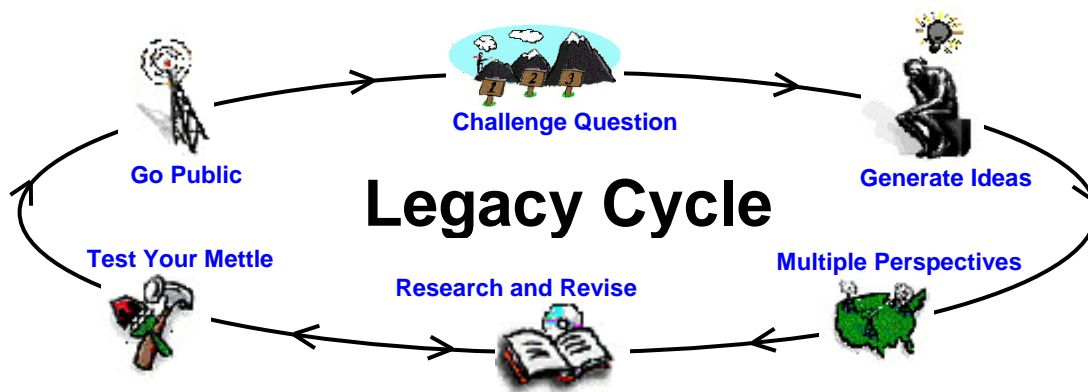


## The Legacy Cycle **Teacher Outline** for the **Feel Better Faster** Unit



**Challenge Question:** You don't feel very well, so your parents take you to see a doctor. The doctor suggests a generic antibiotic, and asks whether you would like to have the prescription filled in pill or liquid form, or he can give you a shot. Which delivery method should you choose? Is there anything else you can do to feel better more quickly?



**Generate Ideas:** Journal topics: What background knowledge do you think we need to know to answer this question? What do you already know from your own experience in taking medicines? What steps should we take to answer this question?



**Multiple Perspectives:** Watch a short video, in which an animation of medicine being introduced into the blood stream. Guide students to generate some more ideas. Did students begin to have a general knowledge of how medicine works on the cell? How does it move through the body? What else should we add to things that might be important to find out? Categorize suggestions and develop an action plan with students.



### **Research and Revise:**

Topic 1: How do antibiotics work?

Gain a general knowledge of how antibiotics kill bacteria in the body, making you feel better.

Topic 2: How does medicine get into your system?

Discuss the affects of receiving medicine in a pill or liquid form, vs. a shot. Discuss which method gets chemicals into a system more quickly. (Show demo of pills dissolving in vinegar.)

Topic 3: How can we test what works best? What are microfluidics and how do we use them?

Discuss engineering aspects of designing and creating microfluidic devices (show example devices). Inform students that they will create their own larger-scale model devices. Why is it important and helpful to do experiments on such a small scale?

Topic 4: How can we get the medicine to move more quickly through the body?

Study flow rate, and distribution of particles. (Introduce flow rate equations and practice examples. View microfluidics video.) How is flow rate increased/decreased? How can we increase/decrease flow rate in the body? (Assign a flow rate problems worksheet.)



**Test your Mettle:** Students create large-scale microfluidic devices using a gelatin (Jell-O) mixture. They test various flow rates and observe how particles are distributed. What happens when it is too slow or too fast? What implications does this have for medicine travelling through a person's blood stream?



**Go Public:** Students write individual statements explaining why they determined that it is best to receive a shot that goes directly in the blood stream. In order to reduce the time for medicine to take effect, they should increase their heart rates.

## Suggested Schedule for the Feel Better Faster Unit

The following schedule is the suggested unit timeline, based on 180 minutes total over two days.

DAY 1	
Lesson 1 (60 min)	Introduce the <i>challenge question</i> .
	Give students five minutes to independently write on paper their answers to the <i>generate ideas</i> questions. Call on students to each share one entry with the class.
	As a class, record all student-generated ideas and the associated needed knowledge.
	To gain <i>multiple perspectives</i> , watch three videos (total of five minutes).
	Moving to the <i>research and revise</i> stage, give students a few more minutes to think of any additional questions or information that they feel is necessary in order to answer the challenge question. Guide students to think about how medicine “flows” through the body. What would we need to learn about the flow?
	Review with students a brief history of antibiotics, and how they destroy bacteria.
Activity 1 (30 min)	Discuss how medicine gets into the blood stream. Conduct a short class demo on how long it takes for three types of pills to dissolve in the stomach. What does this imply about those in liquid form? What happens when you receive a shot? Students should now be able to determine what form of medicine to take (the shot). For homework, students think of three suggestions of how to make the medicine work more quickly.
Lesson 2 Activity 2 (45 min)	Introduce the concept of microfluidic devices and their uses. Moving to the <i>test your mettle</i> stage, students create their own large-scale model microfluidic devices using JELL-O. Leave molds in a refrigerator overnight to set.
DAY 2	
Activity 2 (25 min)	Students inject their devices with colored liquid and watch a short microfluidics video clip. What do they now notice about the particles? What is the most effective flow rate (slow, medium, fast)?
	Moving to the <i>go public</i> stage, students should be able to answer the challenge question. Conclude with a classroom discussion on what students think they could do to get medicine to work more quickly. Guide them to think about trying to move the cells more quickly through the body. In terms of the microfluidics device, what is happening as the size of the channel changes? Assign students to write short answers to questions.
Lesson 2 (20 min)	Introduce flow rate, and its basic equation. Solve several example flow rate problems. How would flow rate pertain to taking medicine? For homework, students complete solve flow rate problem provided on a worksheet.