

Antigens and Antibodies

The functioning of the Immune System is based on the concept of self/non-self recognition. Almost every single one of our cells has a specific marker, or epitope, that says “me”. Pathogen invaders also have identifying markers. B-cells “recognize” these markers, or antigens, and create antibodies that bind with them, inactivating the pathogen and making it a target for phagocytes or killer cells.

In this activity, students match antibodies to antigens. Then a roving Macrophage “eats up” the bound antigen-antibody complex.

Materials:

Cardboard templates for antibodies and antigens

Several colors of railroad board or tagboard

Scissors

Plastic garbage bag

To Do and Notice:

Divide students into two groups—antigens and antibodies.

One group cuts Y-shaped antibodies out of one color. Notice that there are different shaped receptors at the ends of the Y, although the rest of the shape is the same from one to the other.

The other group cuts antigens out of different colors. The protruding shape is the epitope, or marker that the B-cell will recognize on the antigen.

Each student should have at least 2 antigens or antibodies.

Students who are antigens go around classroom holding up their shapes. When an antibody recognizes a shape, he/she binds with it, and that antigen is out of business.

Some of the “fits” are better than others. This happens. B-cells clone rapidly, making the antigen/antibody fit more precise as time goes on.

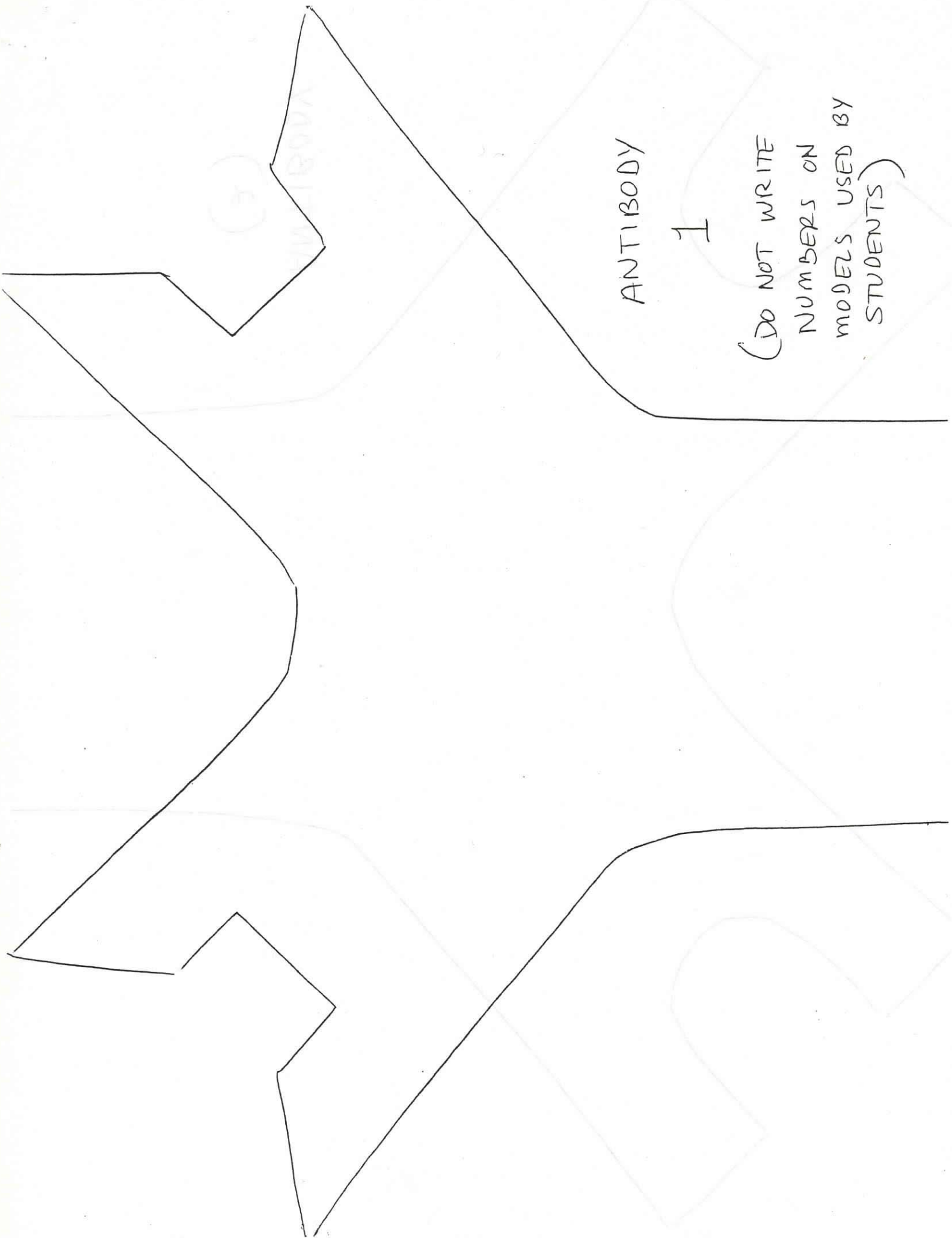
Some antibodies will bind with two antigens at their two receptor ends, and these antigens may also be bound by other antibodies at other marker sites on the antigen. This creates a “chain” or agglutination of antibody/antigen.

