filtering agent I the excretory system.
- I will then explain that I chose the tubing as the ureter because it successfully carries waste from the kidneys to the bladder.
- I will explain that the funnel was chosen for the bladder because it does a good job of holding and storing waste.
- The last piece of tubing with the rubber stopper will serve as the urethra because it carries waste out of the body and has an on off valve (sphincter) in the stopper.

CLOSURE:

- Explain to the students that for homework they have to do 2 things.
- They have to complete an empty diagram of the excretory system without notes.

- They have to look up and come to class with one excretory malfunction and cures for the malfunction. Print and bring the page containing the malfunction to class the following day.

ASSESSMENT:

- Students will be assessed on *recalling* information on the digestive system and its function by my classroom questions and by the homework diagram that they will label.
- Students will be assessed on *planning* the construction of an accurate representation for the excretory system by the worksheet that they completed in class, creating an excretory system.
- Students will be assessed on *problem solving* to create solutions that occur in the excretory system by aiding me in fixing a malfunction that will be present in model for a warm up.

REFERENCES:

- colleen_snow.azschool.org/teacher/files/.../humanbodysystems.pptx (edited)

Excretory system model plan

Name: _____

Directions: Using the information that you will only have 3 pieces of tubing, 12 coffee filter, a funnel, a rubber stopper, a spoon, 2 water bottles, yellow food coloring and molding clay; create a plan to make a model of an excretory system. Draw and label the materials and what digestive organ they represent. (Students won't see the model I will use but I will include a link to a video like the model below)

<https://www.youtube.com/watch?v=nJVbFIIycKo>

Excretory System Worksheet

Name: _____

Purpose: to rid the body of wastes, including excess water and salts

Major Organs and Their Functions

Kidneys – the main organs of the excretory system-- waste-laden blood enters the kidney and the kidney filters out urea, excess water and other waste products, which eventually travel out of the kidney as urine-- eventually they travel through the ureter to the urinary bladder

Rectum – solid (food) waste travels out of the body through the rectum

Skin – sweat glands remove excess water and salts from the body

Lungs – expel the waste gas carbon dioxide

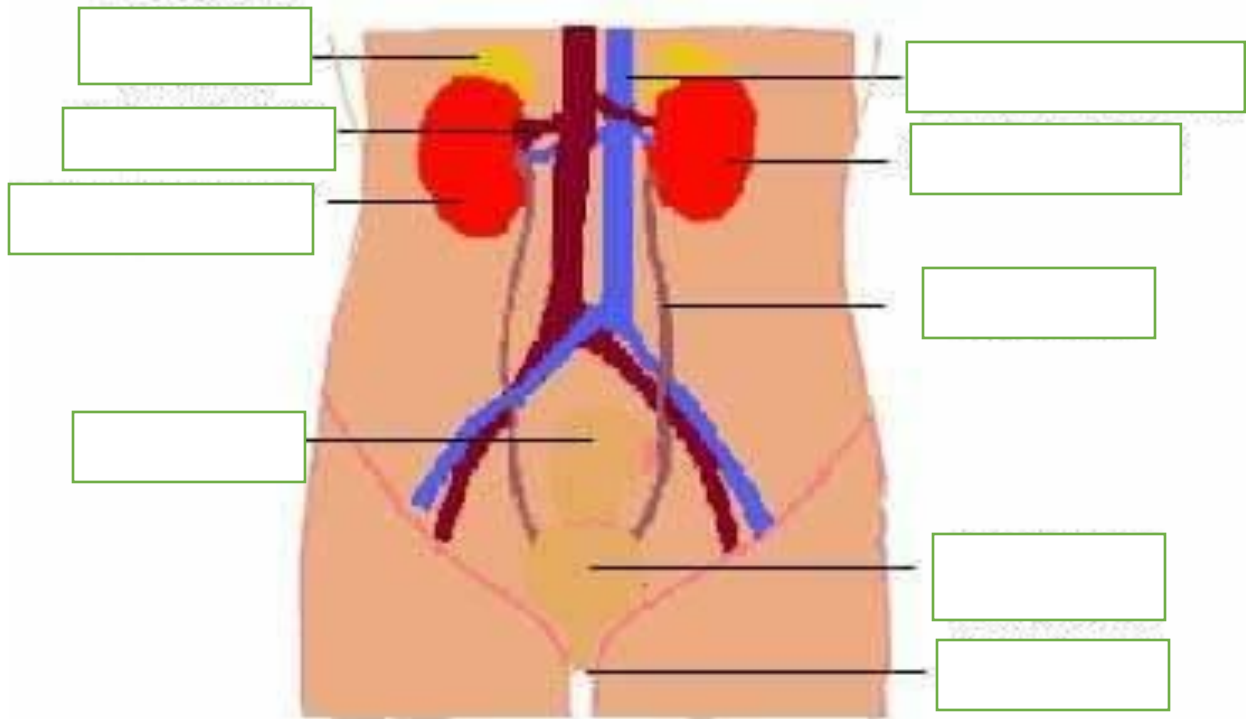
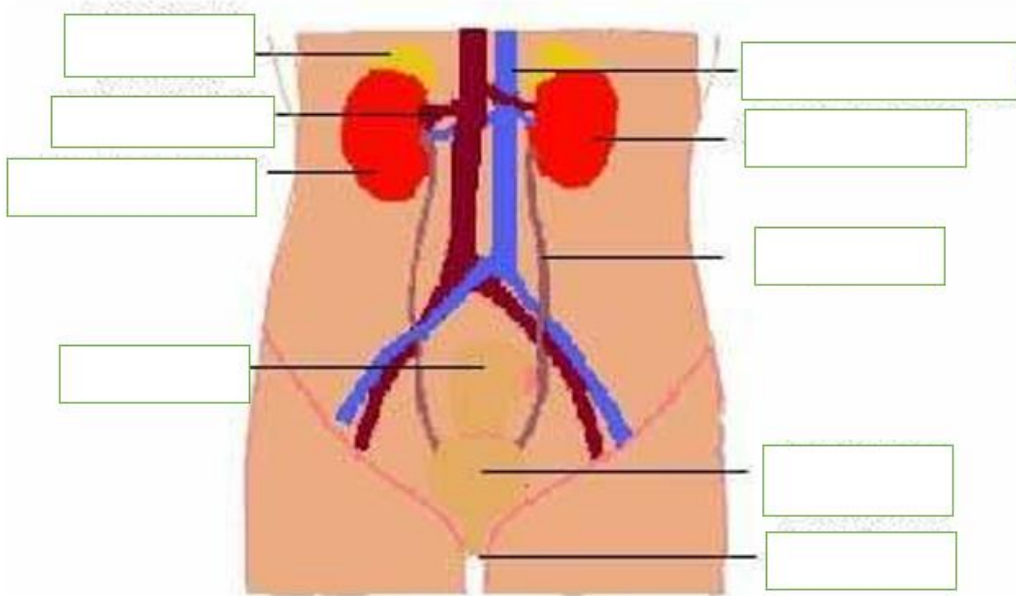


Figure 19.1 <http://pinkmonkey.com/studyguides/subjects/biology-edited/chap19/b1919201.asp>

Excretory System Homework

Name: _____

Directions: Try to complete without notes. For each organ write its function at the bottom. You only have to label the organs that are *starred below.



*Kidney:

*Ureter:

*Bladder:

*Rectum:

*Urethra:

Skin:

Lungs:

DAY 3

TIME: 40 minutes

NYS SCIENCE STANDARDS:

- 1.2a, 1.2 b, 1.2d, 1.2j

OBJECTIVES:

- Students will *recall* information on the excretory system and its function
- Students will *plan* the construction of an accurate representation for the respiratory system
- Students will *identify* structure and function for organs in the respiratory system
- Students will *problem solve* to create solutions that occur in the respiratory system.

MATERIALS:

- Body Systems PowerPoint (Slides 9-11)
- Excretory system set up
- Respiratory system notes
- Respiratory system homework
- Glass jar with open bottom, sheet of rubber, 2 balloons, jar lid with whole, glass straw that splits on one end, modeling clay and rubber band

PREPARATION:

- Take a piece of rock salt and add it to the upper left tube in the excretory model. This will serve as a kidney stone.
- Take the lid of the glass jar (body) and place the split side of the straw (bronchi) on the inside of the lid, sliding the unsplit side (trachea) through the whole in the lid.
- Seal the straw in the whole with modeling clay.
- On each end of the split straw place an empty balloon (lungs) making sure that they are secured tightly against each split end.
- Screw the lid onto the open bottom glass jar.
- On the bottom of the jar place the rubber sheet (diaphragm) and pull it tight and secure it with a rubber band so it is airtight at the bottom of the jar.

• **INTRODUCTION:**

- Ask students to volunteer their excretory system malfunctions. Ask each student to briefly mention what their malfunction was and what the cure for the malfunction was.
- If a student does not mention kidney stones, then I will bring it up by saying, “Has anyone ever heard of a kidney stone and know what a kidney stone is?”
- I will then bring the students back to the model we set up the previous day with the addition of the kidney stone.
- Pose question: Does anyone know what forms a kidney stone?
- Pose Question: Did anyone look up how to fix a kidney stone? If not does anybody have an idea about how we could remove this kidney stone?
- If a student recommends dissolving it, say it’s a good idea but most chemicals that would dissolve the stone are not safe to ingest.

- If a student recommends breaking it up so it will flow through mention that they have a system where they use pulses to break up kidney stones and allow them to pass.
- Pose Question: what if breaking the stone up doesn't work. Mention that it could be surgically removed and have one student volunteer to be the surgeon. Removing the kidney stone.

LESSON/ACTIVITY:

- Pass out the Respiratory system notes and have the students fill in the notes as we work through them
- Start on slide 8, so the students cannot already see the purpose of the excretory system.
- Pose the question: Does anyone know the purpose of the respiratory system?
- Have a student volunteer to read slide 9 and allow time for all students to fill in their notes.
- When the students are done with their notes ask for a volunteer.
- This student with the help of the class will write a flow chart of where the air goes from the outside the body to the bloodstream.
- Make statement: Student A is going to write out a flow chart of each organ the air passes through in the respiratory system, if he/she needs help he/she will ask for help and he/she will call on someone raising their hand to help.
- Statement: Please copy this flow chart on the back of your note sheet.
- For slide 10 I will have another student read the content to the class as I circulate and check in on the students.
- Bring up slide 11 and go through labeling each part of the digestive system. For each part of the digestive system I will not just tell them what organ we are labelling, but instead I will ask them what organ it is that I am pointing to.
- Pose the question: What organ is this? Can anyone say what this organ does without looking back in your notes?
- After completely labeling the diagram the students will be prompted to plan a model of the respiratory system using Glass jar with open bottom, sheet of rubber, 2 balloons, jar lid with whole, glass straw that splits on one end, modeling clay and rubber band
- I will prompt the students to think about the function of the organ when they are trying to figure out what piece of material they want to use for what organ.
- I will give the students 10 minutes to work on this, at the end of the ten minutes I will ask the students what material they chose for each organ.
- I will then bring out the model I created showing the students.
- As I go through the demonstration I will explain that I chose the glass straw for the trachea because it stays rigid allowing air to pass through.
- I will explain that I used the split end of the straw for the bronchi because it is rigid but also splits and allows access to both lungs.
- I will explain to the student that I chose the Balloons for the lungs because they hold air and have the capability to expand and hold greater amounts of air with training.
- I will finally explain that I chose the rubber mat as the diaphragm because it is pliable but still very strong or muscular. Allowing it to work repetitively without failure.

CLOSURE:

- Explain to the students that for homework they have to do 2 things.
- They have to complete an empty diagram of the respiratory system without notes.
- They have to look up and come to class with one respiratory malfunction and cures for the malfunction. Print and bring the page containing the malfunction to class the following day.

ASSESSMENT:

- Students will be assessed on *recalling* information on the excretory system and its function by my classroom questions and by the homework diagram that they will label.
- Students will be assessed on *planning* the construction of an accurate representation for the respiratory system by the worksheet that they completed in class, creating a respiratory system.
- Students will be assessed on *problem solving* to create solutions that occur in the excretory system by aiding me in fixing a malfunction that will be present in model for a warm up.
- Students will be assessed on *identify* structure and function for organs in the respiratory system by their ability to complete the homework assignment of labeling position and function of organs.

REFERENCES:

- colleen_snow.azschool.org/teacher/files/.../humanbodysystems.pptx (edited)

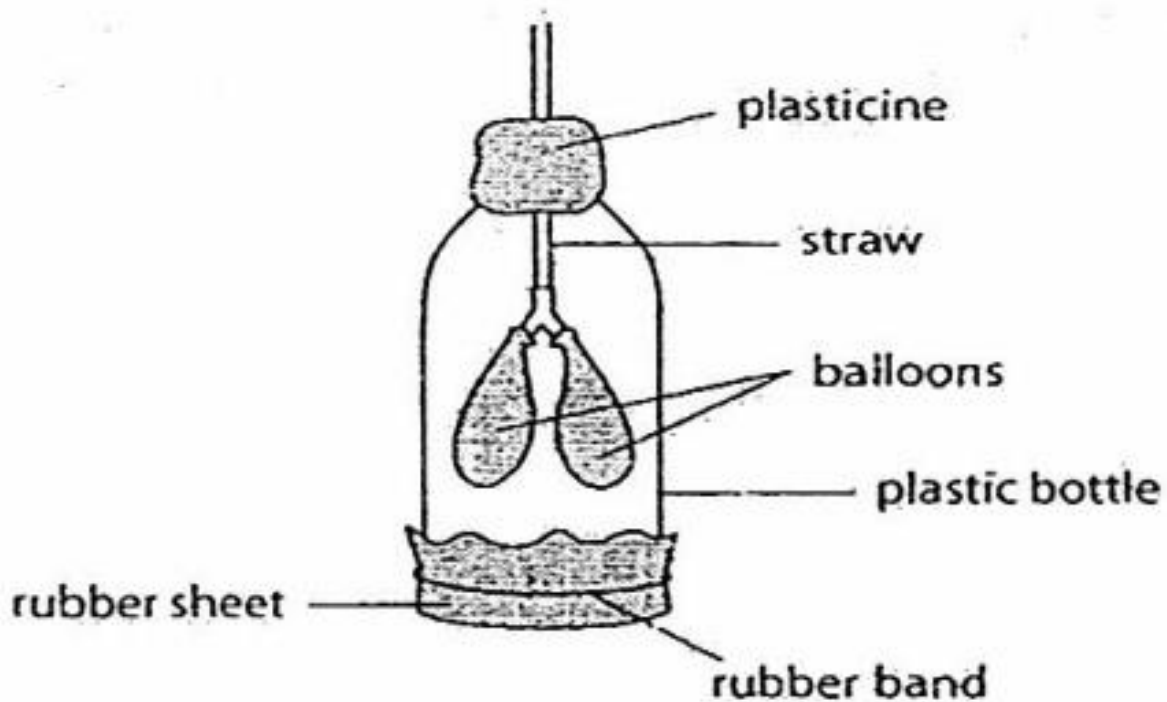
Respiratory system model plan

Name: _____

Directions: Using the information that you will only have Glass jar with open bottom, sheet of rubber, 2 balloons, jar lid with whole, glass straw

that splits on one end, modeling clay and rubber band; create a plan to make a model of a excretory system. Draw and label the materials and what digestive organ they represent. (Students won't see the model but I picture is provided below

http://www.oldschool.com.sg/index.php/module/PublicAccess/action/Wrapper/sid/597167a402eb2fb7800f02ccf96c7860/recs_ppg/10/cat_grp_id/69/qn_type/QN/pg_id/7)



