

Student Directions

UNIT: CHIKUNGUNYA

LESSON 4: MAKING THE CASE AGAINST CHIKV

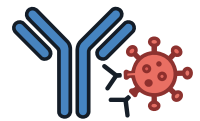
Activity 4B: Most Likely to Go Viral!



TEXAS BIOMEDICAL
RESEARCH INSTITUTE
HEALTH STARTS WITH SCIENCE

Your New Job!

You were recently hired by Texas Biomedical Research Institute (Texas Biomed) as a lab assistant. Scientists at Texas Biomed study pathogens which cause infectious diseases. The types of infectious pathogens studied are parasites, bacteria, and viruses.



You will work in a lab led by Dr. Guerrero, a virologist and immunologist who is currently studying and evaluating the development medical interventions against the Chikungunya virus (CHIKV). But you are not familiar with CHIKV! You learn that others have been newly hired as lab assistants for Dr. Guerrero's lab. Like you, they do not know much about CHIKV either! To prepare for your new position, you and the other lab assistants need to locate a recently published journal article about CHIKV authored by Dr. Guerrero and his lab staff:

Chikungunya: Silly Name, Serious Virus.

Prepping for the Job

Go to the Lab Supply Manager (your teacher) to get a copy of the article. Read through the article with your fellow lab assistants.

The article provides information, but there are some terms that you need to review. Use context clues from the article to define the following terms:

- › Pathogenesis (path-oh-JEN-eh-sis):
- › In vitro:
- › Murine:
- › Macrophage:
- › Multiplicity of Infection (MOI):
- › RNA replication:

After reading the article, you are asked to get the supplies needed for the first day on the job. But you are in luck! The Lab Supply Manager has the supplies you and your team of lab assistants need! Get the following from the Lab Supply Manager:

MIDDLE & HIGH SCHOOL LEVEL

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Materials

- › 3 Color Highlighters (Suggested colors: Pink, Yellow, Green)
- › Scissors
- › Glue
- › Calculator



Calculating Rate of Change

Working with your team of lab assistants, Dr. Guerrero has asked your team to compare the MOIs of human macrophages and murine macrophages. You will do this by looking at two graphs from the article, Figure 2 and Figure 3. Calculate the rate of change for each line at each time interval indicated on the data table. To calculate the rate of change, use the following formula:

$$\text{Rate of Change} = \frac{\Delta y}{\Delta x} = \frac{(y_2 - y_1)}{(x_2 - x_1)}$$

In addition to inside the article, Figure 2 and Figure 3 are located on page 5 of this activity.

Show set up for one example of a Human (RAW) rate of change calculation and one Murine (U937) rate of change calculation below:

The rate of change outcomes are data. Record the outcomes of each calculation in the Rate of Change table on page 4.

Data

Compare each MOI pair to identify which data set has the greatest, lowest, or no change in rate. To help with data analysis, use three colors to code each individual square in the data table. Create a key/legend below the Rate of Change table.

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Interpreting Data

As a lab assistant, you are responsible not only for collecting data but for interpreting the meaning of the data. As this is a comparative study between human and murine macrophages, the interpretations need to compare the differences between the two. You need to explain what the data means. In other words, what does a low rate of change indicate and what does a higher rate of change indicate? In a real situation, interpretations for every rate of change would be required. However, in this case, provide explanations for the three time-intervals listed below:

Time Interval	U937 High MOI vs. RAW High MOI	U937 Low MOI vs. RAW Low MOI
0-2 hrs		
2-6 hrs		
24-48 hrs		

Correlating Data to Pathogenesis Stages

Reminder: Pathogenesis is the process by which a pathogen, like CHIKV, leads to the development of disease. Obtain pathogenesis cards from the Lab Supply Manager. The cards which may need to be cut out. Follow Lab Supply Manager instructions.

Refer to the Rate of Change table as you and the other lab assistants read the pathogenesis cards. Based on the data outcomes, place the corresponding pathogenesis card next to the appropriate row in the table. Discuss justifications for each card placement with the other lab assistants. Once all agree, ask the Lab Supply Manager to confirm correct placements. Once approved, glue the cards in the appropriate block.

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Rate of Change: Human vs. Murine

Figure 2

Figure 3

Time Interval	 U937 High MOI	 RAW High MOI	 U937 Low MOI	 RAW Low MOI	Pathogenesis Stage
0–2 hrs					
2–6 hrs					
6–8 hrs					
8–16 hrs					
16–24 hrs					
24–48 hrs					

Rate of Change Key	Highest	Lowest	No Change

Cut out and place the Pathogenesis Stages cards on page 5 in the appropriate time intervals (on your table) to show the pathogenesis stage. Do not glue until after the teacher checks!

MIDDLE & HIGH SCHOOL LEVEL

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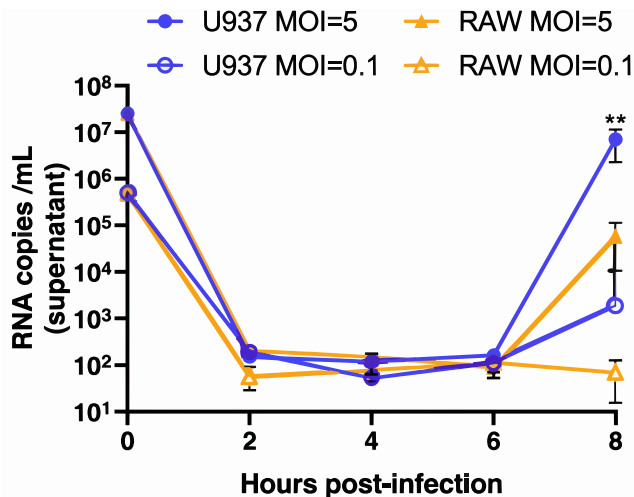


Figure 2: CHIKV replicates more efficiently in human macrophages than in murine macrophages. A) quantification of CHIKV RNA collected from 2 to 8 hours post infection (hpi).

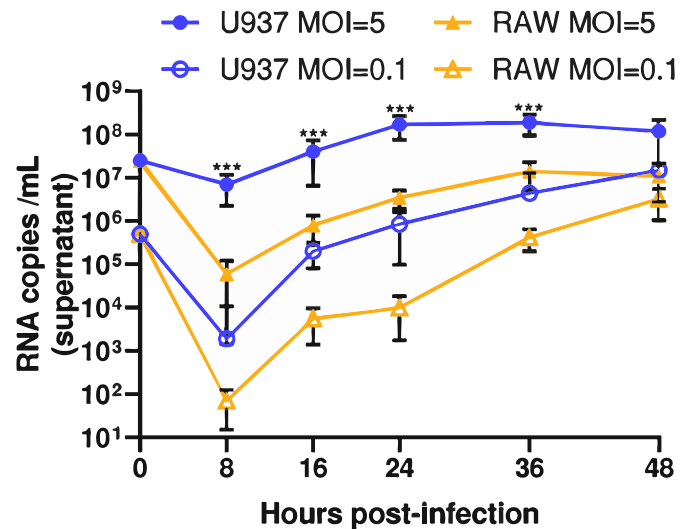


Figure 3: CHIKV replicates more efficiently in human macrophages than in murine macrophages. B) quantification of CHIKV RNA collected from 8 to 48 hours post infection (hpi).

Pathogenesis Stages

CHIKV continues to disseminate and overwhelm the body	CHIKV disseminates throughout the body	CHIKV enters the cells to evade detection and begins to replicate	CHIKV starts to run out of cells to infect	CHIKV enters the body and adheres to the body's cells.	CHIKV infected cells are numerous throughout the body and even less cells are available to infect
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cut line