UNIVERSITETET I OSLO

Det matematisk-naturvitenskapelige fakultet

Exam in: MBV4230 and MBV9230 Eukaryotic transcription factors – structures, function, regulation
Day of exam: Friday 6 Nov 2015
Exam hours: 10:00 – 13:00
This examination paper consists of two pages.
Permitted materials: None

Make sure that your copy of this examination paper is complete before answering.

All questions are given in English, but you may choose yourself in which language (Norwegian or English) you prefer to answer. For all questions, you are supposed to provide brief and concise answers with the key information given, not to write elaborate and long explanations.

I

Regulated genes will generally be under the influence of one or several enhancers.

1. What are the characteristic features of an enhancer, how would you define an enhancer?
2. Enhancers often act at a distance from the promoter, implying long-distance physical contacts between enhancers and promoters. Explain our current understanding of how DNA-loops are formed to create such contacts.
3. Enhancers are often marked by specific histone modifications, or show other epigenetic features, creating a typical signature. Describe briefly this signature and name the enzymes responsible for the modifications.
4. What distinguish superenhancers from normal enhancers?
5. Many enhancers have been found to produce specific RNAs (eRNAs). What characterize these eRNAs?

II

Below is given the names of a few proteins found in different nuclear complexes. Each of these contains a specific domain as indicated. For each example, explain briefly what these domains bind to when they act as "readers" of specific histone modifications or other epigenetic marks. State also very briefly (no more than three phrases) the functional role of the complex in which the protein is a part.

1. TAF3 which contains a PHD finger
2. MLL1 which contains a CXXC domain
3. CHD4 which contains two chromo domains
4. BRD4 which contains two bromo domains

III

Zinc finger proteins constitute a large family of proteins, many of which act as transcription factors. Describe briefly two main subclasses of zinc fingers and explain how they are structured and how they interact with DNA.

IV

1. Describe briefly key features of Forkhead factors with focus on how they interact with DNA and with chromatin.
2. How do you define a pioneer factor? Use a forkhead factor to illustrate how they operate.
3. If you were to study a new transcription factor to find out whether it operates as a pioneer factor or not, what properties would you investigate?

V

The Rb (retinoblastoma) protein is a transcriptional repressor playing an important role in linking the cell cycle with transcriptional control.

1. Explain briefly how Rb causes repression of its target genes.
2. Describe some key target genes that are repressed by Rb and how these relate to the cell cycle.
3. How does the repressive effect change in relation to the cell cycle progression?
4. Describe very briefly upstream enzymes that are controlling Rb.