Respiratory System Worksheet

Name: _____

Purpose: to provide the body with a fresh supply of oxygen for cellular respiration and remove the waste product carbon dioxide

Nose – internal entry and exit point for air

Pharynx – serves as a passage way for both air and food at the back of the throat

Larynx – your “**voice box**”, as air passes over your vocal chords, you speak

Trachea – the “**windpipe**”, or what connects your pharynx to your lungs-- a piece of skin, called the epiglottis, covers the trachea when you swallow, preventing food from entering

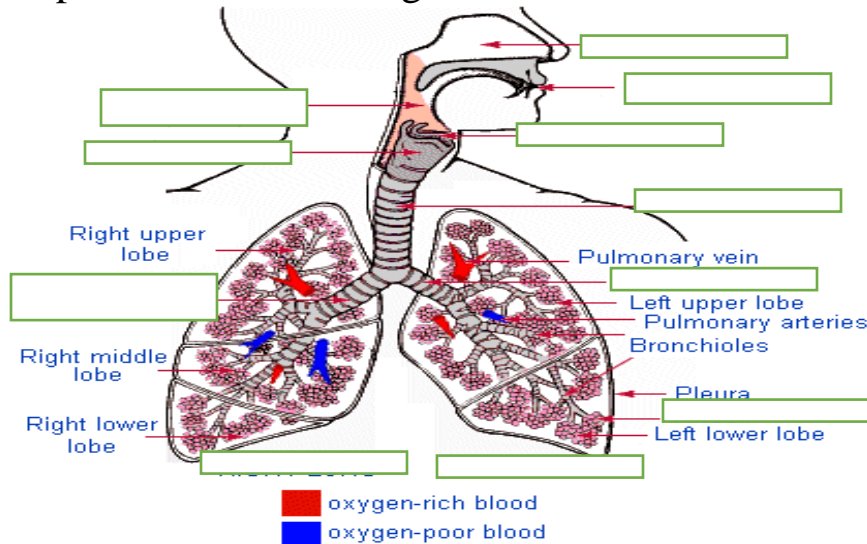
Bronchi – the two large passageways that lead from the trachea to your lungs (one for each lung)

-- The bronchi are further subdivided into bronchioles

-- eventually, the further subdivisions lead to tiny air sacs called **alveoli**-- alveoli are in clusters, like grapes-- capillaries surrounding each alveolus is where the exchange of gases with the blood occurs

The diaphragm- is the muscle that causes you to breath-- hiccups are involuntary contractions of the diaphragm

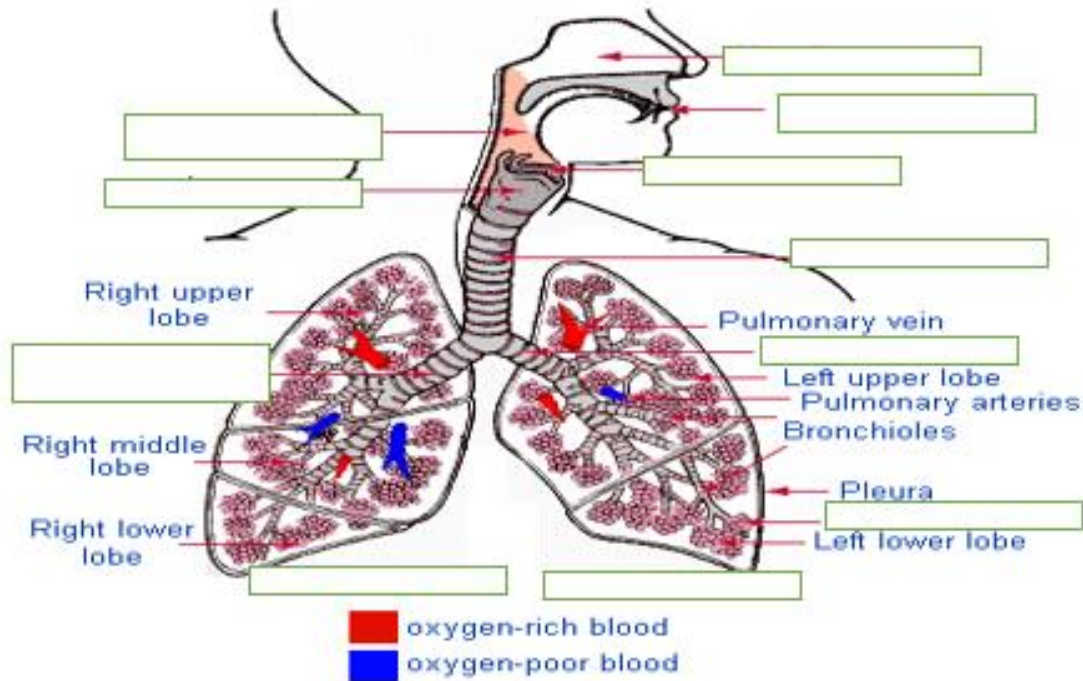
<http://www.herrinhs.org/Teachers/EricJohns/Humanlungs.htm>



Respiratory System Homework

Name: _____

Directions: Try to complete without notes. For each organ write its function at the bottom. You only have to label the organs that are *starred below.



*Nose –

*Pharynx –

*Larynx –

*Trachea –

*Bronchi –

*alveoli-

The diaphragm-

DAY 4

TIME: 40 minutes

NYS SCIENCE STANDARDS:

- 1.2a, 1.2 b, 1.2f, 1.2j

OBJECTIVES:

- Students will *recall* information on the respiratory system and its function
- Students will *plan* the construction of an accurate representation for the circulatory system
- Students will *identify* structure and function for organs in the circulatory system
- Students will *problem solve* to create solutions that occur in the circulatory system.

MATERIALS:

- Body Systems PowerPoint (Slides 12-14)
- Respiratory system set up
- Circulatory system notes
- Circulatory system homework
- Carolina STEM Challenge®: Circulatory System 8-Station Kit
<http://www.carolina.com/physiology-kits/carolina-stem-challenge-circulatory-system-8-station-kit/691003.pr#>

PREPARATION:

- Take water and pour it into a balloon (pleural cavity), add this balloon around the balloons in the model of the model and into the lungs (balloons) of the model, this will simulate pleural effusion for the model.
- Use the provided instructions to produce a circulatory system with two loops, one to the lungs and one to the body. Use 4 pipettes in the system to act as 4 chambers of the heart.

- **INTRODUCTION:**

- Ask students to volunteer their respiratory system malfunctions. Ask each student to briefly mention what their malfunction was and what the cure for the malfunction was.
- If a student does not mention pleural effusion, then I will bring it up by saying, “Has anyone ever heard of a pleural effusion and know what and pleural effusion is?”
- I will then bring the students back to the model we set up the previous day with the addition of the water in the balloons.
- Pose question: Does anyone know what pleural effusion is?
- Pose question: Does anyone know something that may cause pleural effusion? Let the students know that pneumonia is technically an infection that leads to fluid in the lungs or pleural effusion.
-
- Ask students why fluid in the pleural cavity could be problematic based on the model? Ask if the air intake is as great as before the pleural effusion took place?

- Hope a student recommend removing with a needle. Take a volunteer and remind them that they have to get the fluid without puncturing the lungs.

LESSON/ACTIVITY:

- Pass out the Circulatory system notes and have the students fill in the notes as we work through them
- Start on slide 11, so the students cannot already see the purpose of the circulatory system.
- Pose the question: Does anyone know the purpose of the respiratory system?
- Field answers and guide students saying. What is the purpose of the blood and heart?
- Have a student volunteer to read slide 12 and allow time for all students to fill in their notes.
- For slide 13 I will have another student read the content to the class as I circulate and check in on the students.
- Bring up slide 14 and go through labeling each part of the digestive system. For each part of the digestive system I will not just tell them what organ we are labelling, but instead I will ask them what organ it is that I am pointing to.
- Pose the question: What organ is this? Can anyone say what this organ does without looking back in your notes?
- When the students are done with their notes ask for a volunteer.
- This student with the help of the class will write a flow chart of where the air goes from the outside the body to the bloodstream.
- Make statement: Student A is going to write out a flow chart of each organ the air passes through in the respiratory system, if he/she needs help he/she will ask for help and he/she will call on someone raising their hand to help.
- Statement: Please copy this flow chart on the back of your note sheet.
- After completing the flow chart the students will be prompted to get into a group of 3. These groups of 3 will use the model kit to design a working circulatory system making sure it include the 4 chambers of the heart and have a body loop and a pulmonary loop.
- I will prompt the students to think about the function of the organ when they are trying to figure out what piece of material they want to use for what organ.
- I will give the students 30 minutes to work on this, at the end of the ten minutes I will ask the students what material they chose for each organ.
- I will then bring out the model I created showing the students.
- Show the students that I used 4 pipettes in series to create the four chambers of the heart
- Then use the plastic tubing as the veins, arteries, and capillaries.

CLOSURE:

- Explain to the students that for homework they have to do 2 things.
- They have to complete an empty diagram of the circulatory system without notes.
- They have to look up and come to class with one circulatory malfunction and cures for the malfunction. Print and bring the page containing the malfunction to class the following day.

ASSESSMENT:

- Students will be assessed on *recalling* information on the respiratory system and its function by my classroom questions and by the homework diagram that they will label.
- Students will be assessed on *planning* the construction of an accurate representation for the circulatory system by the worksheet that they completed in class, creating a circulatory system.
- Students will be assessed on *problem solving* to create solutions that occur in the respiratory system by aiding me in fixing a malfunction that will be present in model for a warm up.
- Students will be assessed on *identify* structure and function for organs in the circulatory system by their ability to complete the homework assignment of labeling position and function of organs.

REFERENCES:

- colleen_snow.azschool.org/teacher/files/.../humanbodysystems.pptx (edited)

Name: _____

Directions: Using the information that you will only have Carolina STEM Challenge®: Circulatory System 8-Station Kit; create a plan to make a model of an excretory system. Draw and label the materials and what digestive organ they represent.

<http://www.carolina.com/physiology-kits/carolina-stem-challenge-circulatory-system-8-station-kit/691003.pr#>



Name: _____

Purpose: **to deliver oxygenated blood to the various cells and organ systems in your body so they can undergo cellular respiration**

Heart – the major muscle of the circulatory system-- pumps blood through its **four chambers** (two ventricles and two atria)-- pumps deoxygenated blood into the lungs, where it gets oxygenated, returned to the heart, and then pumped out through the aorta to the rest of the body-- valve regulate the flow of blood between the chambers

Arteries – carry blood away from the heart and to the major organs of the body

Veins – carry blood back to the heart away from the major organs of the body

Capillaries – small blood vessels where gas exchange occurs

Blood – the cells that flow through the circulatory system

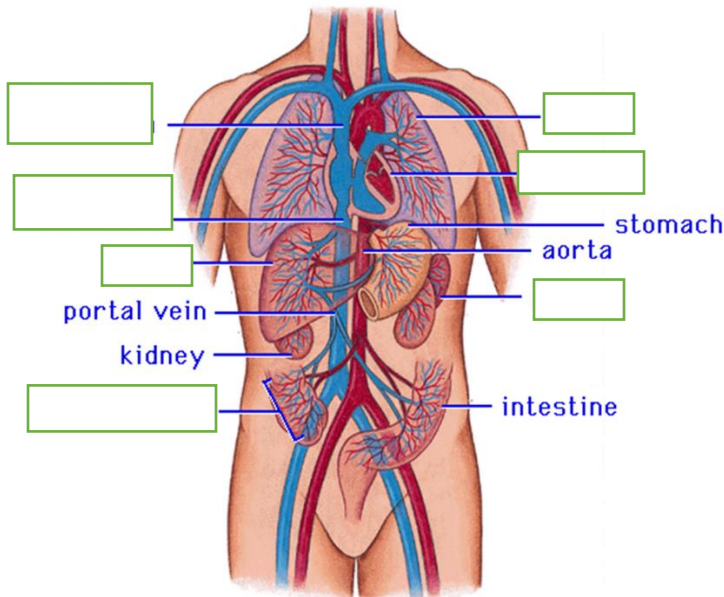
-- Red blood cells contain hemoglobin, an iron-rich protein that carries oxygen

-- White blood cells function in the immune system

-- Platelets help in blood clotting

Spleen – helps to filter out toxins in the blood

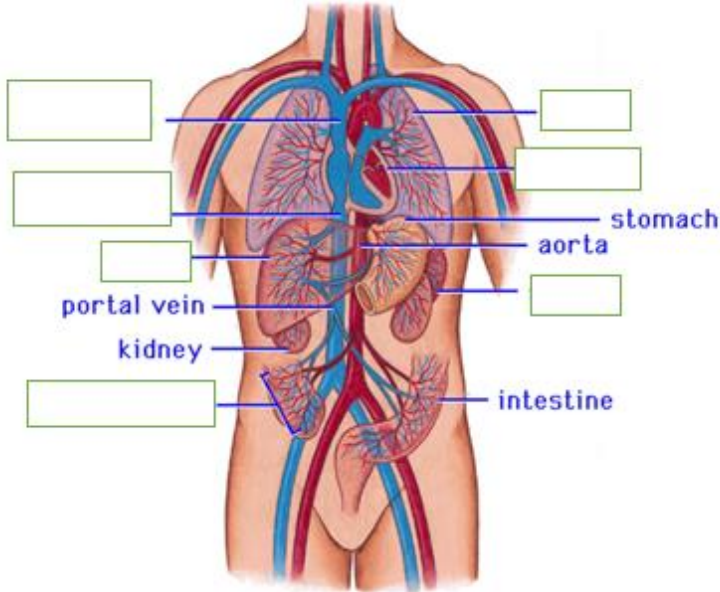
<http://rgonzalezbiochem.weebly.com/circulatory-system.html>



Circulatory System Homework

Name: _____

Directions: Try to complete without notes. For each organ write its function at the bottom. You only have to label the organs that are *starred below.



***Heart** –

***Arteries** –

***Veins** –

***Capillaries** –

***Blood** –

***Spleen** –

DAY 5- Nervous

TIME: 40 minutes

NYS SCIENCE STANDARDS:

- 1.2a, 1.2 b,1.2h, 1.2j

OBJECTIVES:

- Students will *recall* information on the Circulatory system and its function
- Students will *plan* the construction of an accurate representation for the nervous system
- Students will *identify* structure and function for organs in the nervous system
- Students will *problem solve* to create solutions that occur in the nervous system.

MATERIALS:

- Body Systems PowerPoint (Slides 15-16)
- Circulatory system set up
- Playdoh
- Nervous system notes
- Nervous system homework
- Thin various sized piece of pvc pipping
- Metal Marbles
- Jingle bells
- Wiffle ball
- Lubricant
- Duct tape
- 3 inch metal rods

PREPARATION:

- Take Play-doh and create a small obstruction in one of the tubes in the circulatory model that completely or almost completely prevents the fluid (blood) from flowing freely.
- Use the provided instructions to produce a circulatory system with two loops, one to the lungs and one to the body. Use 4 pipettes in the system to act as 4 chambers of the heart.

- **INTRODUCTION:**

- Ask students to volunteer their circulatory system malfunctions. Ask each student to briefly mention what their malfunction was and what the cure for the malfunction was.
- If a student does not mention Deep vein thrombosis, then I will bring it up by saying, “Has anyone ever heard of a Deep vein thrombosis and know what and deep vein thrombosis is?”
- I will then bring the students back to the model we set up the previous day with the addition of the play-doh in the one of the tubes (veins).
- Pose question: Does anyone know what Deep vein thrombosis is?

