# Beta Cells and Box Plots

## Student Activity

Name _____

Class _____

**Open the TI-Nspire document *Beta Cells and Box Plots.tns.***

Imagine having to give yourself an insulin injection with a needle 6 to 10 times a day, every day, for the rest of your life. That's the routine for someone with Type 1 Diabetes (T1D). T1D is an **autoimmune** disease where the body's immune system attacks the cells in the **pancreas** that make **insulin**, called **beta cells**. Developing treatments to improve the body's ability to naturally produce insulin is a path to a cure. Sanford Research is on the front line of this research. Check out the activity and think about the math and science that go into fighting a disease like Type 1 Diabetes.

**Move to pages 1.2—1.4.**

1. Pages 1.2 to 1.4 describe Katie Zucker, a Hollywood executive whose family has been involved in the creation of many popular movies and television shows. Katie also has T1D and she is a strong advocate for more medical research and eventual cure for the disease.

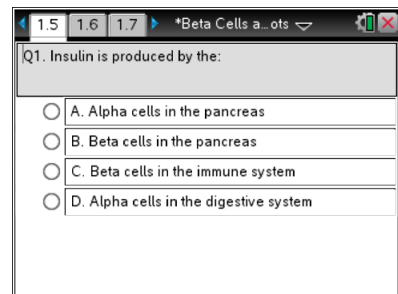2. Read through the background information to become familiar with Type 1 Diabetes.
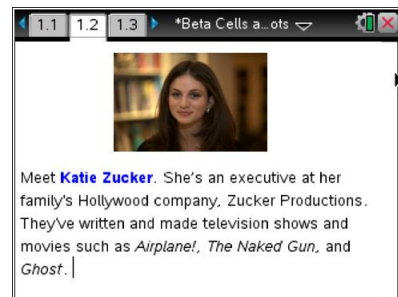
**Move to page 1.5.**

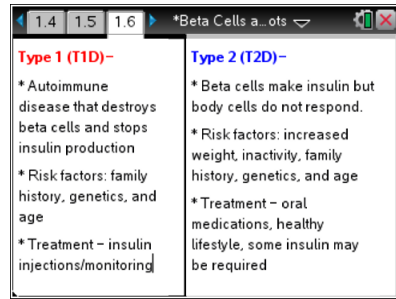Answer the question here and/or in the .tns file.

Q1.    Insulin is produced by the:

A.  Alpha cells in the pancreas
B.  Beta cells in the pancreas
C.  Beta cells in the immune system
D.  Alpha cells in the digestive system

**Move to pages 1.6--1.7.**

3. Read through the comparisons of Type 1 Diabetes and Type 2 Diabetes. Think about which of the risk factors can be can be controlled and which cannot be controlled.

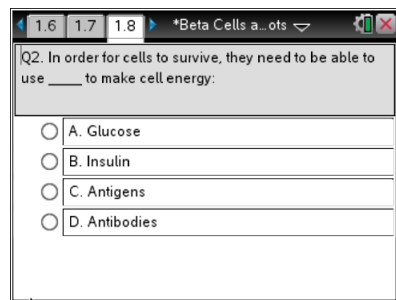4. Page 1.7 introduces Sanford Research, which is on the front lines of fighting Type 1 Diabetes.

**Move to pages 1.8.**

Answer the question here and/or in the .tns file.

Q2. In order for cells to survive, they need to be able to use _____ to make cell energy.

A. Glucose
B. Insulin
C. Antigens
D. Antibodies

**Move to pages 1.9--1.12.**

5. Page 1.9 introduces Camille Parker, a senior lab coordinator at Sanford Research under Dr. Alexei Savinov's lab. Camille discusses what she does for a living and her role in fighting T1D.
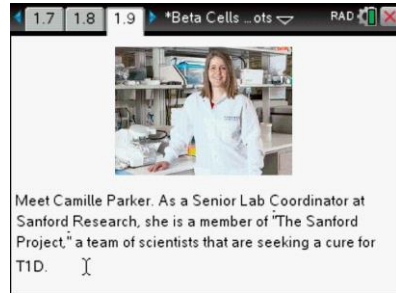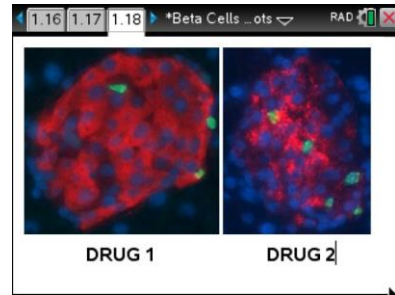
**Move to pages 1.13--1.16.**

6. Pages 1.13 to 1.16 take you into the lab as you learn about the different immunofluorescent stains and their specific targets in the cells. Through simulations and images of actual tissue samples supplied by Sanford, you will do cell counting just like the researchers at Sanford! You are part of the effort to determine the replication rate of beta cells!
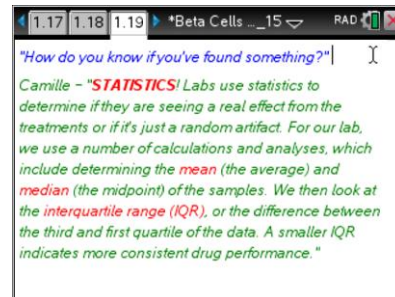
**Move to pages 1.17--1.18.**

7. Pages 1.17 and 1.18 explain that the researchers at Sanford experiment with different treatments to increase the replication rate of beta cells. The faster the beta cells replicate, the more insulin will be produced and the fewer injections a patient will potentially require.

