

BIOLOGICAL FRAMEWORKS FOR ENGINEERS

Laboratory Experience #2

LAB ON CHIP FOR BLOOD TYPING

The purpose of this exercise is to familiarize you with microfluidics devices, antibodies, antigens, and genetic heredity pertaining to blood. We will use Micronics Inc.'s (Redmond, WA) *ABO Card*, to rapidly and conveniently identify a person's blood type. Volunteers will take a small drop of blood and load it into the *ABO Card* to identify what antigens are present on the surface of their red blood cells. Blood can harbor blood-borne pathogens, and so we MUST use universal precautions to prevent infection.

Micronics has a YouTube video of the card's operation which can be viewed at

<http://youtu.be/KFbcJRNNH2g>

Unfortunately, the operator should have been wearing gloves!

I. UNIVERSAL PRECAUTIONS

1. Medical history and examination cannot reliably identify whether someone is infected with HIV or other blood-borne pathogens. As such, all students and instructors will use precautions when handling blood. This approach, referred to as "Universal Precautions" has been recommended by the Center for Disease Control (CDC) and advises you to consider all blood as infectious. This laboratory experience has been reviewed and approved by UW's EH&S Research and Biological Safety Office.

2. Everyone participating in the laboratory will use appropriate barrier precautions to prevent skin and mucous-membrane exposure. These items are to be **worn at all times**.

- a. Nitrile gloves must be worn when handling blood or surfaces soiled with blood. Gloves should be changed after contact with blood.
- b. Surgical masks to prevent exposure to mouth and nose.
- c. Protective eyewear to prevent exposure to the eyes.

3. Hands and other skin surfaces should be washed immediately and thoroughly if contaminated with blood or other body fluids. Hands should be washed immediately after gloves are removed.

4. If there is a spill or splash that results in exposure to your mucous-membranes (eyes, nose, mouth), immediately flush the affected part thoroughly

with water for 15 minutes. The eyewash is located at the front of the classroom. You will proceed to Hall Health for exposure evaluation.

II. PREPPING THE ABO CARD

1. Prepare a dish with 10% bleach solution (1 part bleach + 9 parts water) to decontaminate and kill any infectious pathogens. Bleach is an eye hazard so wear safety glasses.
2. Remove the *ABO Card* from its packaging and place it on a clean surface of the lab bench. Dispose of the wrapping in regular trash.
3. Twist off BUFFER tube and pour into buffer hole.
4. Lift the card CAREFULLY and look underneath to identify if the pre-sample microchannels have been fully wetted with buffer solution. ****Keep the card level during this step. Do not tip it or incline the card or the buffer will leak into the mixing channels**
5. Inspect the backside of the card to verify that buffer has fully wetted the channels. You will see green, yellow, and blue channels containing the antibodies. A properly prepped ABO Card will have liquid in all three channels.

III. DRAWING BLOOD

1. The VOLUNTEER will use a UNISTIK 3 single-use safety lancet to pierce his or her skin. The needlepoint is hidden before use and automatically retracts after use to avoid accidental needlestick injuries and cross infection. The OPERATOR will draw the blood and run the card.
2. VOLUNTEER: wash one hand, dry it, and clean the skin of the ring finger with rubbing alcohol. Continue to wear a glove on the other hand.
4. Lay out an absorbent paper towel for your workspace.
5. Cut and layout a piece of lab tape (5 mm²) and second paper towel.
6. VOLUNTEER: twist off the protective sterile cap from the Unistik and firmly place it against the soft skin of the ring finger.
7. While the Unistik is against the finger, press on the back of the Unistik to inject the lancet blade. The single use needle will quickly stab the skin and the

lancet will retract immediately after sampling, leaving the device safe until disposal. Place the used Unistik into the sharps waste container at the front of the classroom.

9. Massage the finger to produce a large drop of blood at the finger tip. Keep the hand downward and below the level of your heart to get a good flow of blood. Be carefully to keep the blood on the finger tip. Keep your punctured hand over the paper cloth so that if a drop of blood falls, it will fall onto the towel and not onto the floor or bench.

10. OPERATOR: slowly draw up the blood sample into the pipette by holding the tip on the drop of blood. The blood will wick up the tube by capillary action.

11. OPERATOR: carefully transfer the blood sample into the BLOOD well of the ABO Card by first holding your fingers over the hole marked by the black lines. Place the tip of the pipette into the bottom of the well and then slowly press the dispensing bulb on the tip of the pipette.

12. VOLUNTEER: tightly grab the second paper towel with your punctured hand to stop the bleeding.

13. Clean the wound site with a disinfectant wipe. The UNISTIK incision is clean and smooth and the wound will quickly clot. Place an adhesive bandage over the wound site. Wear new gloves on both hands.

IV. OPERATING THE ABO CARD

1. Wait until a red color appears in all three VERIFICATION WINDOWS. Your blood has now filled the microchannels and is ready to be mixed with the antibodies in buffer to identify your blood type.

2. Lift the card carefully to check that the prechannels have been filled. **Keep the card level during this step. Do not tip it or incline the card or the blood and buffer will leak into the mixing channels.

3. Lay the card back down on a level surface.

4. Press down on the AIR PUMP button (P) with your left index finger and place your right index finger over the VENT hole (V).

5. While continuing to hold your finger over the VENT button, release the PUMP button to draw the blood-buffer solution into the serpentine channels to mix the blood with the antibodies.

6. When the blood-buffer solution enters into the RESULTS window, immediately remove your finger from the VENT hole.
7. Hold the card upright and compare the agglutination results in the RESULTS window with the results chart supplied by Micronics.
8. Place lab tape over the BLOOD well to seal it and to protect others from accidental blood exposure.

V. CLEAN UP

1. Dispose of the *ABO Card* into a biohazard waste container.
2. Spray the lab bench surface with bleach solution for 20 minutes to decontaminate. Wipe surface down with water and dry with paper towels.
3. Dispose of gloves and face masks if visibly contaminated into a biohazard container
4. Place safety glasses into storage box and put lab coats into laundry bag. If contaminated, clean with bleach spray
5. Wash hands thoroughly.