- Pose question: Does anyone know something that may cause Deep vein thrombosis? Let the students know that deep vein thrombosis is technically the formation of a blood clot that restricts the flow of blood and therefore oxygen to organs.
- Ask students why a clot in a vein or artery could be problematic based on the model? Ask if the blood flow has remained the same after the clot took place?
- Hope a student recommend dissolving the clot. Take a volunteer and have them administer the medication that is commonly used to break clots. In this case we will use acetone to dissolve the play-doh and allow the free flow of fluid (blood).

LESSON/ACTIVITY:

- Pass out the Nervous system notes and have the students fill in the notes as we work through them
- Start on slide 14, so the students cannot already see the purpose of the Nervous system.
- Pose the question: Does anyone know the purpose of the nervous system?
- Field answers and guide students saying. How do you process what you touch? Is your hand able to think? If students mention the brain, ask the student how the brain knows what happens with the hand?
- Have a student volunteer to read slide 15 and allow time for all students to fill in their notes.
- Bring up slide 16 and go through labeling each part of the Nervous system. For each part of the digestive system I will not just tell them what organ we are labelling, but instead I will ask them what organ it is that I am pointing to.
- Pose the question: What organ is this? Can anyone say what this organ does without looking back in your notes?
- When the students are done with their notes ask for a volunteer.
- This student with the help of the class will write a flow chart of where the chemical signal travels as it is passed along the neuron.
- Make statement: Student A is going to write out a flow chart of each part of the neuron as the signal passes through it in the nervous system, if he/she needs help he/she will ask for help and he/she will call on someone raising their hand to help.
- Statement: Please copy this flow chart on the back of your note sheet.
- After completing the flow chart the students will be prompted to get into a group of 3. These groups of 3 will use the materials (PVC, steel marbles, steel rods, duct tape, and lubricant, wiffle ball, jingle bell) to design a working neuron making sure it include dendrite, axon, myelin sheath, cell body, synapsis.
- I will prompt the students to think about the function of the organ when they are trying to figure out what piece of material they want to use for what part of the neuron.
- I will give the students 30 minutes to work on this, at the end of the ten minutes I will ask the students what material they chose for each part.
- I will then bring out the model I created showing the students.
- My model will use small pvc pipes as dendrites, wiffle ball as cell body, steel marble as chemical signal, long pvc as axon, steel rod as myelin sheath, and jingle bell as synapse.

CLOSURE:

- Explain to the students that for homework they have to do 2 things.
- They have to complete an empty diagram of the neuron without notes.

- They have to look up and come to class with one nervous system malfunction and cures for the malfunction. Print and bring the page containing the malfunction to class the following day.

ASSESSMENT:

- Students will be assessed on *recalling* information on the Nervous system and its function by my classroom questions and by the homework diagram that they will label.
- Students will be assessed on *planning* the construction of an accurate representation for the nervous system by the worksheet that they completed in class, creating a working neuron.
- Students will be assessed on *problem solving* to create solutions that occur in the nervous system by aiding me in fixing a malfunction that will be present in model for a warm up.
- Students will be assessed on *identify* structure and function for organs in the nervous system by their ability to complete the homework assignment of labeling position and function of organs.

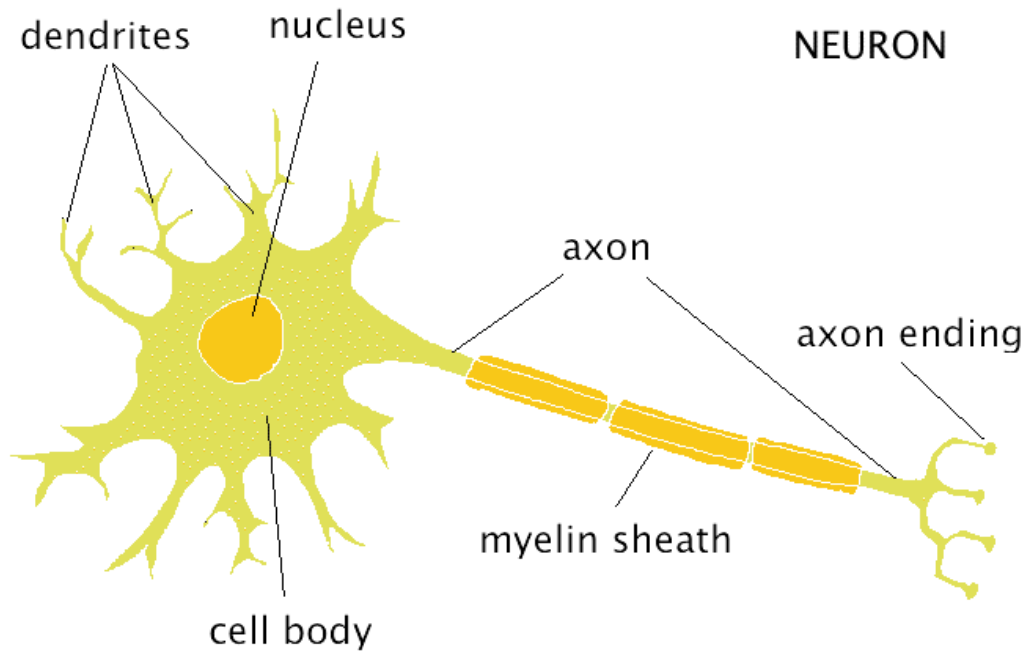
REFERENCES:

- colleen_snow.azschool.org/teacher/files/.../humanbodysystems.pptx (edited)

Nervous system model plan

Name: _____

Directions: Using the materials (PVC, steel marbles, steel rods, duct tape, and lubricant, wiffle ball, and jingle bell) design a working neuron making sure it includes a dendrite, axon, myelin sheath, cell body, synapsis and chemical signal.



<http://webspace.ship.edu/cgboer/theneuron.html>

Nervous System Worksheet

Name: _____

Purpose: to coordinate the body's response to changes in its internal and external environment

Major Organs and Their Functions

Brain – control center of the body, where all processes are relayed through

-- consists of cerebrum (controls thought and senses) and cerebellum (controls motor functions)

Spinal Cord – sends instructions from the brain to the rest of the body and vice versa

-- Any organism with a major nerve cord is classified as a **chordate**

Nerves – conduct impulses to muscle cells throughout the body

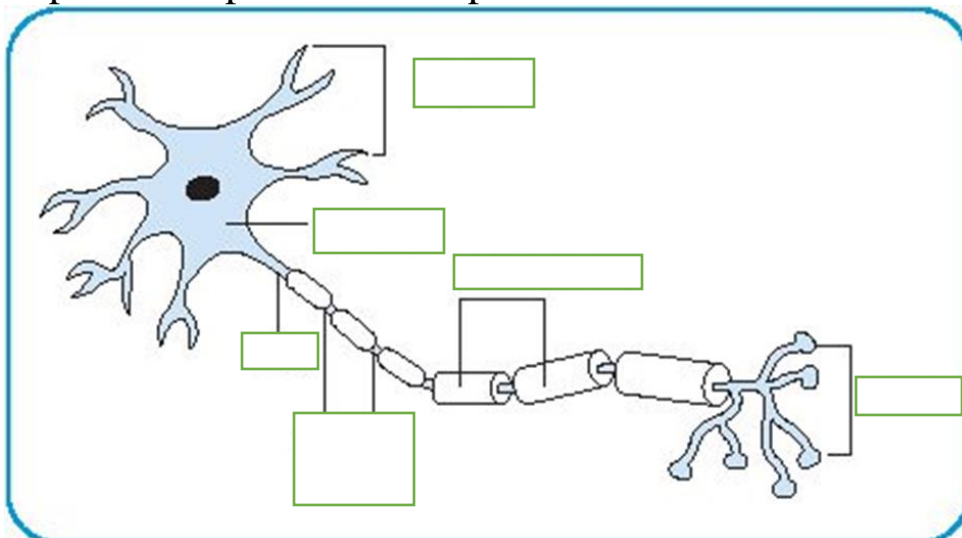
--Axon- the long threadlike part of a nerve cell along which impulses are conducted from the cell body to other cells

--Myelin sheath- the insulating covering that surrounds an axon and that increases the speed a signal can travel along an axon

--Dendrite- a short branched extension of a nerve cell, along which impulses received from other cells.

--Synapses- a junction between two nerve cells.

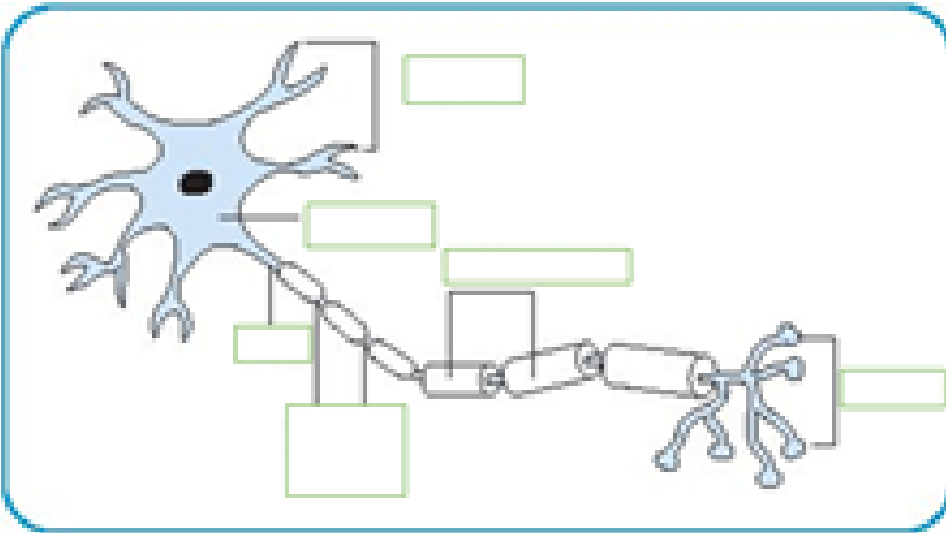
<https://www.pinterest.com/pin/380976449707055691/>



Nervous System Homework

Name: _____

Directions: Try to complete without notes. For each organ write its function at the bottom. You only have to label the organs that are *starred below.



***Myelin Sheath** –

***Synapse** –

***Axon** –

***Dendrite** –

DAY 6- Endocrine

TIME: 40 minutes

NYS SCIENCE STANDARDS:

- 1.2a, 1.2 b, 1.2h, 1.2j

OBJECTIVES:

- Students will *recall* information on the Nervous system and its function
- Students will *plan* the construction of an accurate representation for the Endocrine system
- Students will *identify* structure and function for organs in the Endocrine system
- Students will *problem solve* to create solutions that occur in the Endocrine system.

MATERIALS:

- Body Systems PowerPoint (Slide 17)
- Neuron set up
- Endocrine system notes
- Endocrine system homework
- Endocrine system feedback loop activity sheet
- Type 1 Diabetic Guest

PREPARATION:

- Prepare two models of the dendrite, using small pvc pieces as the dendrites, wiffle ball as the cell body, long pvc as the axon, steel rods inside the axon as the myelin sheath, jingle bell as the synapse and metal marbles as the chemical signal. The second model will be exactly the same excluding the myelin sheath.

- Bring multiple bags of candy and create signs for students, all of the signs should be blood cells except one person should have a pancreas label, liver label, glucagon label and an insulin label.

- **INTRODUCTION:**

- Ask students to volunteer their nervous system malfunctions. Ask each student to briefly mention what their malfunction was and what the cure for the malfunction was.
- If a student does not demyelination, then I will bring it up by saying, “Has anyone ever heard of a demyelination and know what demyelination is?”
- I will then bring the students back to the models I set up, the one with and without the myelin (steel rods)
- Pose question: Does anyone know what demyelination is?
- Pose question: Does anyone know something that maybe effected by demyelination? Give the students stop watches and allow them to time how long it takes from release of

the signal, to the ring of the bell (synapse). Repeat this 5 times and have students record their results.

- Repeat the previous step with the model missing the myelin sheath.
- Have students take the average of each of their scores and record the class's scores on the board.
- Ask the students why we received these results based on what we know about myelin sheath, what does myelin sheath do?
- Ask students how slower moving signals may affect someone.
- Discuss diseases with students that involve demyelination (multiple sclerosis)

LESSON/ACTIVITY:

- Pass out the Endocrine system notes and have the students fill in the notes as we work through them
- Start on slide 16, so the students cannot already see the purpose of the endocrine system.
- Pose the question: Does anyone know the purpose of the endocrine system?
- Field answers and guide students saying. What is the purpose of the liver or the pancreas?
- Have a student volunteer to read slide 17 and allow time for all students to fill in their notes.
- Bring up slide 18 and go through labeling each part of the Glucagon, insulin feedback loop. For each part of the feedback loop. I will not just tell them what part of the feedback loop I am labeling but I will explain the nature of the feedback loop and how it maintains consistent blood sugar level..
- Pose the question: What happens if we have too much or too little sugar in our blood? Introduce the students to Matt, my brother in law with type one diabetes. Have them ask questions about diabetes, how he maintains his blood sugar and any other question.
- When the students are done with their notes ask for a volunteer.
- This student with the help of the class will write a flow chart of how the feedback loop works using glucagon, insulin, liver and pancreas.
- Make statement: Student A is going to write out a flow chart of step of the blood glucose feedback loop.
- Statement: Please copy this flow chart on the back of your note sheet.
- After completing the flow chart I will ask for four volunteers. 1 student will act as glucagon, 1 insulin, and 1 pancreas. The remaining students will be blood cells.
- Each student will have a script based on their job on what to do. They will follow these scripts and the classroom will become a real life negative feedback loop.
- Recap the activity and fill out the diagram with the class, without the use of notes.
- I will read the stimulus to the students and ask them what action needs to be taken, what organ will act and what hormone will be released.

CLOSURE:

- Explain to the students that for homework they have to do 2 things.
- They have to complete an empty diagram of the glucose feedback loop without notes.
- They have to look up and come to class with information on type two diabetes and one cause.

ASSESSMENT:

- Students will be assessed on *recalling* information on the respiratory system and its function by my classroom questions and by the homework diagram that they will label.
- Students will be assessed on *planning* the construction of an accurate representation for the endocrine system by the worksheet that they completed in class, and for homework.
- Students will be assessed on *problem solving* to create solutions that occur in the respiratory system by aiding me in fixing a malfunction that will be present in model for a warm up.
- Students will be assessed on *identify* structure and function for organs in the endocrine system by their ability to complete the homework assignment of labeling position and function of organs.

