

## Data Analysis: How do membrane proteins move?

Necessary background knowledge:

- 1) Fluid mosaic model of the cell (Question #10 Lecture and Inner Life of the Cell activity)
- 2) Diffusion and what affects the rate of diffusion (Question #11 Lecture and What Makes a Valid Justification Lesson)
- 3) Role of ATP (Question #5 Lecture)
- 4) Mean, range

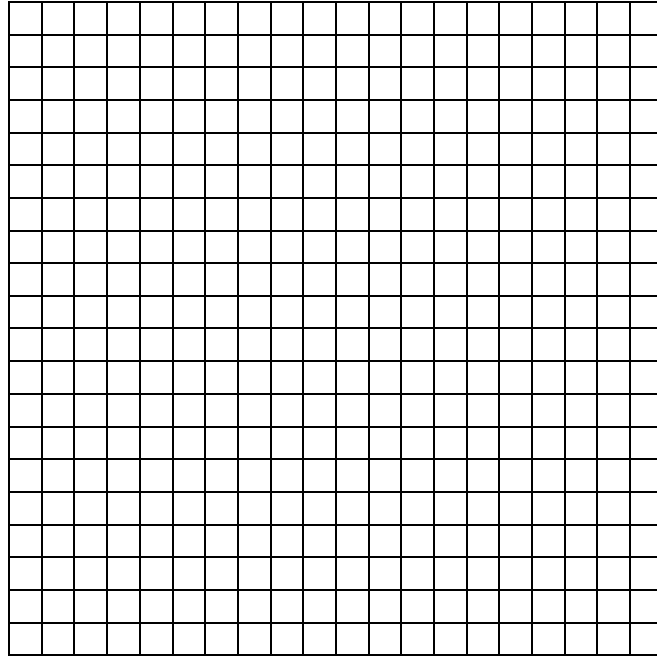
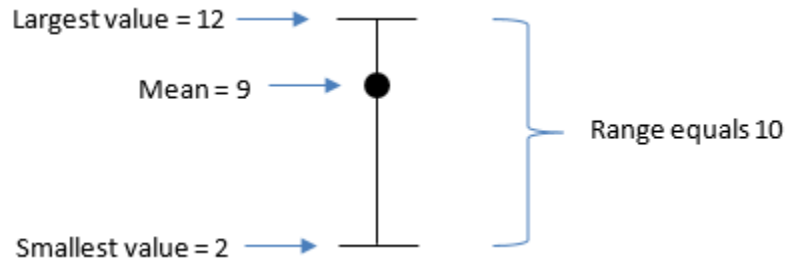
Frye and Edidin used an elegant technique to obtain evidence for the fluid nature of membranes. They attached fluorescent markers to membrane proteins – green markers to mouse cells and red markers to human cells. In both cases, spherical cells growing in tissue culture were used. The marked mouse and human cells were then fused together. At first, the fused cells had one green hemisphere and one red one, but over the minutes following fusion, the red and green markers gradually merged, until they were completely mixed throughout the whole of the cell membrane. Blocking of ATP production did not prevent this mixing (ATP supplies energy for active processes in the cell).

- 1) Illustrate the experiment with 3 drawings. The first should show 2 cells that are not fused. The second should show 2 fused cells with minimal mixing. The third should show a cell with complete mixing. Use a different color for each cell type.

- 2) Calculate the mean percentage of cells with markers fully mixed for each time after fusion and enter in the table to the right. Show your work!

Time after fusion / minutes	Cells with markers fully mixed/%				
	Result 1	Result 2	Result 3	Result 4	Mean
5	0	0	–	–	
10	3	0	–	–	
25	40	54	–	–	
40	87	88	93	100	
120	100	–	–	–	

- 3) Plot a graph of the results, including range bars for times where there was variation in the results. To do this you plot the highest and lowest results with a small bar and join these bars with a ruled line. This will lie on the range bar.



- 4) Describe the trend shown by the graph. Use specific numbers in your explanation.
- 5) Explain the benefit of plotting range bars on graphs.
- 6) During this experiment the cells were incubated at 37°C. Suggest a reason for the researchers choosing this temperature.

7) Circle how the membrane proteins mixed?

Active transport, Diffusion, Passive transport (osmosis), Passive transport (facilitated diffusion)

8) Justify your answer to the question above. Justifications have 3 components: 1) theory or established knowledge, 2) data from analysis related to the theory or knowledge, and 3) an explanation of the HOW the data supports the theory or knowledge.

9) Predict the results of the experiment if it had been conducted at 40°C. Sketch a graph showing both experiments. Use a different color for the 2 treatments.

10) Justify your prediction and graph. Justifications have 3 components: 1) theory or established knowledge, 2) data related to the theory or knowledge, and 3) an explanation of the HOW the data supports the theory or knowledge.