NTNU
Det skapende universitet

Department of Biology

Examination in Bi3016 Molecular Cell Biology

Contact person during exam:
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Date: 25. May 2016
Number of hours: 4
Permitted aids: none

All of the five main questions count as equal (20%).
Each question (1-5) must be started on a new page.

Language: English
Total number of pages: 3 (including cover page)
Attachments: 0

Kontrollert av:

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Dato Sign

NOTICE THAT THE QUESTIONS 1-5 ARE WEIGHTED EQUALLY (20 %), BUT SINGLE QUESTIONS MIGHT BE WEIGHTED DIFFERENTLY (INDICATED IN %). IF NO WEIGHTING IS GIVEN THE SUB-QUESTIONS ARE WEIGTHED EQUALLY.
PLEASE START ANSWERING EACH QUESTION (1-5) ON A NEW SHEET OF PAPER.

Question 1

Transcription factors bind specific recognition sites in DNA and regulate gene expression.

a. How does a transcription factor interact and recognize a binding site in a DNA strand?

b. Explain how transcription factors specificity and affinity to DNA can be increased. How can this also increase the number of potential binding sites for the transcription factor?

c. How does the nucleosome structure affect the binding of transcription factors? How does DNA become accessible for the general transcription factors and the RNA polymerase?

Question 2.

G-protein coupled receptors constitute the largest family of plasma membrane receptors in humans and mediate signals from various extracellular stimuli.

a. Describe how G-protein coupled receptors can mediate signals via phospholipids localized in the plasma membrane.

b. Explain how changes in Ca^{2+} concentration inside a cell contribute to regulation of enzyme activity and protein function.

c. Explain how Ca^{2+} levels in cells are regulated and describe how positive and negative feedback can produce waves of Ca^{2+} ions that spread across the cytosol.

Question 3.

a. Explain how receptor tyrosine kinases activate the Ras GTPase and how this can affect gene expression (40%)

b. Genetic analyses of colorectal carcinoma have identified mutations in Ras and other oncogenes / tumor suppressor genes. Describe how these mutations and other genetic changes contribute to the development of colorectal carcinoma and explain what signaling pathways and processes they are connected to. (60%)

Question 4.

Programmed cell death, apoptosis, is an important process during the development of multicellular organisms and it regulate the size and shape of organs and limbs.

a. Explain the principle behind apoptosis and how extracellular signals can induce programmed cell death.

b. Extracellular signals can also prevent cell undergoing apoptosis through survival factors. Describe two ways survival factors inhibits apoptosis.

c. Explain how DNA damage can induce apoptosis.

Question 5.

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

a. RNA editing

b. GTPase activating protein (GAP)

c. Cancer stem cell

d. Integrin

e. Cohesin

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