REFERENCES:

- colleen_snow.azschool.org/teacher/files/.../humanbodysystems.pptx (edited)

Endocrine system activity

Name: _____

Directions:

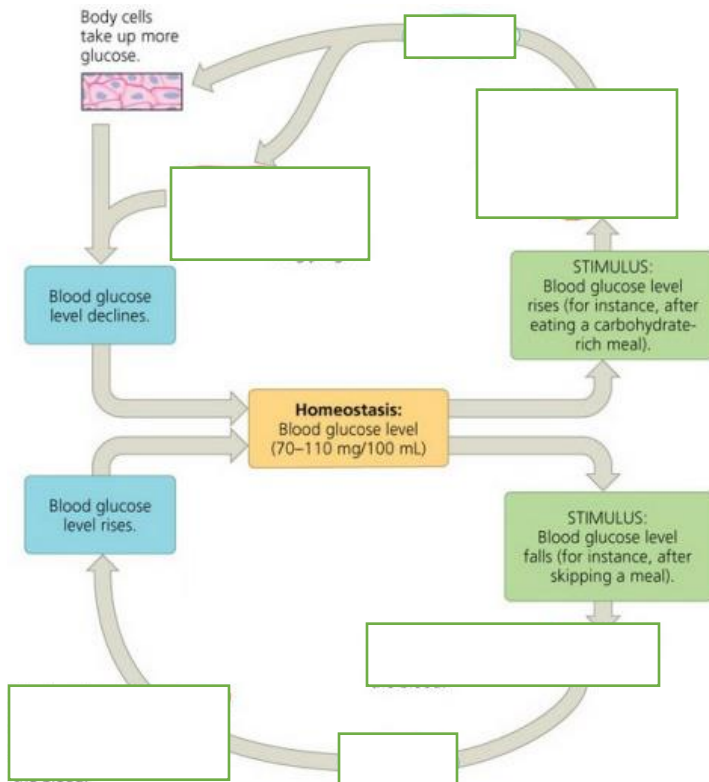
Blood cells- randomly circulate the classroom, when you have a piece of candy, continue to circulate and put your hand in the air.

Pancreas- When less than ½ of the students have their hand up, release glucagon. When more than ½ of students have their hands up release insulin.

Glucagon- when the pancreas tells you go to insulin tell him/her to head back to the pancreas, then go to the liver, take individual pieces of candy and hand them to the blood cells.

Insulin- when the pancreas tells you go to glucagon tell him/her to head back to the pancreas, then take individual pieces of candy from the blood cells and take them to the liver.

Liver- Will be a bucket full of candy



<http://www.chegg.com/homework-help/questions-and-answers/1-vertebrates-two-major-communication-control-systems-endocrine-system-nervous-system-choo-q4632216>

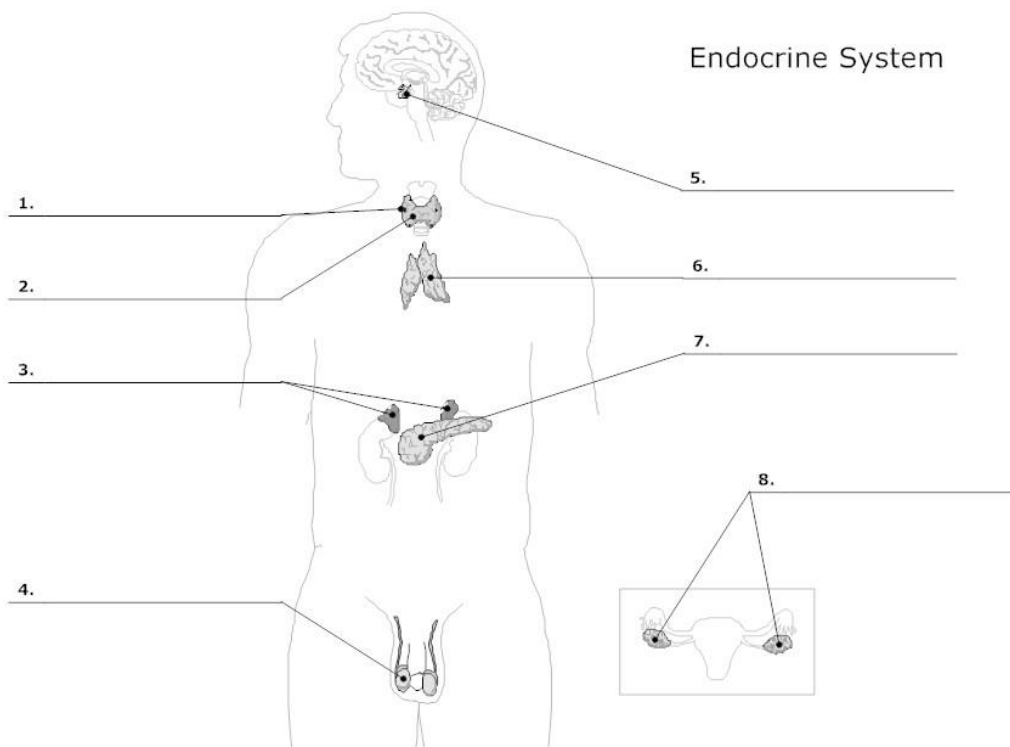
Endocrine System Worksheet

Name: _____

Purpose: to control growth, development, metabolism and reproduction through the production and secretion of hormones

<http://www.innerbody.com/image/endoov.html>

- hypothalamus-
- pituitary gland-
- thyroid-
- parathyroid-
- adrenal glands-
- pancreas-
- testes-
- ovaries-



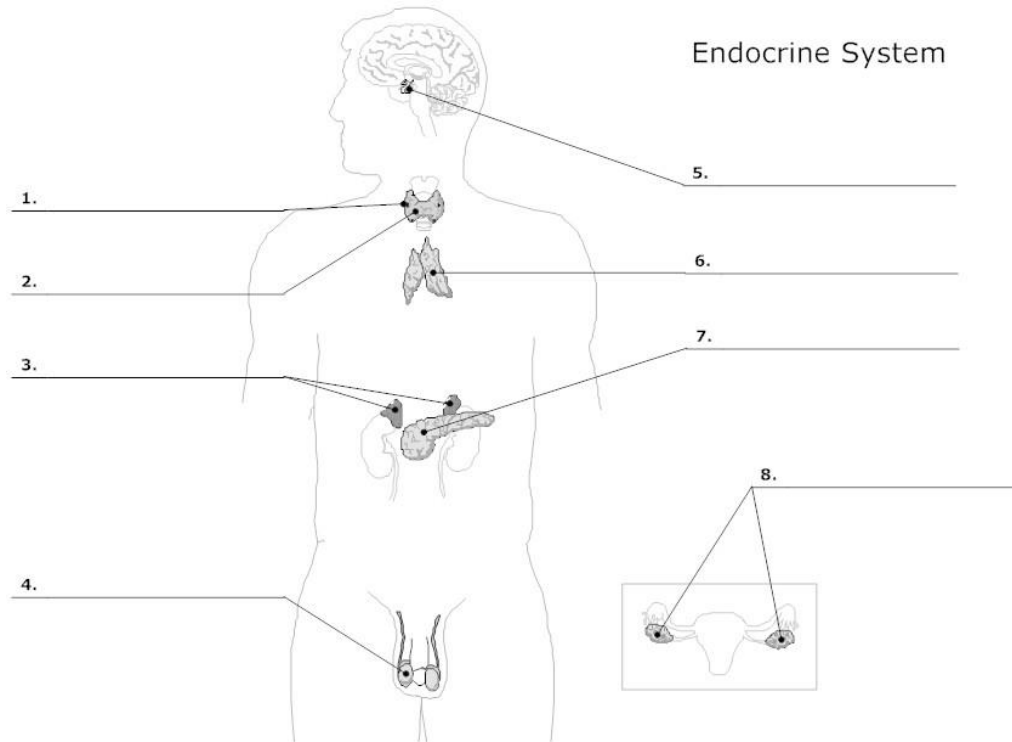
LifeART Collection Images Copyright © 1989-2001 by Lippincott Williams & Wilkins, Baltimore, MD

https://www.biologycorner.com/anatomy/endocrine/notes_endocrine_system.html

Endocrine System Homework

Name: _____

Directions: Try to complete without notes. For each organ write its function at the bottom. You only have to label the organs that are *starred below.



LIFEART Collection Images Copyright © 1989-2001 by Lippincott Williams & Wilkins, Baltimore, MD

-- hypothalamus-

-- pituitary gland-

-- thyroid-

-- parathyroid-

-- adrenal glands-

-- pancreas-

-- testes

DAY 7- Skeletal

TIME: 40 minutes

NYS SCIENCE STANDARDS:

- 1.2a, 1.2 b, 1.2g, 1.2j

OBJECTIVES:

- Students will *recall* information on the Endocrine system and its function
- Students will *plan* the construction of an accurate representation for the skeletal system
- Students will *identify* structure and function for organs in the skeletal system
- Students will *problem solve* to create solutions that occur in the skeletal system.

MATERIALS:

- Body Systems PowerPoint (Slide 19-20)
- Endocrine system set up
- Skeletal system notes
- Skeletal system homework
- Skeletal system project sheet (loose cardboard, wiffle balls, toilet paper tubes, duct tape, twine)

PREPARATION:

- Pass out warm up and remind students of yesterday's blood glucose level activity
- Build a representation of each of the three joints to show students if they are unable to create them themselves.
- To create the ball and socket joint, cut one of the wiffle balls in half tapping it to one toilet paper roll. Tape another complete wiffle ball to the end of another toilet paper roll. Use a piece of twine to tie the inside of the half wiffle ball to the outside of the full wiffle ball loosely. This will allow the joint to stay together but still have full range of movement.
- To create the hinge joint cut out and 1/6 piece of wiffle ball and tape it to the end of a toilet paper roll so the convex side is facing out. Take another 1/6 of a wiffle ball and tape it to a toilet paper roll so that the concave portion of the paper is facing outward. Fit the convex piece inside the concave piece and use twine to tie the pieces together tightly at both ends using the excess wiffle ball. This will allow the joint to hinge without rotating.
- To create the pivot roll up a piece of cardboard so that it threads perfectly through two lined up wiffle ball holes. Once the piece threaded through the wiffle ball tape both side of the cardboard outside the wiffle ball until they are too large to fit back through the wiffle ball holes. This will allow the joint to pivot without hinging.

INTRODUCTION:

- Ask students to volunteer their research on type 2 diabetes and one cause that they found. Recap with students what diabetes is and what part of the endocrine system it affects?
- Ask the students what the two hormones that regulate blood glucose levels are?
- Ask what the main organ for monitoring blood glucose level was?
- Have the students use their information of blood glucose feedback to complete the warm up
- Students will be instructed to label which part of the graph represents normal blood glucose monitoring, pre-diabetic and diabetic. Then the students need to defend why they chose the answers they did.
- I will take volunteers to give their answers to the classroom.

LESSON/ACTIVITY:

- Pass out the Skeletal system notes and have the students fill in the notes as we work through them
- Start on slide 18, so the students cannot already see the purpose of the skeletal system.
- Pose the question: Does anyone know the purpose of the skeletal system?
- Field answers and guide students saying. What is the purpose of the bones or the skeleton?
- Have a student volunteer to read slide 19 and allow time for all students to fill in their notes.
- Bring up slide 20 and go through labeling each part of the skeletal system. For each part of the skeletal system I will not just tell them what bone we are labelling, but instead I will ask them what bone it is that I am pointing to.
- Pose the question: What bone is this? Can anyone show me exactly on themselves where this bone is?
- When the students are done with their notes ask for a volunteer.
- This student will demonstrate for the class how different joints move.
- Make statement: Student A is going to show us all the different ways he/she can move her bones at the joining of the shoulder. Now she will show us all the ways she can move her bones at the joining of her knee.
- Statement: Based on what she/he has shown us do we think all joining of bones move in the same way?
- Does anyone know what the joining of bones is called? Wait for students to volunteer the answer joint.
- The three main types of joints are pivot, hinge, and ball and socket.
- Please take your project sheet and the materials and find a way to create one of the three joints below. When you have completed making the joint compare it to movements on your body and give an example of a place where this joint exists in the human skeletal system.
- I will give the students 30 minutes to work on this, at the end of the ten minutes I will ask the students what joint they decided to create and how they tend to design it.

- When all students are complete I will have an individual who created each of the joints to present their model to the class.

CLOSURE:

- Explain to the students that for homework they have to do 2 things.
- They have to complete an empty diagram of the skeletal system without notes.
- They have to look up and come to class with one skeletal system malfunction and cures for the malfunction. Print and bring the page containing the malfunction to class the following day.

ASSESSMENT:

- Students will be assessed on *recalling* information on the skeletal system and its function by my classroom questions and by the homework diagram that they will label.
- Students will be assessed on *planning* the construction of an accurate representation for the skeletal system by the worksheet that they completed in class, creating a skeletal joint.
- Students will be assessed on *problem solving* to create solutions that occur in the endocrine system by aiding me in identifying diabetes that will be present in the graph during the warm up.
- Students will be assessed on *identify* structure and function for organs in the skeletal system by their ability to complete the homework assignment of labeling position and function bones.

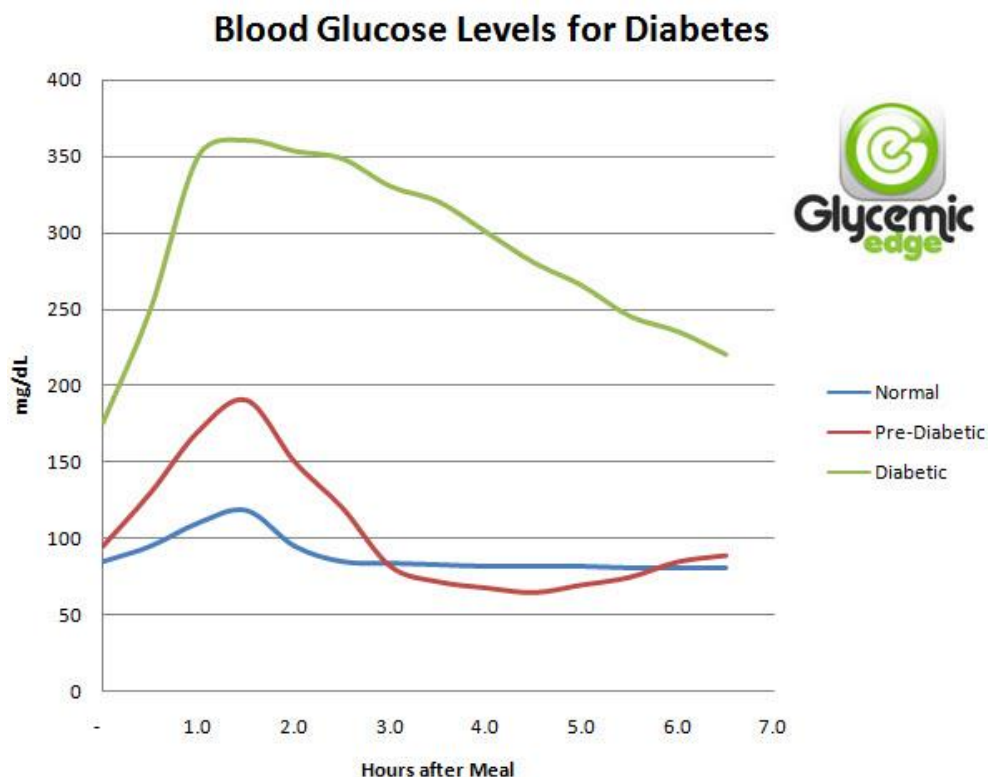
REFERENCES:

- colleen_snow.azschool.org/teacher/files/.../humanbodysystems.pptx (edited)

Warm Up

Name: _____

Directions: Label Diabetic, pre-diabetic, and normal based on the chart showing blood glucose levels. Write a couple sentences explaining how you came to your conclusion.



