**Lesson 2:**

Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Diabetes Research Day 2:

Problem Statement/EQ: *How can we decrease the prevalence of diabetes in the US within the next 20 years?*

Use the information from the Centers for Disease Control and Prevention website to take notes on the current understanding Diabetes.

|  |
| --- |
| CDC Homepage: <http://www.cdc.gov/diabetes/home/> |
| Basics of Diabetes: <http://www.cdc.gov/diabetes/basics/index.html> |
| Data and Statistics: <http://www.cdc.gov/diabetes/data/index.html> |
| One other credible sources of Diabetes information: |
| It’s March! Make the Diabetes-Kidney Connection |

**Life’s Balancing Trick: Homeostasis!**

What happens to your body when you get hot? How about when you get too cold? Your body has the ability to regulate its temperature, blood pressure, wastes, glucose levels, and much more! The ability of a life form to control and adapt to their changing environments is called **HOMEOSTASIS**. In other words, homeostasis is the process by which an organism tries to remain stable when it’s external environment changes. In order to maintain this balance organisms use **NEGATIVE FEEDBACK SYSTEMS**. A negative feedback system is a series of parts that are all about maintaining homeostasis. For example, when you get hot your brain will send a message to your sweat glands to release water on to the surface of your skin. The evaporation of the water on your skin will help to cool your body and bring your body temperature back down to normal. If we were to draw a loop of this process, it might look like this:

98.6 **°F**

Sweat glands release more sweat

Rise in temperature

Water evaporates off the skin

Temperature drops

**Objective:**

In this activity you will explore some ways in which your body tries to maintain balance and then will determine the negative feedback system for each station.

**Station 1: Eyes and Light**

1. In pairs, select one person to be the observer and the other to be the experimenter.
2. Have the experimenter hold a flashlight to the side of the observer head, at eye level.
3. Then, turn on the flashlight and slowly bring it to the front of the observer’s eye, holding it about 10 cm from their eye.
4. The experimenter should note what happens to the pupil of the eye. (The pupil is the black circle in the middle of the eye.)
5. Repeat this with the other eye and observe/record what happens.
6. Now, switch roles and repeat steps 2-6.

**Data Table:**

|  |  |
| --- | --- |
| **Subjects** | **Pupil Size (increase or decrease?)** |
| Person 1 – Left eye |  |
| Person 1 – Right eye |  |
| Person 2 – Left eye |  |
| Person 2 – Right eye |  |

**Station 2: Exercise and Breathing**

1. While sitting down and breathing normally, count how many breaths you inhale in one minute. (timers are provided)
2. Record the number of breaths per minute in the data table below.
3. Now, do jumping jacks for TWO minutes. Please make sure you have enough space for this!
4. Immediately, sit down and count how many breaths you inhale in one minute. Record again.

**Data Table:**

|  |  |  |
| --- | --- | --- |
| Subjects | Number of Breaths per minute at rest | Number of Breaths per minute after jumping jacks |
| 1 |  |  |
| 2 |  |  |
| 3 |  |  |
| 4 |  |  |

**Station 3: Exercise and Heart Rate**

1. While sitting down record your pulse by counting the number of times your heart beats for 15 seconds and then multiplying that number by 4.
2. Record this value in the data table below.
3. Now, either run up and down the stairs or do jumping jacks for 5 minutes.
4. IMMEDIATELY following the exercise, take your pulse again as instructed in step number 1.
5. Record this value in the data table below.

**Data Table**

|  |  |  |
| --- | --- | --- |
| **Subject** | **Pulse Before Exercising (bpm)** | **Pulse After Exercising (bpm)** |
| 1 |  |  |
| 2 |  |  |
| 3 |  |  |
| 4 |  |  |

**Station 4: Skin Color and Cold Water**

1. Note the color the palm of your hand and record it in the data table below. Use the scale below.
2. Place your hand in the cold bucket of water for at least one minute. (If you can keep it in there longer, great!)
3. Note the color of your hand when you take it out of the bucket and record it in the data table below.
4. If time permits, try your elbow as well and see if you get the same results!

