**Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**How Bacteria “Talk”**

**Introduction –** Watch the video, <https://www.youtube.com/watch?v=-dbRterutHY>

**Part I - How bacteria “talk”: Bonnie Basler, molecular biologist. Watch the following TED talk by Dr. Basler and answer the questions that follow.** [**TED Talk**](https://www.ted.com/talks/bonnie_bassler_on_how_bacteria_communicate?language=en) **Keep in mind that Dr. Basler talks fast, you may need to pause, rewind, rewatch portions of her talk, you can also turn on the Closed- captioning feature.**

1. Bacteria everywhere.

A.How many more bacterial than human cells are there in a human body?

B. What are some of the benefits to having this many bacteria? Describe what ‘good’ bacteria do for us.

2. What must happen before the *Vibrio fischeri* bacteria will glow?

3. What kind of **symbiotic** relationship do the bacteria and that cool squid have? **Parasitic** **Mutualistic** **Commensal**

4. Do you think it is an **obligate mutualism** relationship? *Look that up if you need to!* Why or why not?

5. What “language” do bacteria use?

6. What type of molecule creates the chemical messengers (#5) inside of the bacteria? (The red box)

7. What do the bacterial cells need in their cell membrane in order to recognize the messenger?

8. When the bacteria take in the messenger, this causes \_\_\_\_\_\_\_\_\_\_ to turn on, starting a new group behavior.

9. Describe **quorum sensing** in your own words.

10. **Virulence** describes how harmful a disease is. More virulence means more harmful. **Pathogenicity** is similar in that it is how harmful an organism is to the host. Using **quorum sensing**, describe how harmful bacteria (pathogens) turn on their **virulence** inside of you to become **pathogenic**.

1. Bacteria is in you
2. They wait and start growing
3. They count themselves with quorum sensing.
4. They count themselves with molecules.
5. They recognize when they have a certain cell number.
6. Launch their virulence attack. → overcome large hosts

11. **Sketch** your answer to #9 in a diagram. Be sure to **draw** and **label** all the parts and molecules you use!! Reflect on your answers to #4-7 to be sure you include as many of the molecules, parts and steps as you can! You can sketch on the computer, or by hand on a separate piece of paper, take a picture with your phone and share it with me. Alternatively, you can submit a paper copy of this project - least desirable - let’s try to reduce paper.

|  |  |
| --- | --- |
| **Virulence Turned Off** | **Virulence Turned On** (yikes!)& **Pathogenic** |

12. How are the messages sent “private”? Describe how at the molecular levels bacteria use secret, private messages.

13. What does Dr. Basler mean when she says that bacteria are multilingual? Explain in both terms of communication and what that means at the molecular level.

14.Differentiate between **INTRAspecific** and **INTERspecific** communication. *Think the meaning and HOW it happens (use your answers to # 12 and 13).*

15. How did Basler’s team apply their knowledge of quorum sensing to a real world problem? Describe the problem itself and the solution they came up with.

15. How did you feel when you heard her final statement about 20-30 year olds (soon to be you!)?

Read the following before answering question 16.

A biofilm is an assemblage of microbial cells (bacteria mostly) that is irreversibly associated (not removed by gentle rinsing) with a surface and enclosed in a matrix of primarily polysaccharide material. Biofilm organisms secrete an Extracellular matrix (like animal cells) that helps them attach to surface and attach to each other. An example of a biofilm is dental plaque- biofilm of bacteria present on the [teeth](https://en.wikipedia.org/wiki/Teeth) where they may cause [tooth decay](https://en.wikipedia.org/wiki/Tooth_decay) and [gum disease](https://en.wikipedia.org/wiki/Gum_disease). Microorganisms often exist in the form of biofilms, rather than individual cells. Organisms within a biofilm engage in quorum sensing and group behaviour. Advantages to biofilm formation are exchange of nutrients between cells, exchange of DNA (including antibiotic resistance genes), higher resistance to stress (changes in pH, pressure), biofilm is not as easy to remove from a surface as individual cells - think rinsing your hands vs. scrubbing with soap or rinsing your mouth vs. brushing your teeth.

16. How do these insights about bacterial communication (quorum sensing) provide evidence of evolution? Your response must include discussion of 1) biofilms, 2) multicellularity and 3) drug.

**Part II - Read the following report from the NIH and answer the questions that follow.**

[**NIH Report**](https://www.nih.gov/news-events/nih-research-matters/disrupting-normal-hormone-cycle-spurs-fat-cells?fbclid=IwAR0IlsItWSm3TRDEk4mjWw08E_yNXJU9T9ZkkcL3ZmofwAuXNHIY76FDQXA)**. You may need to do some additional reading to answer some of the questions.**

(you can use the [Hormones and their Feedback loops](https://docs.google.com/document/d/18obP-Y6M151HzyiVD4Hn_XBuKeUc7UKG8HmN0jeoI8E/edit?usp=sharing) document and any other reputable sources)

1. Circadian Rhythms
   1. What is circadian rhythm?
   2. Which organisms have a circadian rhythms?
   3. You encountered this term in Dr. Basler’s TED talk. Explain its importance in the squid-bacteria relationship.
2. Describe one disorder/condition that is connected to disrupted circadian rhythms.
3. Describe the glucocorticoid feedback loop. What roles do glucocorticoid hormones play in our bodies? (List all effects of the hormone)
4. When are glucocorticoids released?
5. What question was Dr. Mary Teruel trying to answer with the experiments described?
6. Why do you think think this question is important?
7. In the first set of experiments which group of mice was the control group, describe the group in terms of hormone levels.
8. What effect did the hormone treatment have on the experimental group?
9. Describe how researchers showed that a dark, “off” period was important (experimental set up explained and results stated)
10. What is the conclusion that can be drawn from Dr. Mary Teruel’s experiments?
11. **Evidence:** Describe ALL the evidence form the experiments

**B. Claim:** Examine andThink about the experimental results/data/evidence and how they answer Dr. Teruel’s question. Your Claim is the answer to that question and is based on the evidence gathered.

11. Researchers have found a correlation between lack of sleep and obesity. **Propose** an explanation for this observation.

12. Synthetic Glucocorticoids are used as medicine to treat many different conditions. Research one such conditions and briefly explain the following:

1. What is the mechanisms of action of the medication? What does the hormone do to treat the condition?
2. What are some side effects of synthetic glucocorticoids?