<http://www.glycemicedge.com/blood-sugar-chart/>

Green= _____

Red= _____

Blue= _____

Skeletal system project

Name: _____

Directions: Using the materials provided (cardboard, duct tape, wiffle ball, scissors, empty toilet paper tubes) create a working model of one of the three joints below. After creating your joint name one joint in the human body that has the same function and demonstrate with your model and body.

hinge joint



pivot joint



ball-and-socket joint



http://www.visualdictionaryonline.com/human-being/anatomy/skeleton/types-synovial-joints_1.php

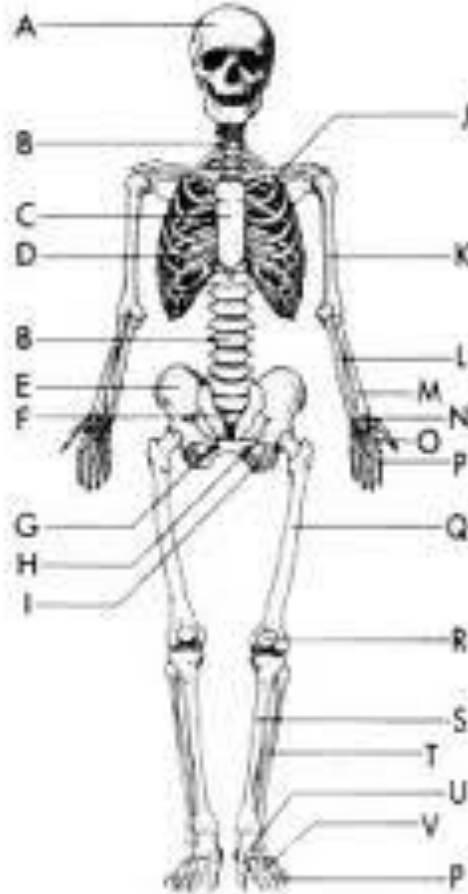
Skeletal System Worksheet

Name: _____

Purpose: to provide structure and support to the human body
Bones are where new blood cells are generated (in the marrow), and require the mineral calcium for strength

human skeleton

- A.
- B.
- C.
- D.
- E.
- F.
- G.
- H.
- I.
- L.
- N.
- N.
- O.
- P.
- Q.
- R.
- S.
- T.
- U.
- V.



<https://www.pinterest.com/pin/3940718396811479/>

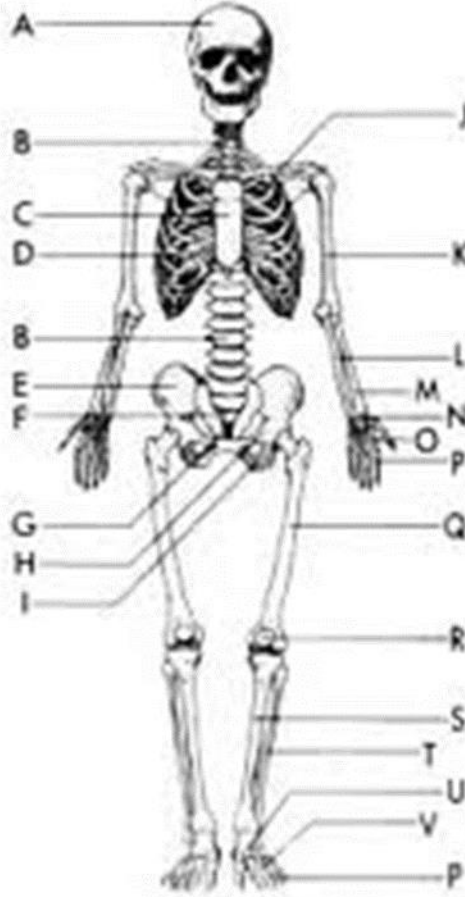
Skeletal System Homework

Name: _____

Directions: Try to complete without notes. Label each bone and designate one for each of the 3 main joint movements (pivot, hinge and ball and socket).

human skeleton

- A.
- B.
- C.
- D.
- E.
- F.
- G.
- H.
- I.
- L.
- N.
- N.
- O.
- P.
- Q.
- R.
- S.
- T.
- U.
- V.



Purpose: _____

DAY 8- muscular

TIME: 40 minutes

NYS SCIENCE STANDARDS:

- 1.2a, 1.2 b, 1.2g, 1.2j

OBJECTIVES:

- Students will *recall* information on the Skeletal system and its function
- Students will *plan* the construction of an accurate representation for the muscular system
- Students will *identify* structure and function for organs in the muscular system
- Students will *problem solve* to create solutions that occur in the muscular system.

MATERIALS:

- Body Systems PowerPoint (Slides 20-21)
- Skeletal system set up
- Muscular system notes
- Muscular system homework
- Muscular system model plan (balloons, tape, scissors, paper towel tubes, paper clips)

PREPARATION:

- Warp a wiffle ball using heat then recreate the ball and socket joint as previously done by cutting the warped wiffle balls in half taping it to one toilet paper roll. Tape another complete wiffle ball to the end of another toilet paper roll. Use a piece of twine to tie the inside of the half wiffle ball to the outside of the full wiffle ball loosely. This will allow the joint to stay together but still have full range of movement.
- Pull up the youtube video of hip replacement demonstration <https://www.youtube.com/watch?v=BYwVaKkRdF4>
- Use the youtube <https://www.youtube.com/watch?v=1phXt2Kumew> video to create a working model of the arm muscle and bone relationship.

- **INTRODUCTION:**

- Ask students to volunteer their skeletal system malfunctions. Ask each student to briefly mention what their malfunction was and what the cure for the malfunction was.
- If a student does not mention hip arthritis or arthritis in general, then I will bring it up by saying, “Has anyone ever heard of arthritis and know what arthritis is?”
- I will then bring the students back to the model we set up the previous day with the addition of the new model containing the warped socket.
- Pose question: Does anyone know what arthritis is?
- Pose question: Does anyone know something that may cause arthritis? Let the students know that arthritis is technically inflammation of the joints.

- Ask students to look at the two models of the ball and socket joint, pointing out that the warped one was experiencing inflammation or arthritis.
- Ask the students why this may be a problem. Field answers and guide the students to that it may limit mobility or cause pain because the joints do not fit together correctly.
- Ask the students if they know how to solve this problem? Ask the students if they ever know someone who had arthritis in their hips and how they may have fixed the problem.
- Hope a student recommends surgery and ask if any of the students know someone who has had hip surgery? Play the video on hip surgery.
- Ask for a volunteer to perform hip surgery on our model and dictate steps as they complete them.

LESSON/ACTIVITY:

- Pass out the muscular system notes and have the students fill in the notes as we work through them
- Start on slide 19, so the students cannot already see the purpose of the muscular system.
- Pose the question: Does anyone know the purpose of the muscular system?
- Field answers and guide students saying. What is the purpose of the muscles (biceps, triceps)?
- Have a student volunteer to read slide 20 and allow time for all students to fill in their notes.
- Bring up slide 21 and go through labeling each part of the muscular system. For each part of the muscular system I will not just tell them what muscle we are labelling, but instead I will ask them what muscle it is that I am pointing to.
- Pose the question: What muscle is this? Can anyone say what bone this muscle helps move?
- After completing the diagram the students will be prompted to get into a group of 3. These groups of 3 will use the materials to design a working muscular system making sure it includes contradictory muscles.
- I will prompt the students to think about the function of the organ when they are trying to figure out what piece of material they want to use for what organ (bone, muscle, joint).
- I will give the students 30 minutes to work on this, at the end of the ten minutes I will ask the students what material they chose for each organ.
- I will then have the students present their models explaining why they chose each material for each organ and what contradicting muscles they decided to use.

CLOSURE:

- Explain to the students that for homework they have to do 2 things.
- They have to complete an empty diagram of the muscular system without notes.
- They have to look up and come to class with one muscular malfunction and cures for the malfunction. Print and bring the page containing the malfunction to class the following day.

ASSESSMENT:

- Students will be assessed on *recalling* information on the muscular system and its function by my classroom questions and by the homework diagram that they will label.
- Students will be assessed on *planning* the construction of an accurate representation for the muscular system by the worksheet that they completed in class, creating a muscular system.
- Students will be assessed on *problem solving* to create solutions to problems that occur in the skeletal system by aiding me in fixing a malfunction that will be present in model for a warm up.
- Students will be assessed on *identify* structure and function for organs in the muscular system by their ability to complete the homework assignment of labeling position and function of organs.

Muscular system model plan

Name: _____

Directions: Using the materials (paper towel tubes, long balloons, scissors, tape and paper clips) to create a working model that shows opposing muscles (ex. Triceps and bicep, Quadriceps and hamstring...). Please designate which material will be used as what organ.

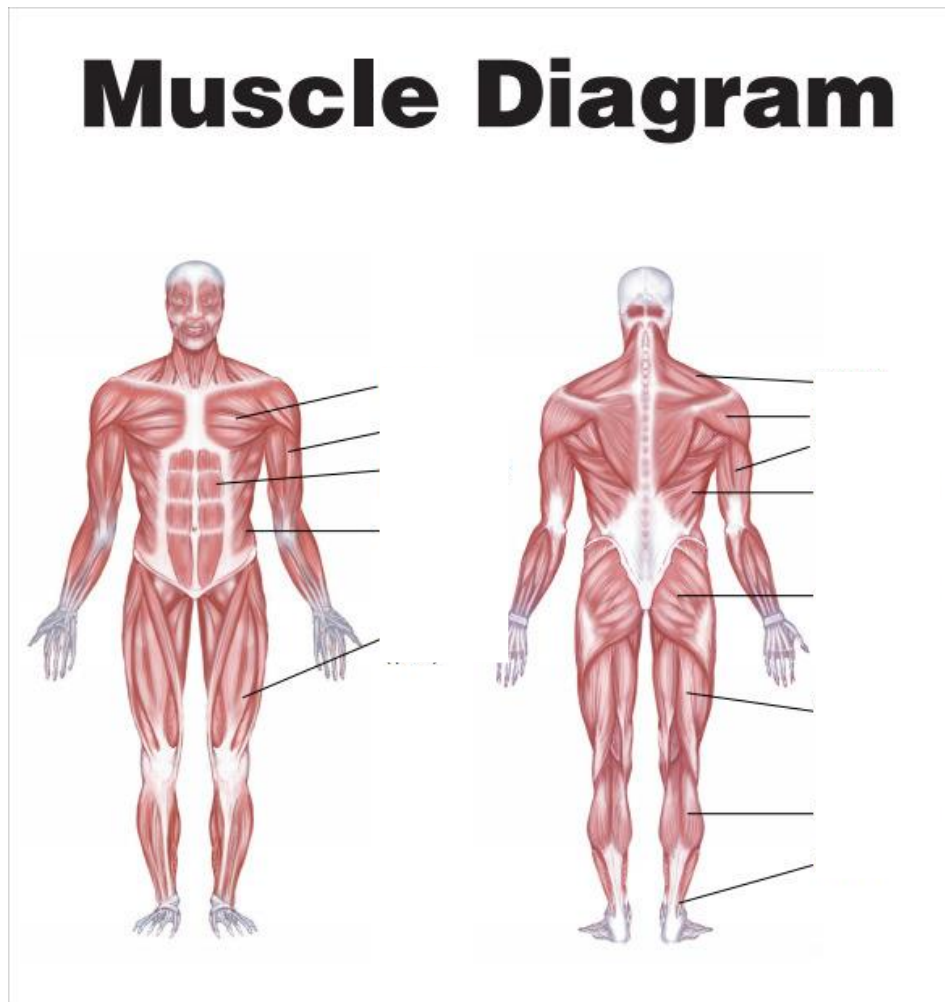


<https://www.pinterest.com/whimsywear/science-experiments/>

Muscular System Worksheet

Name: _____

Purpose: works with the skeletal and nervous system to produce movement, also helps to circulate blood through the human body, muscle cells are fibrous. Muscle contractions can be voluntary or involuntary.

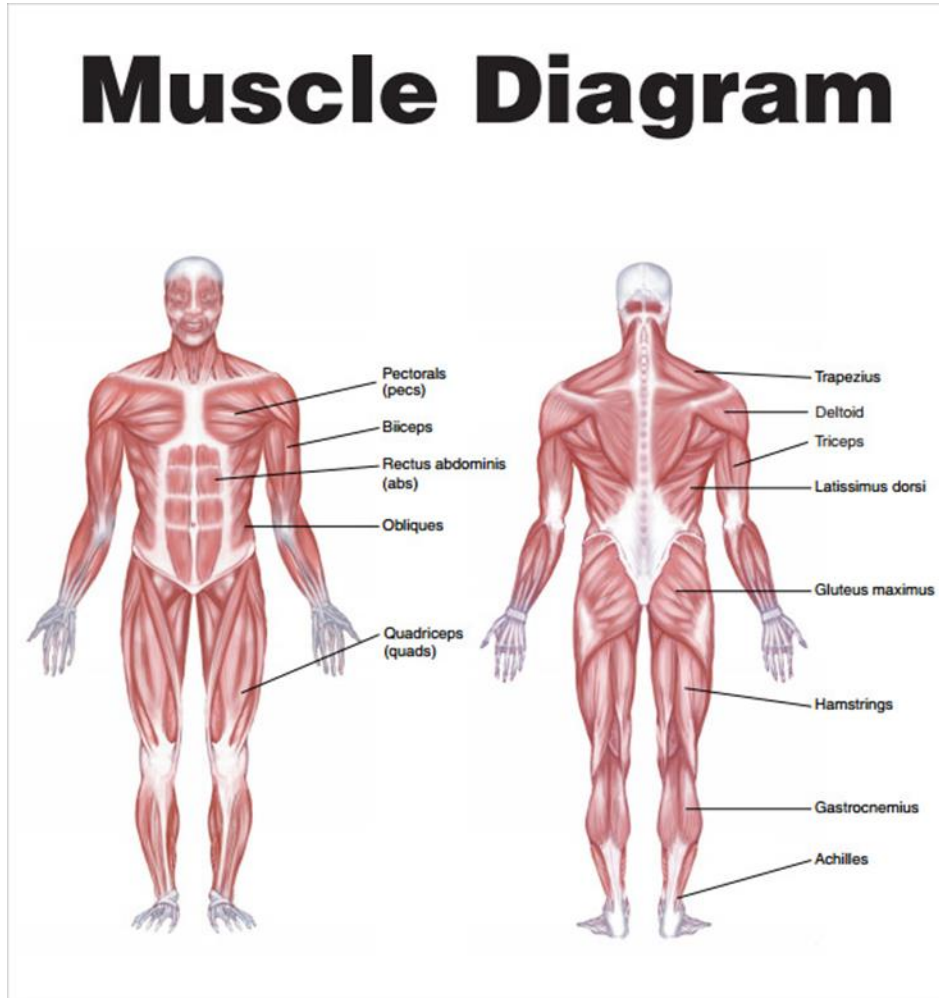


<https://www.sampletemplates.com/business-templates/muscle-chart-template.html>

Muscular System Homework

Name: _____

Directions: Label muscles and complete the purpose of the muscular system without your notes:



<https://www.sampletemplates.com/business-templates/muscle-chart-template.html>

Purpose: _____

DAY 9- Immune

TIME: 40 minutes

NYS SCIENCE STANDARDS:

- 1.2a, 1.2 b, 1.2j

OBJECTIVES:

- Students will *recall* information on the muscular system and its function
- Students will *compare* the immune system to a local security system.
- Students will *identify* structure and function for organs in the immune system
- Students will *problem solve* to create solutions that occur in the immune system.

MATERIALS:

- Body Systems PowerPoint (Slides 22-23)
- Muscular system set up
- Immune system notes
- Immune system homework
- Immune system project

PREPARATION:

- Use muscular system setup from previous day (two smaller paper towel rolls attached to longer paper towel roll with a paper clip, Balloons tied on either side of the joint to hold the elbow straight, and tape to hold the balloons in place.)