**Palm Color code:**

1. whitish/yellow
2. slightly pink/slightly yellow
3. pink
4. very pink

**Data Table**

|  |  |  |
| --- | --- | --- |
| Subject | **Number for Color of Palm before ice water** | **Number for Color of Palm after ice water** |
| 1 |  |  |
| 2 |  |  |
| 3 |  |  |
| 4 |  |  |

**Homeostasis Analysis Questions (Please answer in your journal.)**

1. Our mini experiments contained a few flaws. Identify one major flaw that affected our reliability of the data.
2. For one of the stations, create a negative feedback system loop like the example at the beginning.
3. Come up with your own analogy of a negative feedback system not used in class.
4. Positive feedback systems are rare in nature. Positive feedback systems occur when a stimulus causes an increase in the effector instead of trying to return it to normal. An example of this is when you get a fever. Certain immune system cells will release proteins called *pyrogens* (can you guess why they’re named this?), these proteins cause the thermostat of the body to keep raising it’s base temperature until the threat of a bacteria/virus is gone. Thus, you end up with an increased body temperature, aka a “fever”. **Is the diagram below an example of a positive or negative feedback system? Explain why you think so!**



**Guided Note Sheet for Research**

Group Topic: Prevention

|  |
| --- |
| National Diabetes Prevention: <http://www.cdc.gov/diabetes/prevention/> |
| Kidney Disease: <http://www.ndep.nih.gov/am-i-at-risk/family-history/four-questions.aspx> |
| Vision Health: <http://www.who.int/blindness/causes/priority/en/index5.html> |
| Native Diabetes Wellness Program: <http://www.cdc.gov/diabetes/projects/diabetes-wellness.htm> |
| One additional really interesting site/video. |

**Guided Note Sheet for Research**

Group Topic: Medical Treatment

|  |
| --- |
| <http://youtu.be/RIyzUFCLbac> - diabetes, nurse’s perspective |
| <http://youtu.be/8z0RYdBSi90> – diabetes, doctor’s perspective |
| <http://youtu.be/BWQK2FFJwxE> – WHO perspective |
| WHO infographic: <http://www.who.int/nmh/publications/ncd-infographic-2014.pdf?ua=1> |
| One additional really interesting site/video. |

**Guided Note Sheet for Research**

Group Topic: Contributing Factors

|  |
| --- |
| [http://www.youtube.com/watch?v=Kp6Jk9vsqkM&am...](http://www.youtube.com/watch?v=Kp6Jk9vsqkM&feature=youtu.be) – diabetes, patient’s perspective |
| Screening test: <http://www.cdc.gov/diabetes/prevention/pdf/prediabetestest.pdf>  Family History Questions: <http://www.ndep.nih.gov/am-i-at-risk/family-history/four-questions.aspx> |
| Diabetes.org: Diabetes basics <http://www.diabetes.org/diabetes-basics/type-2/?loc=db-slabnav> |
| One additional really interesting site/video. |

**Guided Note Sheet for Research**

Group Topic: Educational Outreach

|  |
| --- |
| National Diabetes Education Program: <http://www.ndep.nih.gov/> |
| Programs and Research: <http://www.ndep.nih.gov/resources/index.aspx?SearchText=children+and+adolescents>  <http://www.diabetes.org/donate/how-your-dollars-make-a-difference/outreach.html> |
| <http://www.diabetesoutreach.org.au/default.asp> |
| One additional really interesting site/video. |

Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Guided Note Sheet for Peer Presentations**

|  |  |  |
| --- | --- | --- |
| Research Topic | Methods Used Currently to Solve Problem | Methods Used to Measure Effectiveness of Current Solution |
| Prevention |  |  |
| Medical treatment |  |  |
| Lifestyle Choices |  |  |
| Educational Outreach |  |  |

**Grant Proposal Template**

**Instructions:** *Work together as a group or independently to complete each section of this template. This will serve as the rough draft of your final grant proposal. Each individual student will need to complete a UNIQUE final grant proposal (1-2 pages in length). This template will help you accomplish that goal. Use your own words, not your group members’, when completing this. Use more paper if you need additional space!*

**Define the problem and provide background information:**

1. What is the problem you are addressing in your proposal?
2. What is Type II diabetes? How is it caused?
3. Insulin is produced through the process of protein synthesis. Explain how this works. Include a diagram.
4. Describe what kind of feedback loop is involved in glucose uptake.
5. Explain how this feedback system is disrupted in diabetes patients.
6. How are enzymes involved in the breakdown and utilization of glucose?
7. What are current prevention methods?
8. What are current medical treatments methods?
9. What are current educational outreach methods?

**Detail the action plan:**

1. What is the greatest limitation in the current methods of addressing the problem?
2. Why do you think this is the most important limitation to improve?
3. Outline your proposal for improving this limitation.

**Explain methods for measuring success of the plan:**

1. How would you measure your improvement to see if it is effective at solving the problem?
2. What are some possible reasons why your proposal/suggestion might not work?

**Consolidate all parts into a cohesive conclusion:**

1. Write a summary of everything above in about 5-6 sentences.