Phagocytes are attracted to these agglutinations and engulf them. (A student with the garbage bag acts as a phagocyte and gathers up the antigen/antibody complexes.)

What’s Going On?

This exercise is somewhat simplified. For the body to mount an immune response, B-cells must recognize an antigen that they have an antibody for, hook up with it, and “present” it to a T-cell. The T-cell then instructs the B-cell to become an antibody factory, churning out millions of copies of that specific shape. The immune system can produce millions of different antibodies,

although there are only a few B-cells for each specific one. That is why the T-cell must activate the appropriate B-cell to clone itself and start mass-producing antibody. A few B-cells do not become factories, but retain the memory of that specific antigen for the next time it may invade.



ANTIBODY

1

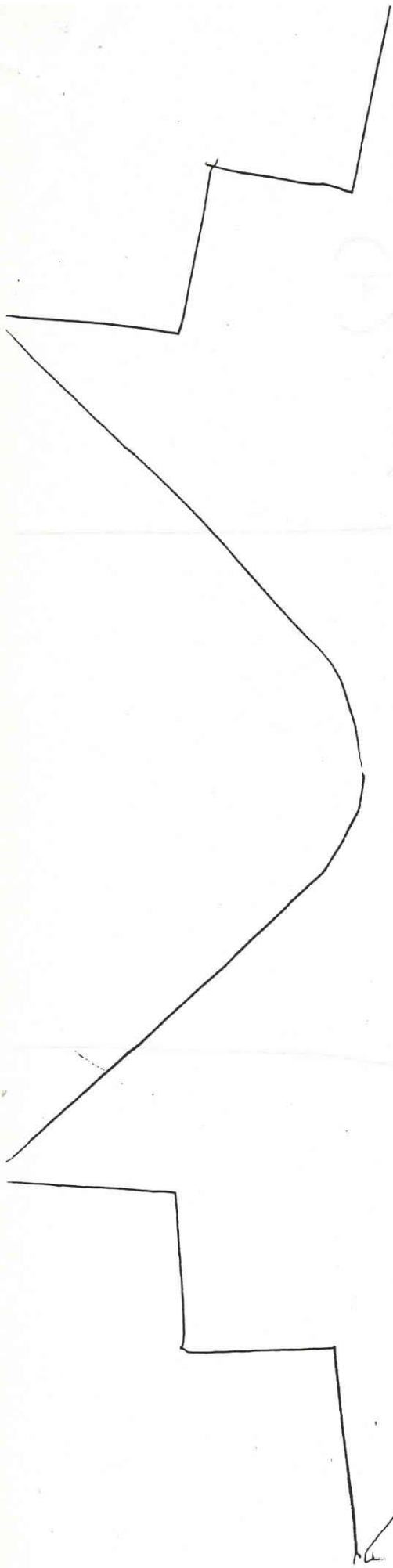
(DO NOT WRITE
NUMBERS ON
MODELS USED BY
STUDENTS)



