These models use 11 different MHC binding pockets, and 11 different peptide antigens. Each binding pocket has one peptide antigen that is an exact shape match – these MHC binding pockets and peptide antigens use the same numerical code.

In addition, some MHC binding pockets have additional peptide antigens that fit well: they can be fully inserted into the binding pocket, and make at least some contact with the sides and bottom of the binding pocket. These include 3D shapes (e.g., 3D pentagon) that also fit within the binding pocket of the corresponding non-3D shape (e.g., pentagon), as well as the triangle (which fits within the binding pocket of the 6- and 9-pointed stars, and the square, which fits within the binding pocket of the 8-pointed star.

Students will find that there are also some peptide antigens that they can fit within a non-matching MHC binding pocket, but either the antigen cannot be pushed all the way in so that it contacts the bottom of the binding pocket (e.g, the circle antigen with the sphere binding pocket), or the antigen can be inserted fully into the binding pocket, but does not make good contact with the sides of the binding pocket (e.g., the 3D hexagon antigen with the pentagon binding pocket). It is at the instructor’s discretion to decide whether to “count” any antigen able to fit in the binding pocket as a true interaction, or to specify that the antigen must make contact with all surfaces of the binding pocket to “count”. This decision will impact the outcome of the “outbreak” simulations described in the activity accompanying these models: if looser interactions are allowed to “count”, more individuals will survive each outbreak.

The tables below list the shape and color of each MHC binding pocket along with the antigens each binding pocket is able to accommodate (Table 1), and the shapes and colors of each antigen (Table 2). In addition, a photo of the painted antigens is included to illustrate the patterns used for the multi-colored antigens.

The file names of each MHC array STL file indicate the three MHC binding pockets present in that array: for example, mhc\_1a6b3c contains 1a (red circle), 6b (yellow hexagon), and 3c (light purple triangle). The file names for each peptide antigen STL file list the individual antigen contained in that file: for example, 1a contains only the red circle antigen.

If using a LulzBot Mini 2 3D printer, 4 MHC arrays can be printed at once on a single build plate, while more than 20 antigens can be printed at once on a single build plate.

One of each peptide antigen and one MHC array are needed per student. Table 3 includes a suggested number of each MHC array to print (based on a 50-student class) to ensure that the number of students surviving decreases with each outbreak, but enough students survive the first two outbreaks to continue through the activity.

| **Code** | **Binding Pocket Shape** | **Binding Pocket Color** | **Antigens able to fit and make contact with sides and bottom of binding pocket** | **Antigens able to fit in binding pocket, but not make full contact with binding pocket** |
| --- | --- | --- | --- | --- |
| 1a | Circle | Red | 1a (red circle)  0a (dark blue sphere) |  |
| 0a | Sphere | Dark Blue | 0a (dark blue sphere) | 1a (red circle) |
| 5b | Pentagon | Green | 5b (green pentagon)  05b (black and green 3D pentagon) | 06b (yellow and white 3D hexagon) |
| 6b | Hexagon | Yellow | 6b (yellow hexagon)  06b (yellow and white 3D hexagon) |  |
| 05b | 3D pentagon | Black | 05b (black and green 3D pentagon) | 5b (green pentagon) |
| 06b | 3D hexagon | White | 06b (white and yellow 3D hexagon) | 6b (yellow hexagon) |
| 3c | Triangle | Light Purple | 3c (pink, purple, and light purple triangle) |  |
| 4c | Square | Orange | 4c (orange square) |  |
| 6c | 6-pointed star | Purple | 6c (purple 6-pointed star)  3c (pink, purple, and light purple triangle) |  |
| 8c | 8-pointed star | Light Blue | 8c (light blue 8-pointed star)  4c (orange square) |  |
| 9c | 9-pointed star | Pink | 9c (pink 9-pointed star)  3c (pink, purple, and light purple triangle) |  |

**Table 1.** Shape and color of each MHC binding pocket, and list of peptide antigens able to bind each binding pocket.

| **Code** | **Antigen Pocket Shape** | **Antigen Color** |
| --- | --- | --- |
| 1a | Circle | Red |
| 0a | Sphere | Dark Blue |
| 5b | Pentagon | Green |
| 6b | Hexagon | Yellow |
| 05b | 3D pentagon | Black/Green |
| 06b | 3D hexagon | White/Yellow |
| 3c | Triangle | Light Purple, Purple, Pink |
| 4c | Square | Orange |
| 6c | 6-pointed star | Purple |
| 8c | 8-pointed star | Light Blue |
| 9c | 9-pointed star | Pink |

**Table 2.** Shapes and colors of peptide antigens.

| MHC STL File | Number to print |
| --- | --- |
| mhc\_1a6b3c | 1 |
| mhc\_1a6b6c | 2 |
| mhc\_1a6b9c | 4 |
| mhc\_1a5b4c | 1 |
| mhc\_1a5b6c | 2 |
| mhc\_1a5b8c | 7 |
| mhc\_1a06b3c | 1 |
| mhc\_1a06b6c | 1 |
| mhc\_1a06b9c | 2 |
| mhc\_1a05b4c | 1 |
| mhc\_1a05b6c | 2 |
| mhc\_1a05b8c | 2 |
| mhc\_0a6b3c | 3 |
| mhc\_0a6b6c | 2 |
| mhc\_0a6b9c | 1 |
| mhc\_0a5b4c | 1 |
| mhc\_0a5b6c | 1 |
| mhc\_0a5b8c | 1 |
| mhc\_0a06b3c | 2 |
| mhc\_0a06b6c | 4 |
| mhc\_0a06b9c | 4 |
| mhc\_0a05b4c | 1 |
| mhc\_0a05b6c | 2 |
| mhc\_0a05b8c | 2 |

**Table 3.** Suggested numbers of each MHC array to print for a 50-student class.



Photo of painted peptide antigens.