NTNU
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Department of Biology

Examination paper for Bi3016 Molecular Cell Biology

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Informasjon om trykking av eksamensoppgave

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Question 1

Genes in eukaryotic cells have complex regulatory mechanisms and many genes display very specific expression, both temporal and spatial.

a. Describe the most common ways a cell uses to control gene expression and explain the functions of the major players. (70%)

b. Explain what we mean by transcription circuits, and describe the most common network motifs we find in transcription circuits and how they operate. (30 %)

Question 2

Enzyme coupled receptors are transmembrane proteins that relay a multitude of signals to the cell.

a. Describe the general structure of a receptor tyrosine kinase (RTK). Explain how they are activated and how they mediate signaling. Use examples from the curriculum in the lecture book. (40 %)

b. What are the advantages of using scaffold proteins during signaling? (20 %)

c. Cytokine receptors are crucial for mediating signal from interferons and hormones. Describe the JAK-STAT signaling pathway and explain how the signaling can be turned off. (20 %)

d. Ethylene is an important plant growth regulator. Explain how ethylene can induce gene expression in plants. (20 %)

Question 3

a. Describe the various phases of the cell cycle and explain briefly what processes take place during the different stages.

b. What are the functions of the cyclins – Cdks and how are they regulated?

c. Describe the different stages of the M phase (mitosis and cytokinesis) and explain how the M-Cdk is activated.

Question 4

Cell-cell anchoring junctions play an important role during embryo development, govern the architecture of the body, and determine its shape and strength.

a. Describe the two types of anchoring cell-cell junctions we find in animal cells.
b. In mammals cadherins constitute a large and diverse protein family. Describe the structure of a classical cadherin and explain how the mediate cell-cell interactions.
c. Explain how cadherins can mediate tissue remodeling and describe how they can orchestrate the formation of the neural tube during early vertebrate development.

Question 5

Define / explain 4 of the 5 the following words and terminologies and give a short description of their function, max 200 words.

a. G-protein coupled receptor (GPCR)
b. Integrin
c. Retinoblastoma protein
d. Egg polarity gene
e. Morphogen

Use figures where appropriate to explain your answers, (questions 1-5).