

**Department of Biology**

## **Examination in Bi3016      Cell and molecular biology**

**Contact person during exam:**

**Assistant professor Per Winge**

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**Date: 26. May 2015**

**Number of hours: 4**

**Permitted aids: none**

**All of the four main questions count as equal (25%).**

**Each question (1-4) 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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NOTICE THAT QUESTIONS 1, 2, 3, AND 4 ARE WEIGHTED EQUALLY, (25% each).  
PLEASE START ANSWERING EACH QUESTION (1, 2, 3, and 4) ON A NEW SHEET OF PAPER.

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### Question 1

Gene regulation in eukaryote cells is more complex than what we observe in bacteria and can involve a number of different DNA binding proteins and other gene regulatory proteins.

- a. Describe the structural organization of the control region of a eukaryotic gene, including the promoter, and name the most important classes of proteins that interact with it and how they participate in regulating gene expression.
- b. Explain how the chromatin structure is involved in regulating gene expression, locally and globally. What function have the histones and what do we mean with the term "histon code"?
- c. Explain and describe the molecular mechanisms that lay behind the phenomenon known as "genomic imprinting".

### Question 2.

Many intracellular signal proteins operate as molecular switches that are activated by binding of the nucleotide GTP.

- a. Describe the two main types of GTPases that are linked to signal transduction from the plasma membrane and explain how they are regulated. Mention some of the cellular processes that they regulate.
- b. What are the similarities and differences between the reactions that lead to the activation of G proteins and those that lead to the activation of Ras?
- c. Describe a general structure of an enzyme linked plasma membrane receptor and explain how tyrosine kinases can activate intracellular signaling pathways.

### **Question 3.**

After replication of the genomic DNA in the S phase and transition through the G<sub>2</sub> phase the cell initiate mitosis.

- a. Describe the different stages of the mitosis and explain some of the control mechanisms that regulate proper progression of mitosis.
- b. What type of function has the kinetochore during mitosis and which processes are regulated by the APC/C?
- c. Explain how DNA damage can block cell division. What happens if the DNA damage is severe?

### **Question 4.**

In multicellular animals or plants there is a continuous exchange of “information” between neighboring cells and the cells probes the local environment for clues that determine many of their functions/activities.

- a. What are the functions of GAP junctions in animal cells and plasmodesmata in plants? Describe how they are constructed and what similarities and differences that exist between these two structures.
- b. What function have integrins in animal cells; describe their structure, how they are regulated / switches from an inactive to active conformation, and what processes they participate in.

**Use figures where appropriate to explain your answers, (questions 1-4).**