ANTIBODY
(2)

ANTIBODY

2 HAVES
AND 2 LIGHT CHAINS
DO NOT WRITE



(4)

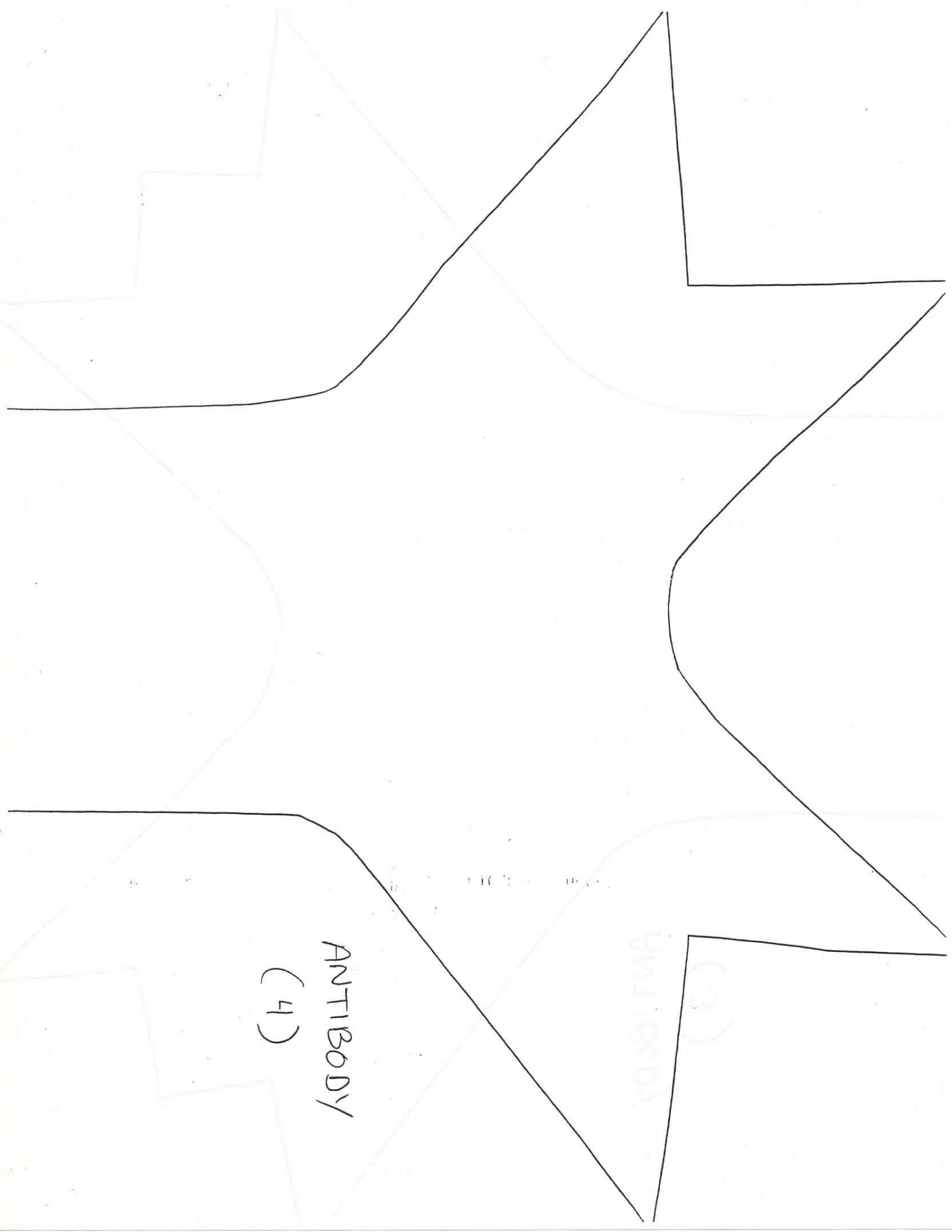
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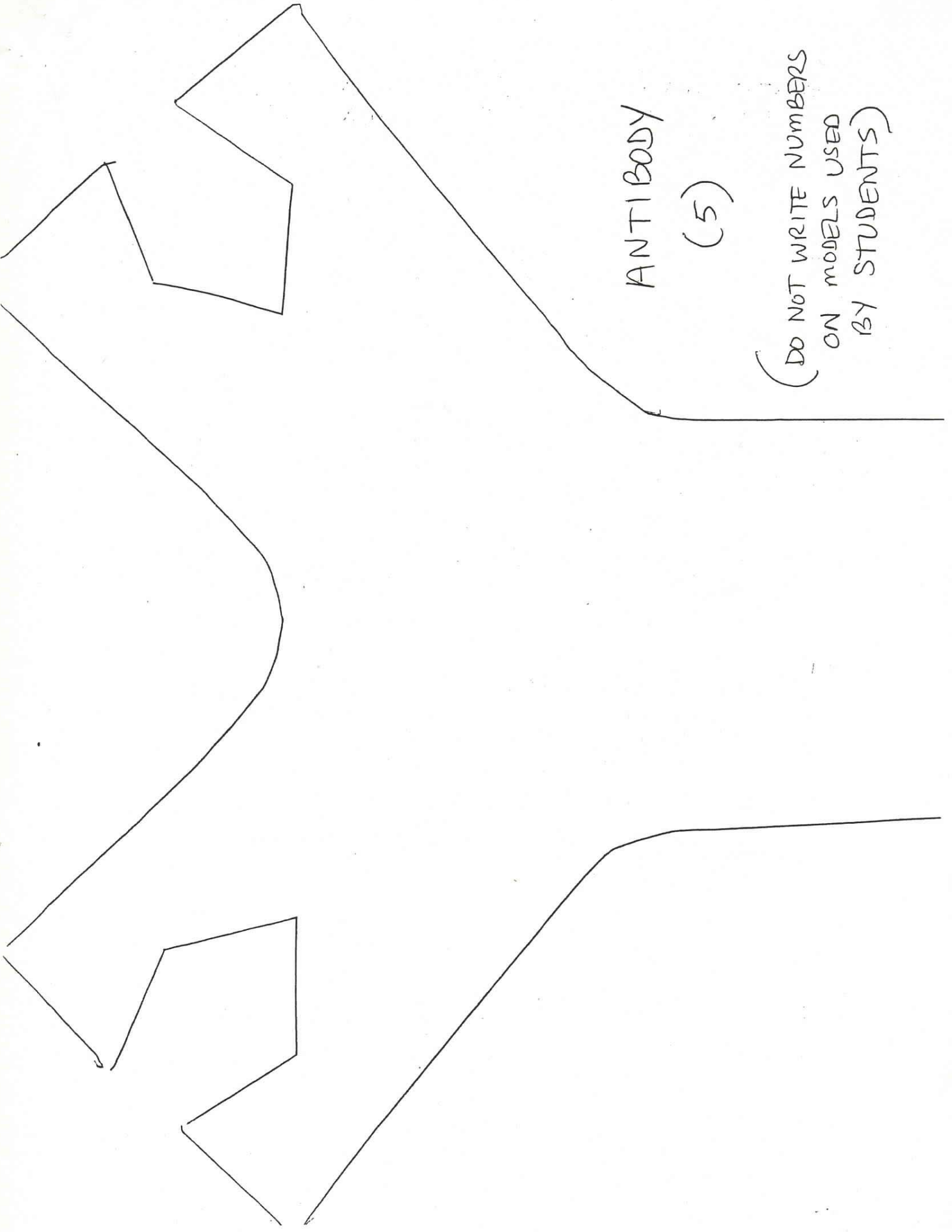
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ANTIBODY

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(DO NOT WRITE NUMBERS
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BY STUDENTS)

