Name:_____Date:_____Class:_____

Student Worksheet
(with answers)

Lab-on-a-Slab 1: What Makes a Good Channel?

Safety
Wear glasses while cutting wire and pouring agar.

Introduction:
Medical tests are used to diagnose many diseases. Until recently, each test required a separate sample from the patient, which often led to the collection of a large vial of blood so that many tests could be done. Modern techniques have shrunk tests to the point where multiple tests can be done automatically on a single drop of blood using a lab-on-a-chip. A lab-on-a-chip works by drawing liquid along channels by capillary action and mixes the fluid with chemicals that change color to give the results of the tests. In this lab, you will explore what makes a good capillary channel.

A lab-on–a-chip is a micro/nano sized device that can run several biochemical analyses (tests) at one time using very small samples. Nanotechnology is playing an important role in lab-on-the-chip development and production. The most common devices are found in medical diagnostics and the most familiar ones are home pregnancy tests, drug tests, glucose monitoring, and strept tests. These devices are becoming very important as we seek ways for early disease detection and hazardous materials detection (important for Homeland Security). This interest has created a large demand for the development of easy-to-handle and inexpensive lab-on-a-chip devices that can work quickly and reliably. So why is nanotechnology important to this? It has the ability to make small devices (microfluidic channels in the micro and nanoscale dimensions) on chips capable of analyzing very small quantities of materials.

Question: What type of channel will be the best capillary?

Make a Prediction

I think a narrow, deep, smooth channel will be a good capillary. _____

_____

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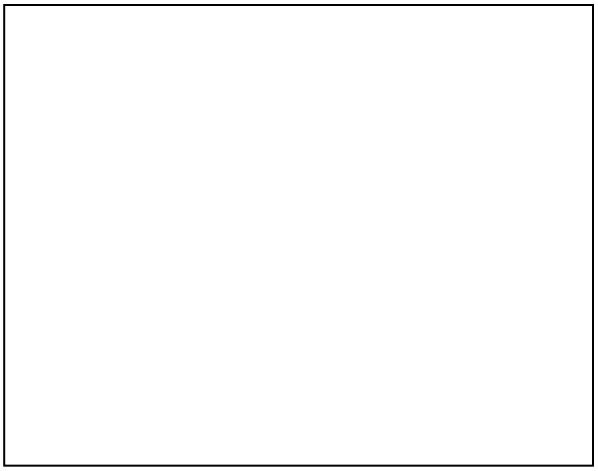
Procedure:

Materials
- various pieces of wire
- paper clip
- needle nose pliers
- toothpick
- popsicle stick
- wire cutters
- styrofoam plate
- permanent marker
- hot liquid agar
- tweezers
- piece of plastic wrap
- paper
- scissors
- 4 hole punch reinforcement rings
- plastic pipette
- cup of colored water
- stopwatch
- plastic knife
- paper towels

1. Choose various thicknesses of wire/sticks to form channels that you will test to see which has *good* capillary action.
2. Record the details of each wire/stick (which roll it came from, color, shape, etc.) in the table on the next page. Cut your wire/stick, shape it, and place in the bottom of a foam plate. Write an ID label next to each wire/stick with permanent marker.
3. Pour agar into the plate. Adjust the wires with tweezers if necessary. Cover with plastic wrap; put it in the refrigerator overnight.
4. Carefully remove the agar from the mold. Place it face/channel-side up on the plate, then use paper labels to mark which wire/stick is which. Using tweezers, carefully remove the wires/sticks.
5. Add a "hole-punch reinforcement" ring over one end of each of the channels to contain the drops of test liquid.
6. Test each channel using drops of colored water from a pipette. Put drop(s) at one end to see how each channel fills up by capillary action. If you need to retest a channel, blot the liquid with a paper towel. Record your results in the table.

Record Your Observations:

Draw and label a diagram of your plate with wires/sticks in:



	Description Examples	# Drops	Complete Fill?	Time to Fill (sec)
Channel 1	*Thickest wire, 16 gauge, dark copper color, very straight*	*4*	*yes*	*2.0*
Channel 2	*Medium wire, 20 gauge, light copper color, s-curved*	*2*	*yes*	*1.2*
Channel 3	*Toothpick, widest channel, wood, straight with pointy ends*	*5*	*no*	*4.4*
Channel 4	*Thinnest wire, 30 gauge, light copper color, wiggly*	*1*	*no*	*5*

Analyze the Results:

1. From your results, what capillary channels work well? How could you tell?

   The medium 20 gauge wire worked well because it filled fast and completely and didn't need much liquid.

2. Make notes on the class discussion of what seems to make a good capillary channel.

   Narrower channels wick well. Smooth channels fill completely. Deeper channels wick well. Triangular cross-section combine deep and very narrow and usually fill fast and completely.

Draw Conclusions:

What channel material will you use for your lab-on-a-slab? Justify your choice.

I will use the 20 gauge wire because it completely filled and didn't take much liquid. It was also easy to get it to lie flat.

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