INTRODUCTION:

- Ask students to volunteer their musculatory system malfunctions. Ask each student to briefly mention what their malfunction was and what the cure for the malfunction was.
- If a student does not mention tendon rupture, then I will bring it up by saying, “Has anyone ever heard of a tendon rupture and know what a tendon rupture is?”
- I will then bring the students back to the model we set up the previous day with the addition of the water in the balloons.
- Pose question: Does anyone know what a tendon rupture is?
- Pose question: Does anyone know something that may cause tendon rupture? Let the students know that a tendon rupture is technically the tearing or bursting of a tendon.
- Ask students why a ruptured tendon could be problematic based on the model? Ask if the when the tendon is torn the model will remain the same?
- Rupture the tendon (remove tape), discuss the common tendon ruptures (Achilles, bicep, rotator cuff)
- Ask a student how to fix the ruptured tendon? Discuss the surgical options and the recovery.

LESSON/ACTIVITY:

- Pass out the Immune system notes and have the students fill in the notes as we work through them
- Start on slide 21, so the students cannot already see the purpose of the Immune system.
- Pose the question: Does anyone know the purpose of the Immune system?
- Field answers and guide students saying. What is the purpose of white blood cells and antibodies?
- Have a student volunteer to read slide 22 and allow time for all students to fill in their notes.
- Bring up slide 23 and go through labeling each part of the digestive system. For each part of the digestive system I will not just tell them what cell we are labelling, but instead I will ask them what cell it is that I am pointing to.
- Pose the question: What type of cell is this? Can anyone say what this cell does without looking back in your notes?
- When the students are done with their notes ask for a volunteer.
- This student with the help of the class will write a flow chart of the immune response.
- Make statement: Student A is going to write out a flow chart of the immune response, with each cell and their job, if he/she needs help he/she will ask for help and he/she will call on someone raising their hand to help.
- Statement: Please copy this flow chart on the back of your note sheet.
- After completing the flow chart the students will be prompted to get into a group of 3. These groups of 3 will use the poster board and colored pencils to design a security system that aligns with the immune system.
- I will prompt the students to think about the function of the immune cells when they are trying to figure out what parallel of aspect of a security system they want to select.
- I will give the students 30 minutes to work on this, at the end of the ten minutes I will ask the students what type of comparisons they'll be using to represent the immune system.
- Students will volunteer projects for the rest of the classroom.

CLOSURE:

- Explain to the students that for homework they have to do 2 things.
- They have to complete an empty diagram of the immune response without notes.
- They have to look up and come to class with one immune system malfunction and cures for the malfunction. Print and bring the page containing the malfunction to class the following day.

ASSESSMENT:

- Students will be assessed on *recalling* information on the immune system and its function by my classroom questions and by the homework diagram that they will label.
- Students will *compare* the immune system to a local security system by creating a project that labels various parts of a local establishment's security with immune system terminology.
- Students will be assessed on *problem solving* to create solutions that occur in the muscular system by aiding me in fixing a malfunction that will be present in model for a warm up.

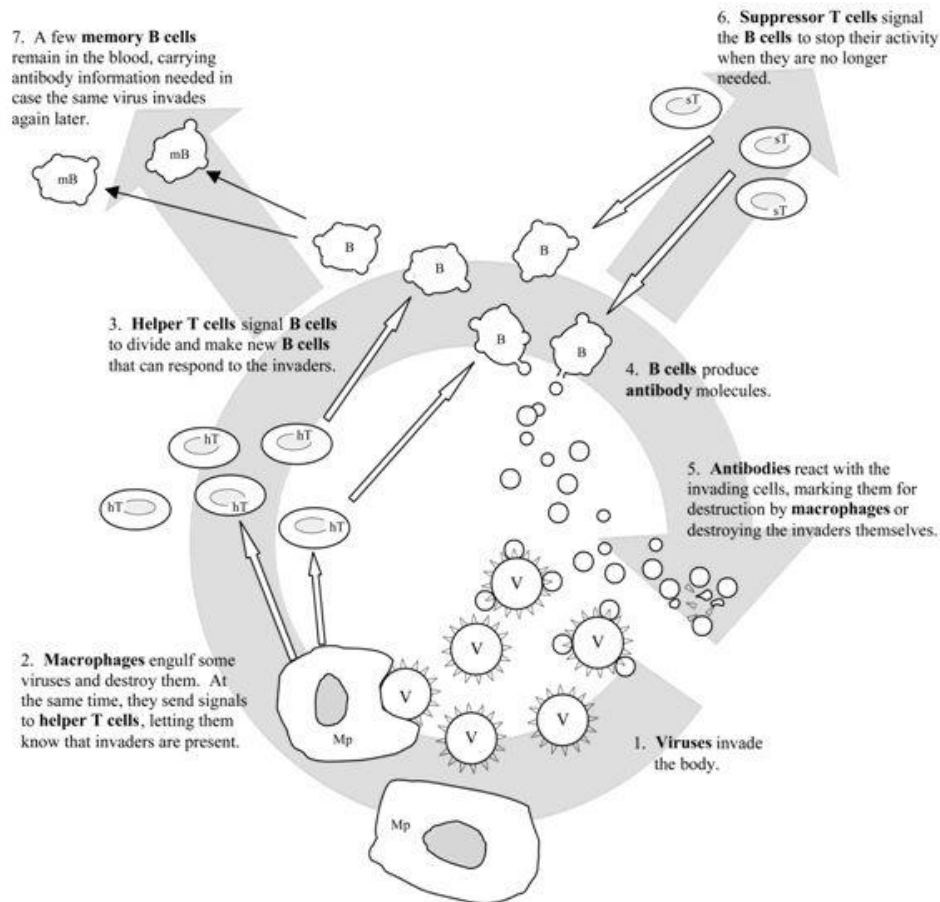
- Students will be assessed on *identify* structure and function for cells in the immune system by their ability to complete the homework assignment of labeling position and function of immune cells.

Immune system model plan

Name: _____

Directions: Use the information from figure 2, to compare the immune system to the security of a building. Ex. The human body= bank, Virus= Bank robber. Create a story that describes the immune response by comparing it to security of something else. Use parenthesis to designate parallels Ex. The bank robber (virus) breaks through the front door (skin).

Figure 2
How the Human Immune System Reacts to Viral Invasions



https://www.teachengineering.org/lessons/view/duk_virus_mary_less

Immune System Worksheet

Name: _____

Purpose: to **remove** infectious diseases and other pathogens from the human body

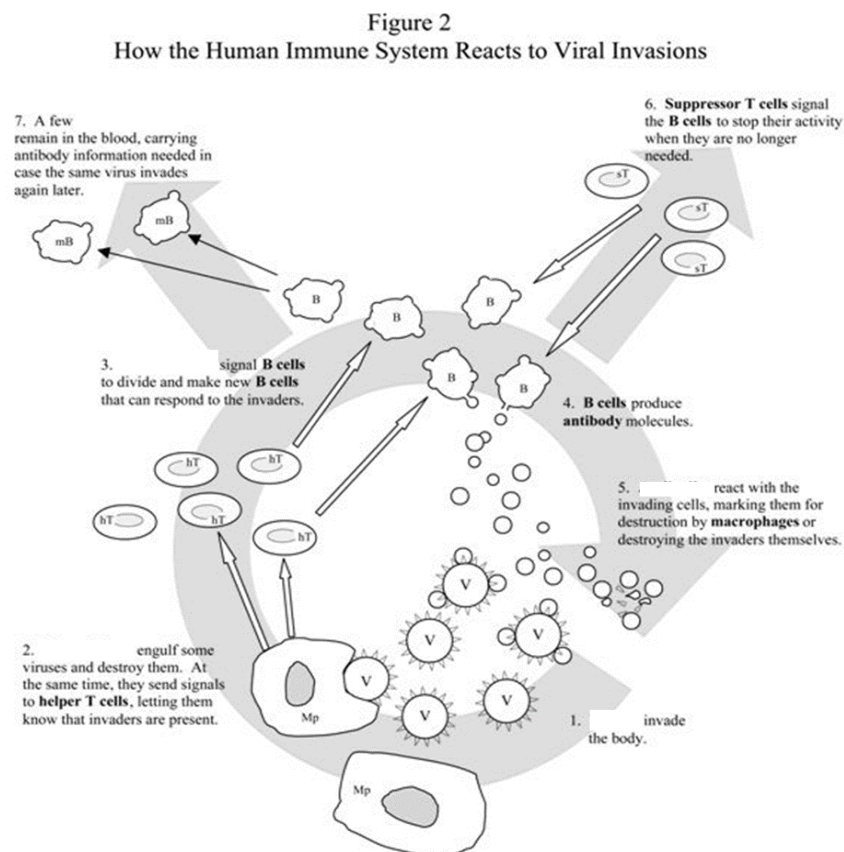
Major Organs and Their Functions

Skin – also called the integumentary system, the skin is the body's first line of defense

White Blood Cells – **recognize** disease agents (antigens) and create antibodies to **tag** and **remove** these antigens

-- Phagocytes are the white blood cell type that actually eats and destroys these antigens

Lymph Nodes – help **restore** fluid lost by the blood and return it to the circulatory system

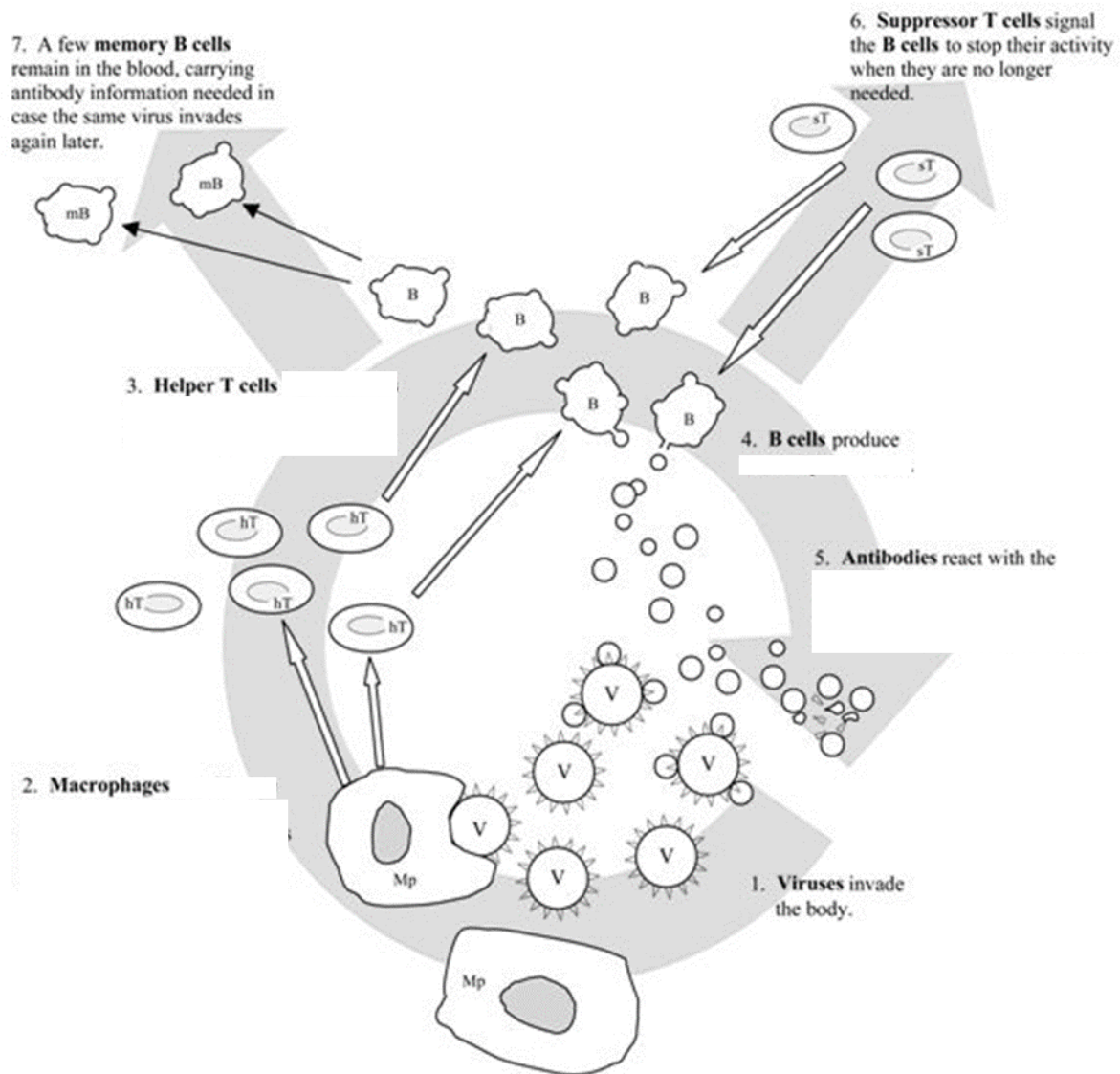


Immune System Homework

Name: _____

Directions: Try to complete without notes. For each cell in the immune system write its function on figure 2.

Figure 2
How the Human Immune System Reacts to Viral Invasions



DAY 10- Integumentary

TIME: 40 minutes

NYS SCIENCE STANDARDS:

- 1.2a, 1.2 b, 1.2j

OBJECTIVES:

- Students will *recall* information on the Integumentary system and its function
- Students will *plan* the construction of an accurate representation for the Integumentary system
- Students will *identify* structure and function for organs in the Integumentary system
- Students will *problem solve* to create solutions that occur in the immune system.

MATERIALS:

- Body Systems PowerPoint (Slides 24-25)
- Integumentary system notes
- Integumentary system homework
- Heat lamp, Water, Ring stand, Glass plates, Digital thermometer

PREPARATION:

- Calibrate digital thermometers
- Lay out experiment materials

INTRODUCTION:

- Ask students to volunteer their Immune system malfunctions. Ask each student to briefly mention what their malfunction was and what the cure for the malfunction was.
- When students volunteer and discuss malfunctions guide them in applying their malfunction and what it may look like in the model they created the previous day.
- If a student presents an autoimmune disease, ask the students what an autoimmune disease is.
- When the student responds that an autoimmune disease is the immune system attacking itself or non-harmful cells ask how that would look in the scenario at the bank?
- Hopefully the students will draw a comparison that it would be similar to one of the bank security guards injuring a bank employee or another bank security guard.
- Ask the student what the solution to the problem in the bank would be and how that would compare to the problem with the immune system.

LESSON/ACTIVITY:

- Pass out the Integumentary system notes and have the students fill in the notes as we work through them

- Start on slide 23, so the students cannot already see the purpose of the integumentary system.
- Pose the question: Does anyone know the purpose of the integumentary system?
- Field answers and guide students saying. What is the purpose of the skin and sweat glands?
- Have a student volunteer to read slide 24 and allow time for all students to fill in their notes.
- Bring up slide 25 and go through labeling each part of the digestive system. For each part of the integumentary system I will not just tell them what organ we are labelling, but instead I will ask them what organ it is that I am pointing to.
- Pose the question: What organ is this? Can anyone say what this organ does without looking back in your notes?
- Students will be prompted to get into a group of 3. These groups of 3 will plan and execute a single variable experiment to prove the benefits of sweat.
- I will prompt the students to think about the function of the sweat gland when they are trying to figure out what the experimental purpose of the sweat gland is.
- I will give the students 30 minutes to work on this, at the end of the ten minutes I will ask the students what their experiment plan is.
- I will have the students present their findings of purpose of the sweat gland and how they collected data.

CLOSURE:

- Explain to the students that for homework they have to do 2 things.
- They have to complete an empty diagram of the Integumentary system without notes.
- They have to look up and come to class with one integumentary system malfunction and cures for the malfunction. Print and bring the page containing the malfunction to class the following day.