ANTIGENS 1-3

marker ↘

marker →

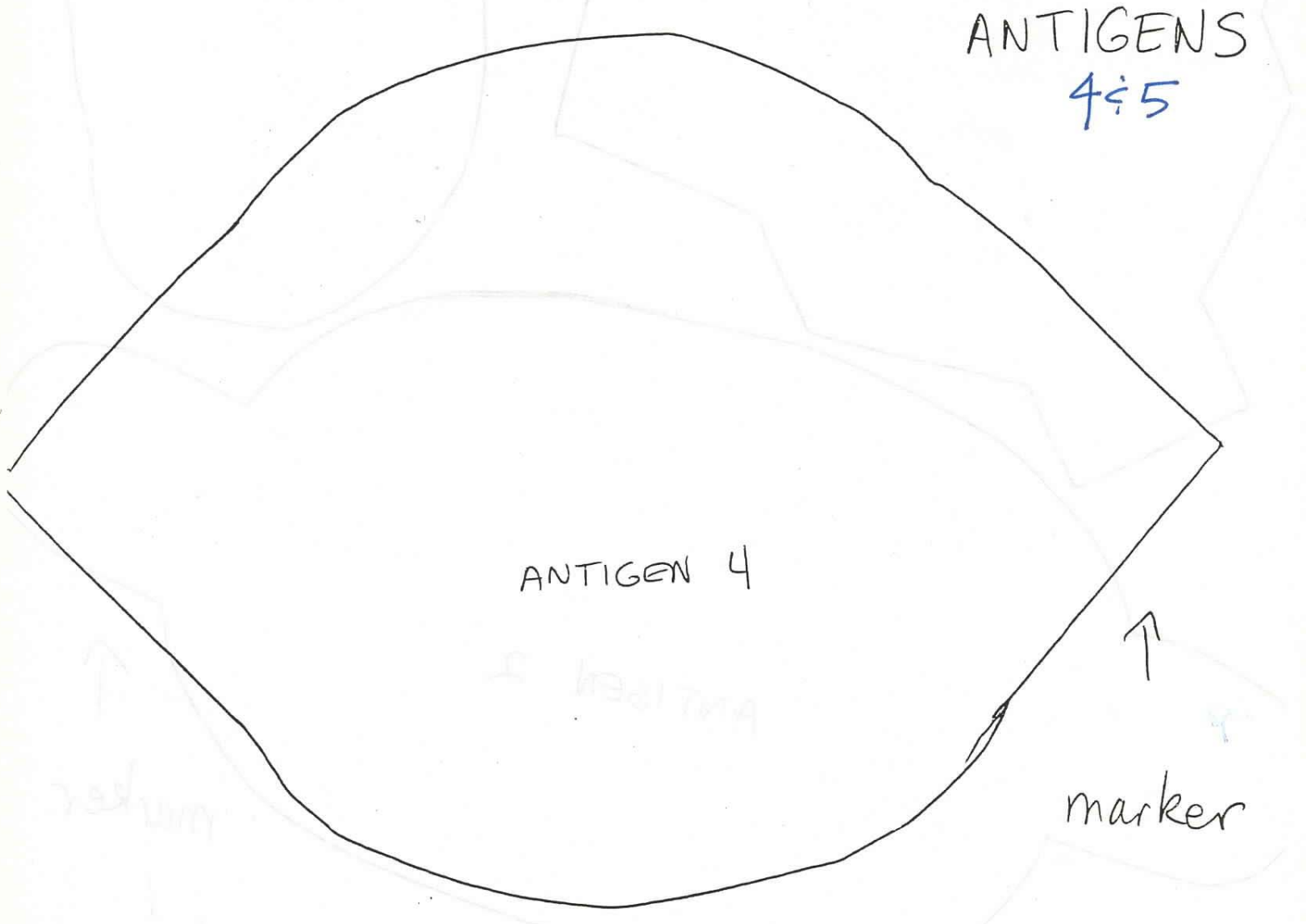
