

The logo of KU Leuven, featuring the text "KU LEUVEN" in white, bold, sans-serif capital letters on a dark blue rectangular background. A light blue vertical bar is on the left side of the rectangle.

KU LEUVEN

MODEL ORGANISMS

Test Exam

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Part 1: theory

To unravel the regulatory system(s) involved in ER stress in *C. Elegans*, you perform a forward mutagenesis screen to search for putative regulators of *hsp-4*, a gene encoding a chaperone protein. For this purpose you made transgenic [*hsp-4::gfp*] worms that are able to stably express the integrated GFP reporter under control of the *hsp-4* promoter.

Q: Which proof-of-principle experiment would be needed to verify that the reporter strain indeed reflects the process you are interested in?

A:

Q: How would you proceed with the screen to eventually identify new regulators?

A:

Part 2: practical

The Snf1/AMPK/SnRK kinases are a well-conserved family of AMP-activated kinases in the eukaryotic kingdom where they function as energy and metabolic sensors. In the yeast *Saccharomyces cerevisiae* this kinase was studied extensively and found to consist of a heterotrimeric protein complex with a catalytic α -subunit and a number of regulatory β -subunits and a γ -subunit.

Genes

Q: Which genes encode these subunits?

A:

Phenotypes

Q: What are the main phenotypes of yeast cells lacking of this kinase?

A:

Transcription factors

Q: Identify at least three transcription factors that are under control of this kinase complex in yeast.

A:

Phosphorylation

Q: To obtain its full activity in yeast, the catalytic α -subunit of AMPK must be phosphorylated. Find the three upstream protein kinases that conduct this phosphorylation in *S. Cerevisiae*.

Deletion mutant(s)

Q: What is the phenotype of the deletion mutant(s) of the homologue(s) of the catalytic α -subunit in *C. Elegans*?

A:

Mutant drosophila

Q: In the fruit fly null mutants for AMPK were obtained by P-element activity. Give the phenotype of one of these mutants.

A:

Zebrafish

Q: What is the name of the gene for the AMPK- α 1 catalytic subunit in zebrafish? Where is this gene expressed in the 14-19 somite embryo and how was this expression visualized? Give a morpholino sequence for this gene.

A:

Other model systems

Q: You want to find new genes that affect complex formation of AMPK. Which model system would you use to address this challenge, and how would you set up the experiments leading to useful results?

A: