BB101: 2023 Autumn semester

Quiz #4: Each correct answer is worth 1 mark. You will not be getting any partial marks so think and answer carefully. You must answer only within the space provided. Time for taking this quiz is 15 minutes.

You want to figure out whether spike protein is the "best" antigen for vaccination. You take three SARS CoV2 proteins found on the surface: spike protein (S), nucleocapsid protein (N) and membrane protein (M). You make large quantities of these proteins by expressing them in bacteria (*E. coli*).

Qs. 1. If you introduce only the Open Reading Frames (ORFs) of the genes into the bacteria, will the proteins get expressed? Circle the correct answer.

Yes

No

Next, you take B cells from human donors and add each of the three proteins to the B cells. You measure antibody concentrations obtained after treatment with each antigen. You find that the spike protein gives the best response.

Qs. 2. What could be the reason for spike protein giving the best B cell response (circle all possible correct answers)?

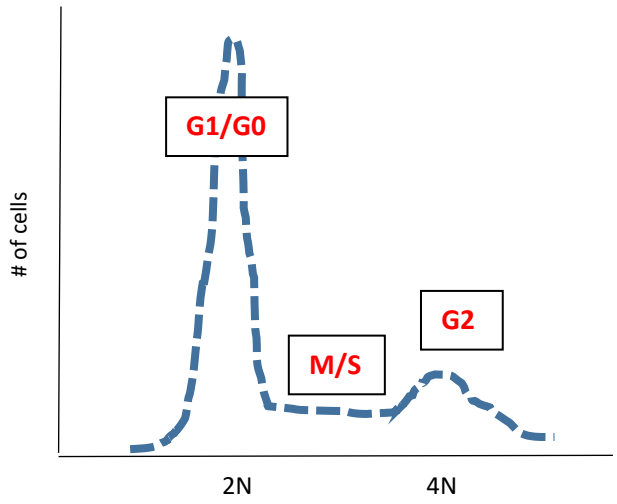
a) Epitopes on the spike protein give very strong binding to the antigen receptors on B cells

b) Proliferation of B cells is less after treatment with spike protein

c) B cells do not recognize the epitopes on the N and M proteins strongly

d) Interaction of spike protein leads to death of B cells

Qs. 3. You also study the phase of the cell cycle of T cells. On the diagram below label the different phases of the cell cycle in the dividing cell population.



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Qs. 4. Based on your discussion in the tutorial, which stage of the cell cycle are T cells found before exposure to antigen?

T cells are found in G0 stage before exposure to antigen. We saw this because all cells were in the stage having 4N DNA content. It is not likely that cells will be stuck in the G1 phase and very likely that they have exited the cell cycle and are in G0.

Qs. 5. Remember the story of the brothers where the younger brother gave his umbilical cord stem cells to his older brother, who had his own blood cells killed by chemotherapy/radiation. If we take the blood cells of the elder brother after stem cell treatment and sequence the genome of these cells, what will be the genome?

a) Elder brother's genome
b) Younger brother's genome
c) A mix of the two brother's genome
d) Parent's genomes

NOTE: Last year, a student emailed me with articles showing that the killing of the recipient's blood cells may not be complete. Therefore, it is a possibility that the genome sequence of the blood of the older brother could be a mix of the two brothers' genomes. You may give full marks to anyone who circled option (c) also. Correct answers are either option (b) or (c), or both.

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