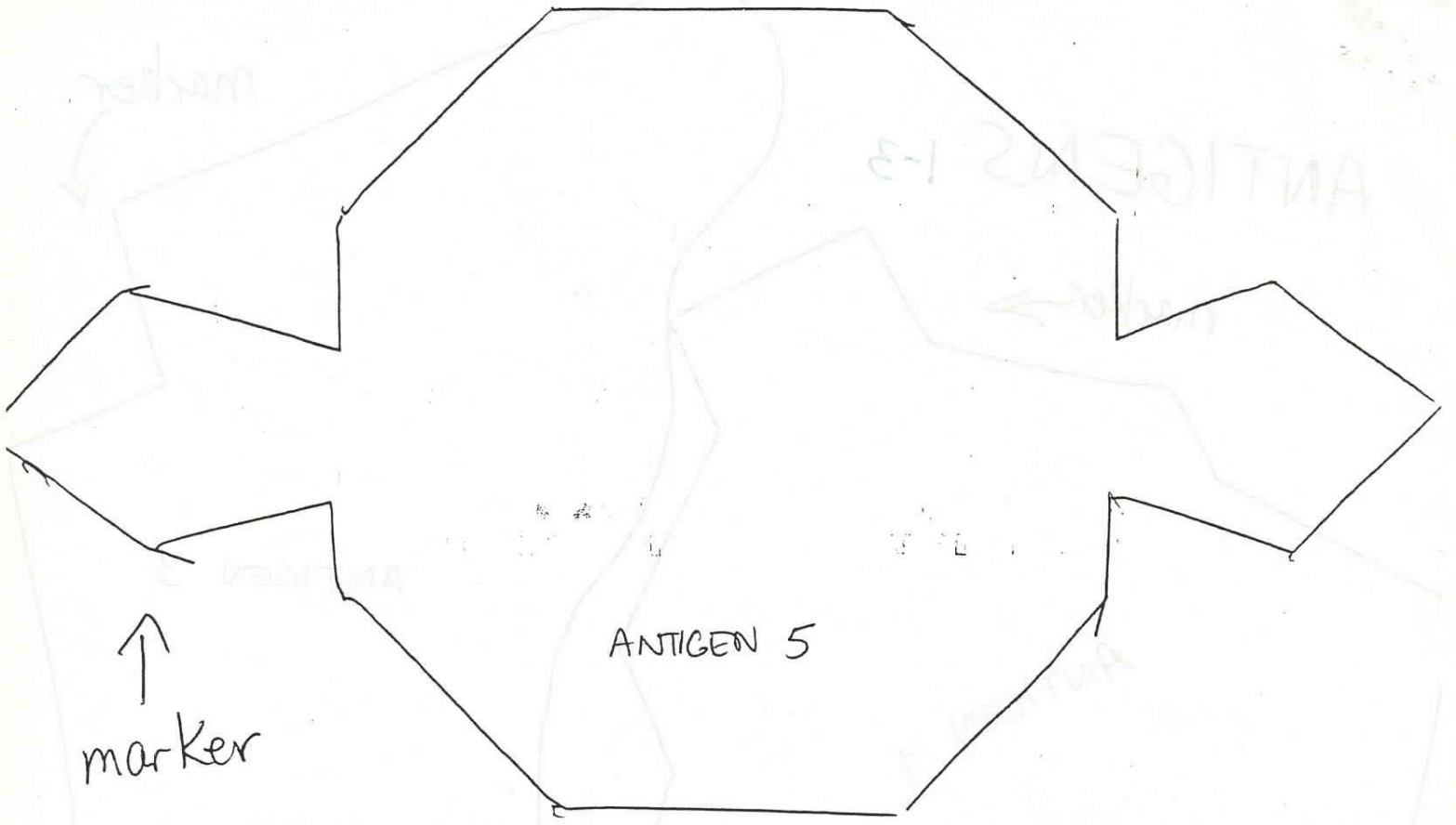
ANTIGEN 1

ANTIGEN 3

ANTIGEN 2

↑
marker





ANTIGENS
4:5