ASSESSMENT:

- Students will be assessed on *recalling* information on the integumentary system and its function by my classroom questions and by the homework diagram that they will label.
- Students will be assessed on *planning* an experiment of an accurate purpose for the integumentary system by the worksheet that they completed in class, creating an experiment demonstrating benefits of the integumentary system.
- Students will be assessed on *problem solving* to create solutions that occur in the immune system by aiding me in fixing a malfunction that will be present in model for a warm up.
- Students will be assessed on *identify* structure and function for organs in the integumentary system by their ability to complete the homework assignment of labeling position and function of organs.

REFERENCES:

- colleen_snow.azschool.org/teacher/files/.../humanbodysystems.pptx (edited)

Integumentary system experiment

Name: _____

Directions: Using the materials provided create an experiment that demonstrates how sweat glands and the release of sweat benefit homeostasis. Make sure the experiment contains only one variable, and collect all data in an organized format (graph, chart..). Give a concluding sentence that is supported by your results and discusses what sweat does to maintain homeostasis.

Materials:

Heat lamp

Water

Ring stand

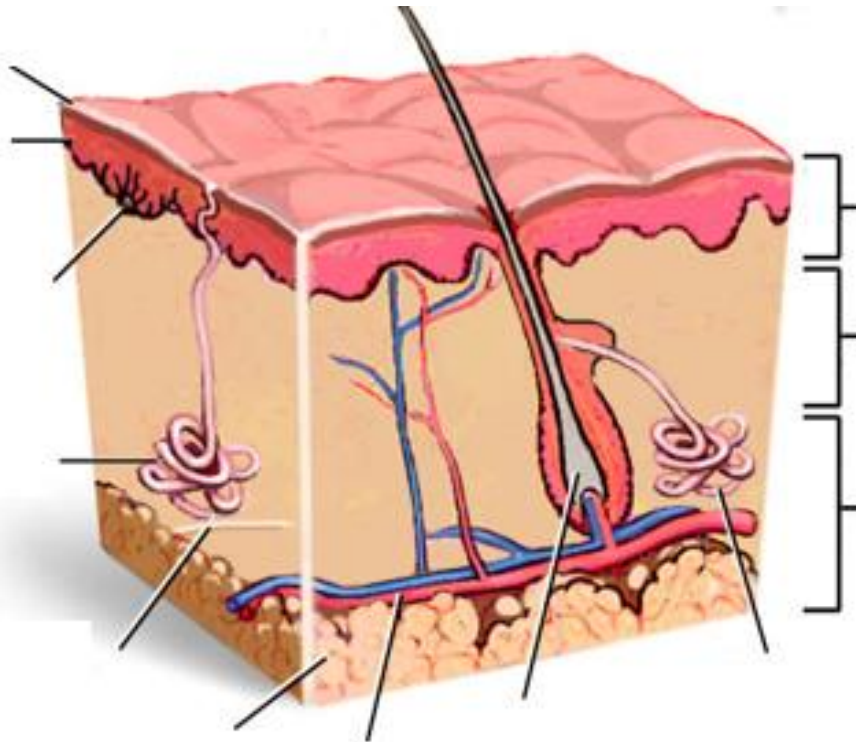
Glass plates

Digital thermometer

Integumentary System Worksheet

Name: _____

Purpose: is to act as a barrier to protect the body from the outside world. It also functions to retain body fluids, protect against disease, eliminate waste products, and regulate body temperature.

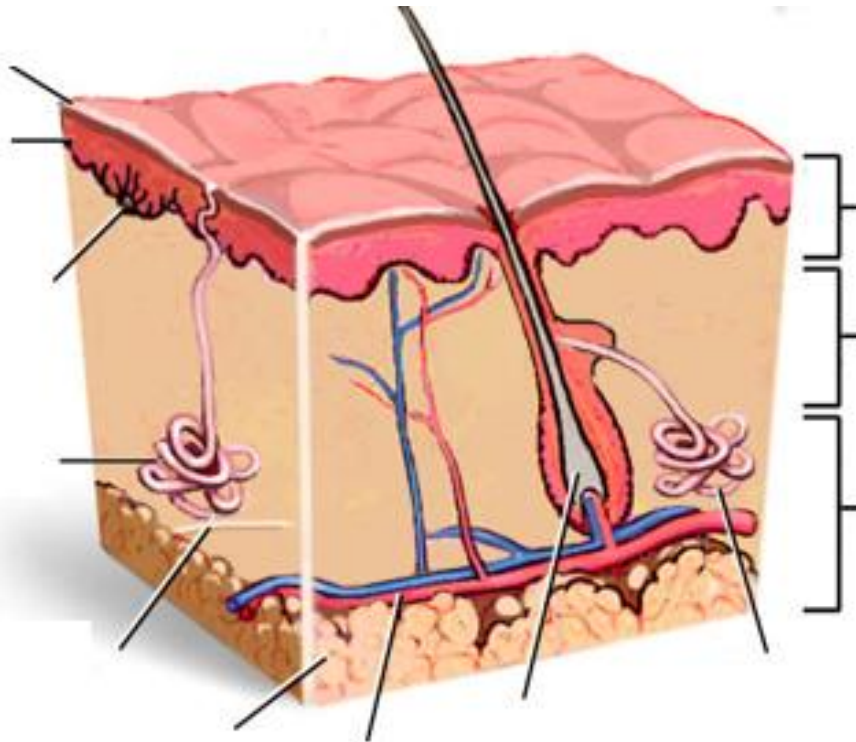


<https://lakshya98.wordpress.com/biology/integumentary-system/>

Integumentary System Homework

Name: _____

Directions: Try to complete without notes. For each organ write its function at the bottom. You only have to label the organs that are *starred below.



***Sweat Glands-**

***Hair Follicle-**

***Epidermis-**

***Dermis-**

***Subcutis-**

***Squamous Cell-**

DAY 11- reproductive

TIME: 40 minutes

NYS SCIENCE STANDARDS:

- 1.2a, 1.2 b, 1.2i, 1.2j

OBJECTIVES:

- Students will *recall* information on the reproductive system and its function.
- Students will *plan* the construction of an accurate representation for the reproductive system.
- Students will *identify* structure and function for organs in the reproductive system.
- Students will *problem solve* to create solutions that occur in the integumentary system.

MATERIALS:

- Body Systems PowerPoint (Slides 27-29)
- Integumentary system lab set up
- Reproductive system notes
- Reproductive system homework

How Gonads Go: <https://www.youtube.com/watch?v=7rsH2loIY8>

PREPARATION:

- Take ring stand, place evaporating dish on ring and fill with water, place heat lamp 4 inches away. Take another ring stand, place evaporating dish, place heat lamp 4 inches away. Turn on both of the heat lamps and start recording temperature changes 10 minutes before class starts.
- Set up chart on the white board and use the digital thermometer to record temperature changes for twenty minutes.

INTRODUCTION:

- Ask students to volunteer their Integumentary system malfunctions. Ask each student to briefly mention what their malfunction was and what the cure for the malfunction was.
- If a student does not mention hyperhidrosis, then I will bring it up by saying, “Has anyone ever heard of hyperhidrosis and know what and hyperhidrosis is?”
- I will then bring the students back to the model I setup 10 minutes before and show them the temperature differences between sweating and non-sweating.
- Pose question: Does anyone know hyperhidrosis is?

- Pose question: Does anyone know something that may cause hyperhidrosis? Let the students know that hyperhidrosis is technically nerve damage that leads to a lack of sweat gland release.
- Ask students why lack of sweating could be problematic based on the model? Ask if the temperature between models is the same? Ask students how they would cure this problem?
- Hope a student recommend surgery, explain that if the students can get life nerves back to the sweat gland that the students will be able to get sweat to the skin and allow the skin to maintain temperature.

LESSON/ACTIVITY:

- Pass out the Integumentary system notes and have the students fill in the notes as we work through them
- Start on slide 25, so the students cannot already see the purpose of the reproductive system.
- Pose the question: Does anyone know the purpose of the reproductive system?
- Field answers and guide students saying. What is the purpose of the uterus and the testicles?
- Have a student volunteer to read slide 26 and allow time for all students to fill in their notes.
- For slide 27 I will have another student read the content to the class as I circulate and check in on the students.
- Bring up slide 28 and go through labeling each part of the digestive system. For each part of the reproductive system I will not just tell them what organ we are labelling, but instead I will ask them what organ it is that I am pointing to.
- Pose the question: What organ is this? Can anyone say what this organ does without looking back in your notes?
- Bring up slide 29 and go through labeling each part of the digestive system. For each part of the reproductive system I will not just tell them what organ we are labelling, but instead I will ask them what organ it is that I am pointing to.
- Pose the question: What organ is this? Can anyone say what this organ does without looking back in your notes?
- When the students are done with their notes ask for a volunteer.
- This student with the help of the class will write a flow chart of where the sperm goes from the testicle to the fertilized embedded zygote, then the bath of the infant for birth.
- Make statement: Student A is going to write out a flow chart of each organ the sperm passes through in the reproductive system, if he/she needs help he/she will ask for help and he/she will call on someone raising their hand to help.
- Statement: Please copy this flow chart on the back of your note sheet.
- After completing the flow chart the students will be introduced to my friend Dr. Obourn and inform them that they will be conducting an interview with Dr. Obourn based on the reproductive system.
- Dr. Obourn will introduce himself and explain that he is trained in gynecology and urology and works locally.

- I will instruct each student to write down 10 questions, whatever they want as long as they are reproduction based.
- I will give the students 10 minutes to create questions and Dr. Obourn will call on students with raised hands fielding and answering questions.
- To close the interview students will have to fill out what they knew coming in, what they learned through the interview and what they still have questions about.

CLOSURE:

- Explain to the students that for homework they have to do 2 things.
- They have to complete an empty diagram of the reproductive system without notes.
- They have to look up and come to class with one reproductive malfunction and cures for the malfunction. Print and bring the page containing the malfunction to class the following day.

ASSESSMENT:

- Students will be assessed on *recalling* information on the reproductive system and its function by my classroom questions and by the homework diagram that they will label.
- Students will be assessed on *planning* interview questions to deeper understand the reproductive system.
- Students will be assessed on *problem solving* to create solutions that occur in the integumentary system by aiding me in fixing a malfunction that will be present in model for a warm up.
- Students will be assessed on *identify* structure and function for organs in the reproductive system by their ability to complete the homework assignment of labeling position and function of organs.

REFERENCES:

- colleen_snow.azschool.org/teacher/files/.../humanbodysystems.pptx (edited)

Reproductive system activity

Name: _____

Directions: After speaking with Dr. O'bourn (Watching the CrashCourse: How Gonads go) write down 2 pieces of information that you already knew, two pieces of information you learned and two pieces of information that you still have questions on.

I already knew:

1. _____

2. _____

I learned:

1. _____

2. _____

I have questions about:

1. _____

2. _____

Reproductive System Worksheet

Name: _____

Purpose: is a system of sex organs within an organism which work together for the purpose of sexual reproduction

Male Major Organs

Penis – The primary male reproductive sex organ used for insemination

Testicles- the male gonad used to produce sperm and to produce androgens, primarily testosterone.

Epididymis- is a tube that stores sperm and connects a testicle to a vas deferens in the male reproductive system

Prostate gland- stores and secretes the white alkaline portion of semen

Seminal vesicle- They secrete fluid that partly composes the semen.

Vas Deferens- transport sperm from the epididymis to the ejaculatory ducts in anticipation of ejaculation.

Urethra- is a tube that connects the urinary bladder to the urinary meatus for the removal of fluids from the body

Female Major Organs

Ovary –ovum-producing reproductive organ in female reproductive system.

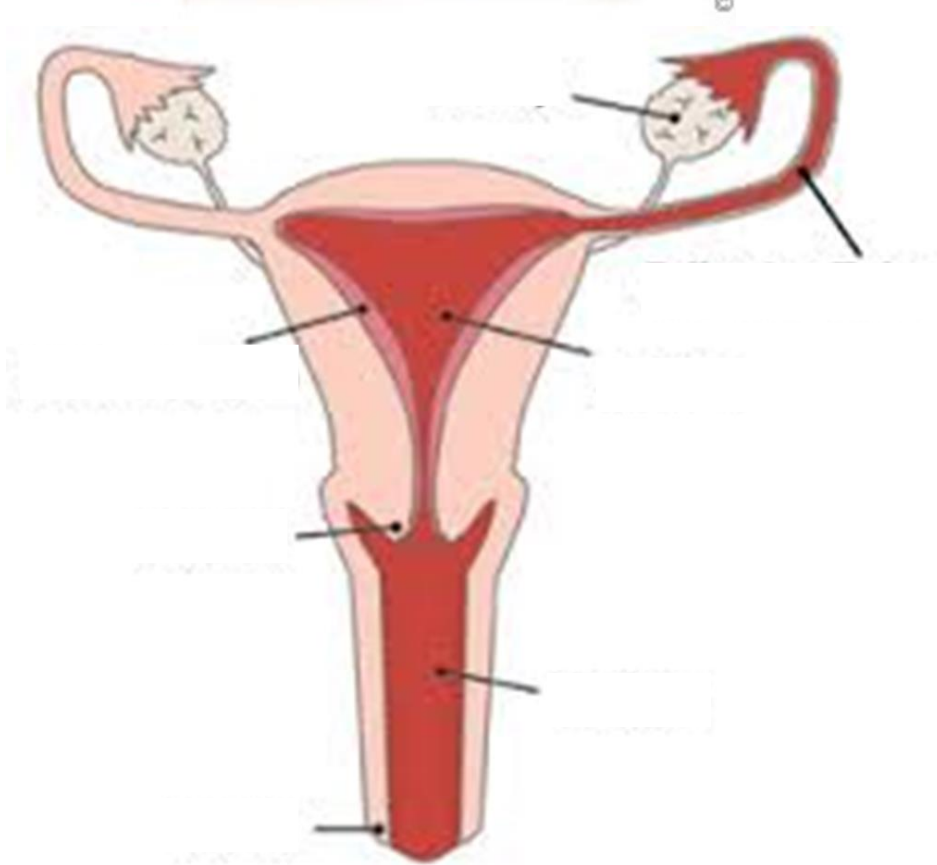
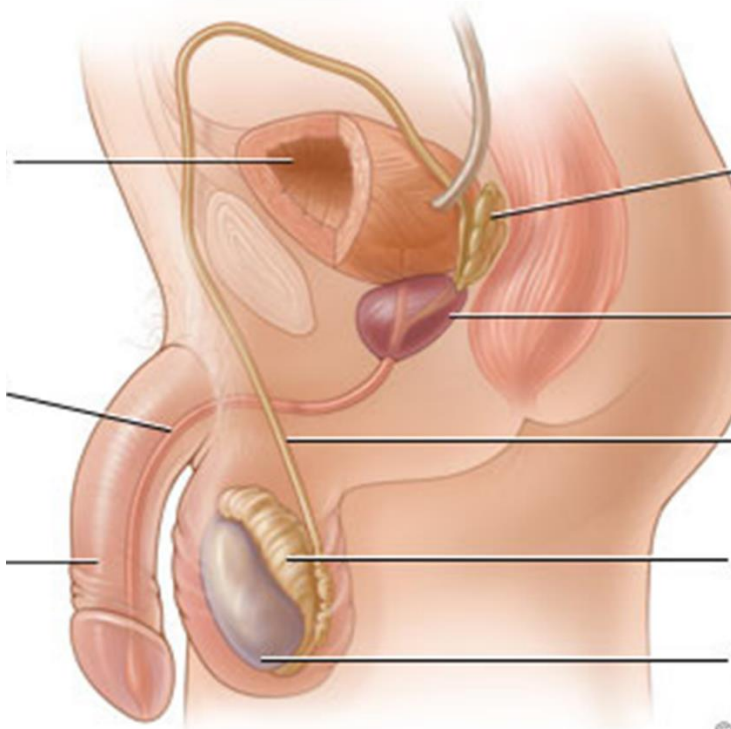
Endometrium-inner epithelial layer, along with its mucous membrane, of the mammalian uterus.