**Move to pages 1.19--1.20.**

8. Pages 1.19 and 1.20 explain that Camille requires statistics to know how to tell if the data collected is reliable. You will review the concept of *MEAN* before moving into the *MEDIAN* and *IQR.*

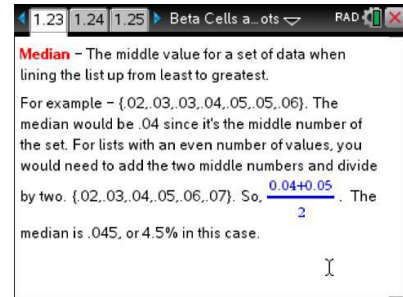**Move to pages 1.21 and 1.22.**

Answer questions here and/or in the .tns file.

Q3. What does the *mean* tell us about the data?

Q4. Find the *mean* for set {5, 11, 9, 10, 5}, using the calculator.

**Move to pages 1.23.**

9. Page 1.23 introduces the concept of *Median*, another statistical calculation that can be used to better interpret data.
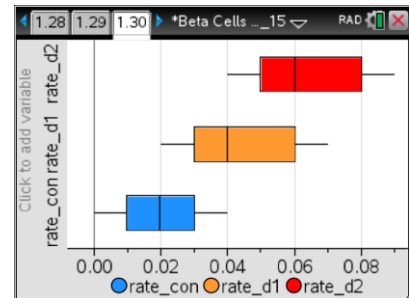
**Move to pages 1.24.**

Answer questions here and/or in the .tns file.

Q5. Which of the following is the *median* of the data set {5,11,9,10,5}?

A. 5
B. 9
C. 9.5
D. 10
E. 11

**Move to pages 1.25--1.30.**

10. Pages 1.25 through 1.30 take a look at the need for a large number of samples to rule out the potential for a random event. Because scientists conduct many trials (in the case of Dr. Savinov's lab, it's 500 of each treatment), they can look at the data sets with a high level of confidence. You are also introduced to the idea of the **box & whisker plot** as a way to visualize the spread of the data away from the median.

**Move to pages 1.31--1.32.**

Answer questions here or in the .tns file.

Q6. Based on the box & whisker plots, Drug 2 (rate_d2) typically showed a better replication rate than Drug 1 (rate_d1) or the control (rate_cont)?
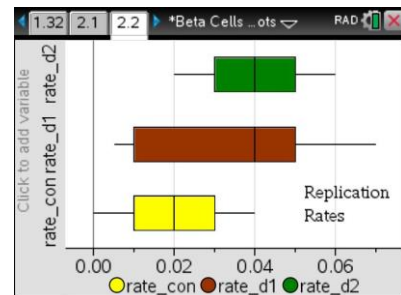
True
False

Q7.    What is the IQR for Drug 1?

    A.   From 0.03 to 0.05
    B.   0.02
    C.   0.065
    D.   An IQR doesn't exist for this treatment.

**Move to pages 2.1--2.2.**

11. Pages 2.1 to 2.2 present a scenario where you'll need to evaluate three box & whisker plots and determine which of the three treatments shows the most promising results and why you came to the conclusion you did.

**Move to pages 2.3—2.5.**

Answer questions here or in the .tns file.

Q8.    Which of the following treatments would you recommend?

    A.   Rate_con (control rate of replication)
    B.   Rate_d1 (Drug 1 rate of replication)
    C.   Rate_d2 (Drug 2 rate of replication)

Q9.    Why did you choose the treatment that you did?

Q10. With a partner, discuss and jot down some ideas about how research on Type 2 Diabetes would be different from the research that is being done by Sanford on Type 1 Diabetes?

**Move to page 2.6.**

12. This page concludes the activity with a reminder that both Katie Zucker and Camille Parker are fighting Type 1 Diabetes in two very different ways. A link to the Juvenile Diabetes Research Foundation is available for students to explore even more information about T1D.

Katie and Camille are both fighting against Type 1 Diabetes in different ways. Now that you have a better idea of what T1D is and what it isn't, maybe you can join the fight too! Check out more information at the Juvenile Diabetes Research Foundation at http://jdrf.org/about-jdrf/fact-sheets/type-1-diabetes-facts/