

2015 Sample exam questions. (The usable examples from the ones you wrote)

### SAQs

In order to understand the mechanisms of enhancers activating transcription sites at a distance, molecular biologists proposed three theories; walking, looping and twisting. Describe the experiments that led to the rejection of two of these theories.

Wolpert's French Flag model requires one or more genes to be activated at moderate levels of morphogen, but not very high or very low levels, to make the middle stripe of the flag. Describe (/draw) a gene network that can achieve activation of a reporter gene at moderate but not at high or very low levels of input signal.

What is hysteresis? Give (/draw) an example of a signalling network that displays hysteresis, and explain how the hysteresis arises in this network.

What is transcriptional interference and how does it work?

### LAQs

Compared to the number of genes in a cell there are very few differentiated cell types. How might Kaufman's N/K Boolean network model explain this?

How are positive feedback and negative feedback used (not necessarily at the same time) by developing embryos?

How do embryos make patterns at scales larger than the typical scales of morphogen gradients?

How do embryos develop accurately despite being made of error-prone biochemical components?

How can a homogenous cell population become heterogenous?

How reasonable is it to regard some transcription factors as master regulators of cell differentiation?