Cervix- is the lower part of the uterus in the human female reproductive system

Vagina- muscular and tubular part of the female genital tract, which in humans extends from the vulva to the cervix

Uterus- or womb is a major female hormone-responsive reproductive sex organ, location where the fetus develops.

Fallopian tube- are two very fine tubes lined with ciliated epithelia, leading from the ovaries of female mammals into the uterus, where fertilization takes place.



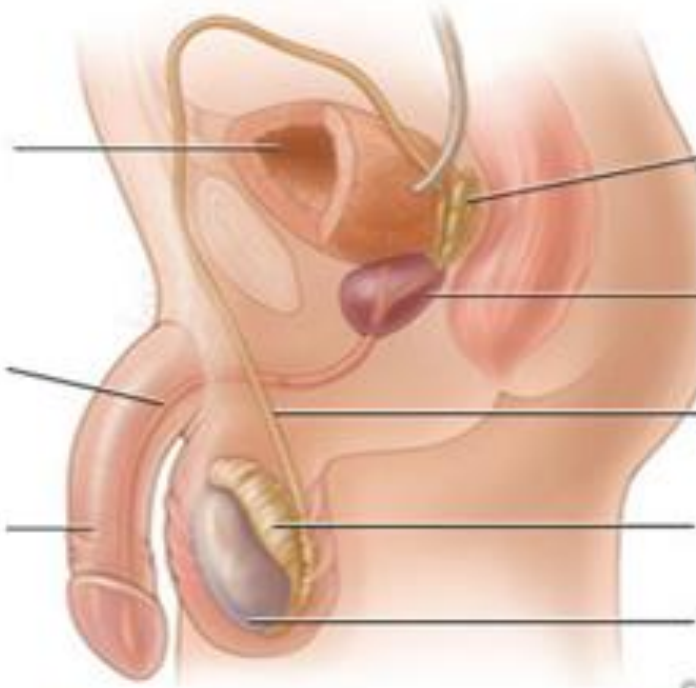
-<http://www.webmd.com/men/male-reproductive-system>

-<https://www.emaze.com/@AZRIZQWF/Reproductive-System>

Reproductive System Homework

Name: _____

Directions: Label each organ without the use of notes.



DAY 12

TIME: 40 minutes

NYS SCIENCE STANDARDS:

- 1.2a, 1.2 b, 1.2j

OBJECTIVES:

- Students will *recall* information on the body systems and their functions
- Students will *plan* the construction of an accurate representation for collaborative body systems
- Students will *problem solve* to create solutions that occur in collaborative body systems.

MATERIALS:

- Laptop cart for students
- Directions on how to log into database
- Final Project directions

PREPARATION:

- Pass out computers
- Plan groups of 3 that will be successful
- Get directions on board for warm up activity Slide

INTRODUCTION:

- Ask the students to get out their worksheet from yesterday.
- Students will be instructed to collaborate with classmates to answer, their unanswered questions.
- Students will be instructed to take their seat when they are able to answer all questions they still had on the reproductive system.
- At the end of the warm up I will take any questions that are still unanswered and work the class through to the answer.

LESSON/ACTIVITY:

- Pass out the final project worksheet and go over the daily directions as the students follow along.
- The directions will explain to the students that their final project is to create a working model that covers two body systems working together.
- Day 1 of the final project will be planning and research based.
- The task for students on the first day will be to pick the two body systems that they will want to model, decide on the malfunction that will be present in these cooperative body

system, research the body systems and how they work together, map out the materials that they will need to collect for homework.

- To complete these tasks in class, students will have to assign responsibilities to all members of the group.
- One student will be in charge of researching the way the body systems work together.
- Another student will be in charge of researching malfunctions with the collaborative body systems, and planning on ways to both cause and cure the malfunction.
- The third student will be in charge of planning the working model of the collective body systems and making a list of materials to collect for homework.

CLOSURE:

- Explain to the students that for homework they have to finish all research that was incomplete from class and collect and bring all the materials they will need to build the model the following day.

ASSESSMENT:

- Students will be assessed on *recalling* information on the body systems and their functions by using their body system knowledge to select two body systems that work closely to maintain homeostasis.
- Students will be assessed on *planning* the construction of an accurate representation for collaborative body systems by researching and filling out their research worksheet.
- Students will be assessed on *problem solving* to create solutions that occur in collaborative body systems by working with a group to plan and research body system malfunctions.

Final project worksheet partner 2

Name: _____

Directions: Use the database and your notes to fill in the worksheet and plan your final project.

Body system number 1

1. Purpose: _____

2. Key Organs and Functions

• _____ -

• _____ -

• _____ -

• _____ -

• _____ -

3. Common system malfunctions and descriptions

• _____ -

• _____ -

Final project worksheet partner 1

Name: _____

Directions: Use the database and your notes to fill in the worksheet and plan your final project.

Body system number 1

3. Purpose: _____

4. Key Organs and Functions

- _____ -

- _____ -

- _____ -

- _____ -

- _____ -

4. Common system malfunctions and descriptions

- _____ -

- _____ -

Final project worksheet partner 1&2

Name: _____

Directions: Use the database and your notes to fill in the worksheet and plan your final project.

5. How body systems 1&2 work together:

6. Malfunctions that effect body system 1&2 and description

- _____ -

- _____ -

Final project worksheet partner 1&2

Name: _____

Directions: Use the database and your notes to draw a plan of your final project that represents two body systems working together. Also list all materials, what organs they will represent and who will collect them for homework.

Material	Organ	Partner collecting

Draw and Label Design:

Day 13

TIME: 40 minutes

NYS SCIENCE STANDARDS:

- 1.2a, 1.2 b, 1.2j

OBJECTIVES:

- Students will *recall* information on the body systems and their functions
- Students will *plan* the construction of an accurate representation for collaborative body systems
- Students will *problem solve* to create solutions that occur in collaborative body systems.

MATERIALS:

- Laptop cart for students
- Directions on how to log into database
- Final Project directions

PREPARATION:

- Pass out computers
- Plan groups of 3 that will be successful

INTRODUCTION:

- Ask the students to get out their worksheet from yesterday and the materials that were collected for homework.
- The task for today will be to use the entire 40 minutes to build a working model and test if they can represent and solve a malfunction on their model.
- Students will be given a checklist to make sure they are addressing all the important information when they are building their model

LESSON/ACTIVITY:

- Pass out the final project worksheet day 2
- Tell students to get in their group and start building their model

CLOSURE:

- Explain to the students that for homework they have to finish building their model, making sure the knock off all aspects of their check list.

ASSESSMENT:

- Students will be assessed on *recalling* information on the body systems and their functions by using their body system knowledge to select two body systems that work closely to maintain homeostasis.
- Students will be assessed on *planning* the construction of an accurate representation for collaborative body systems by researching and filling out their research worksheet.
- Students will be assessed on *problem solving* to create solutions that occur in collaborative body systems by working with a group to plan and research body system malfunctions.

Final project worksheet day 2

Name: _____

Directions: Use the database, your notes and the previous days plans to build your working model of the collaborative body systems. Make sure to take care of all check list items.

Checklist

- Does the model represent 2 body systems working together
- Is the model a working model, does it represent the purpose of both body systems functions.
- Does the model have representations of all major organs in both body systems?
- Do you have the ability to inflict a malfunction that effects both body systems involved
- Do you have the ability to solve the inflicted body systems malfunction?
- Did you label all organs on the model?

Day 14

TIME: 40 minutes

NYS SCIENCE STANDARDS:

- 1.2a, 1.2 b, 1.2j

OBJECTIVES:

- Students will *recall* information on the body systems and their functions
- Students will *plan* the construction of an accurate representation for collaborative body systems
- Students will *problem solve* to create solutions that occur in collaborative body systems.

MATERIALS:

- Laptop cart for students
- Directions on how to log into database
- Final Project presentation rubric

PREPARATION:

- Pass out computers
- Plan groups of 3 that will be successful

INTRODUCTION:

- Ask the students to get out their worksheet from yesterday and the materials that were collected for homework.
- The task for today will be to use the entire 40 minutes to plan a presentation around their working model.
- Students will be given a checklist and presentation rubric to make sure they are addressing all the important information when they are planning their presentation.

LESSON/ACTIVITY:

- Tell students to get out their checklist from the previous day
- Pass out the final project presentation rubric
- Tell students to get in their group and start planning their presentation.

CLOSURE:

- Explain to the students that for homework they have to finish their presentation, making sure the knock off all aspects of their check list and address all criteria in the rubric.

ASSESSMENT:

- Students will be assessed on *recalling* information on the body systems and their functions by using their body system knowledge to select two body systems that work closely to maintain homeostasis.
- Students will be assessed on *planning* the construction of an accurate representation for collaborative body systems by researching and filing out their research worksheet.
- Students will be assessed on *problem solving* to create solutions that occur in collaborative body systems by working with a group to plan and research body system malfunctions.

Final presentation rubric

NAME: _____

5	4	3	2	1
Students have functional model and demonstrates collaboration between systems, malfunctions, major organs and cure for malfunction.	Student's model is not functional/student is unable to completely demonstrate function or representation.	Students model is incomplete or student does not know how the model would function	Student model is complete but contains errors and missing functional aspect	No Model
Student fully explains the body systems and how they work together for homeostasis of their organism	Student explains 1 body system to a semi-complete level	Students body system is incomplete missing key organs or purpose	Student explains body system with inaccurate information	Cannot describe life function
Student fully explains how their body system functions and demonstrates using working model	Student explains body system partially or body system model partially works	Student explains body system partially and the model is non-working.	Student cannot explain body system and model is non-working	Student does not address working nature of the model or purpose of body system
Student is able to field and answer questions with clear logical answers	Student is able to partially answer questions given	Student is unable to answer questions completely and appears unprepared	Student answers questions with some inaccurate information	Student doesn't try to answer questions

Day 15

TIME: 40 minutes

NYS SCIENCE STANDARDS:

- 1.2C, 1.2E

OBJECTIVES:

- Students will *recall* information on the body systems and their functions
- Students will *plan* the construction of an accurate representation for collaborative body systems
- Students will *problem solve* to create solutions that occur in collaborative body systems.

MATERIALS:

- Presentation, participant worksheet

PREPARATION:

- Pass out presentation participation worksheet and plan presentation order.

INTRODUCTION:

- Inform students that they will be presenting their models today
- One representative will come up and draw one of 6 playing cards that I have on my desk, these numbers will designate the presentation order.
- Each group will be graded by both me and the 3 group members that present after the group currently presenting (Group 2 will evaluate group 1, group 5 will evaluate group 4 and so on)

LESSON/ACTIVITY:

- Pass out the evaluation sheets
- Let the students who are evaluating know that they each must ask the presenting group 1 questions
- Get the presentations started.

CLOSURE:

- No homework

ASSESSMENT:

- Students will be assessed on *recalling* information on the body systems and their functions by using their body system knowledge to select two body systems that work closely to maintain homeostasis.

- Students will be assessed on *planning* the construction of an accurate representation for collaborative body systems by researching and filling out their research worksheet.
- Students will be assessed on *problem solving* to create solutions that occur in collaborative body systems by working with a group to plan and research body system malfunctions.

Final presentation rubric- peer evaluation

NAME: _____

5	4	3	2	1
Students have functional model and demonstrates collaboration between systems, malfunctions, major organs and cure for malfunction.	Student's model is not functional/student is unable to completely demonstrate function or representation.	Students model is incomplete or student does not know how the model would function	Student model is complete but contains errors and missing functional aspect	No Model
Student fully explains the body systems and how they work together for homeostasis of their organism	Student explains 1 body system to a semi-complete level	Students body system is incomplete missing key organs or purpose	Student explains body system with inaccurate information	Cannot describe life function
Student fully explains how their body system functions and demonstrates using working model	Student explains body system partially or body system model partially works	Student explains body system partially and the model is non-working.	Student cannot explain body system and model is non-working	Student does not address working nature of the model or purpose of body system
Student is able to field and answer questions with clear logical answers	Student is able to partially answer questions given	Student is unable to answer questions completely and appears unprepared	Student answers questions with some inaccurate information	Student doesn't try to answer questions

Questions:

1. _____

2. _____

References

- Adams, J. j., Gupta, P., & DeFelice, A. (2012). Schools and informal science settings: collaborate, co-exist, or assimilate?. *Cultural Studies Of Science Education*, 7(2), 409-416. doi:10.1007/s11422-012-9399-x
- Bicer, A. a., Navruz, B. b., Capraro, R. r., Capraro, M. m., Oner, T. t., & Boedeker, P. p. (2015). Stem schools vs. non-stem schools: comparing students' mathematics growth rate on high-stakes test performance. *International Journal on New Trends in Education & Their Implications (IJONTE)*, 6(1), 138-150
- Billiar, K., Hubelbank, J., Olivia, T., & Camesano, T. (2014). Teaching STEM by design. *Advances In Engineering Education*, 4(1), 1-21.
- Brophy, S., Klein, S., Portsmore, M. & Rogers, C. (2008). Advancing engineering education in P-12 classroom. *Journal of Engineering Education*, 97 (3), 369-387.
- Fantz, T. t., & Grant, M. m. (2013). An engineering design stem project t-shirt launcher. *Technology & Engineering Teacher*, 72(8), 14-20.
- Gehlhar, A. A., & Duffield, S. S. (2015). Deconstruction geography: A STEM approach. *Middle School Journal*, 46(3), 3-9.
- Israel, M. m., Maynard, K., & Williamson, P. (2013). Promoting literacy- embedded, authentic STEM instruction for students with disabilities and other struggling learners. *Teaching Exceptional Children*, 45(4), 18-25.
- Kennedy, T. t., & Odell, M. m. (2014). Engaging students in STEM education. *Science Education International*, 25(3), 246-258
- McConnell, W. w., & Dickerson, D. D. (2014). A real-world integrated STEM lesson. *Technology & Engineering Teacher*, 73(8), 24-29.
- Reeve, E. e. (2014). STEM thinking! *Technology & Engineering Teacher*, 74(4), 8-16.
- Robinson, A., Dailey, D., Hughes, G., & Cotabish, A. (2014). The effects of a science-focused STEM intervention on gifted elementary students' science knowledge and skills. *Journal Of Advanced Academics*, 25(3), 189-213. doi:10.1177/1932202X14533799

Schumacher, A. a., & Reiners, C. c. (2013). Designing authentic learning environments in chemistry lessons: paving the way in pre-service teacher education. *Science & Education*, 22(9), 2173-2191. doi:10.1007/s11191-012-9552-7

Strimel, G. g. (2014). Authentic education. *Technology & Engineering Teacher*, 73(7), 8-18

Tofel-Grehl, C., & Callahan, C. M. (2014). STEM high school communities: common and differing features. *Journal Of Advanced Academics*, 25(3), 237-271. doi:10.1177/1932202X14539156

Willems, P. p., & Gonzalez-DeHass, A. R. (2012). School--community partnerships: using authentic contexts to academically motivate students. *School Community Journal*, 22(2), 9-30.