

## MC Question – Cell Cycle Chapter 1

<b>Title</b>	Cell cycle progression from G1 to S phase
<b>Introduction/Description</b>	The introduction of different mutations in budding yeast led to changes in the phenotype, which in turn revealed mechanisms of cell cycle progression. The transcription of specific proteins, which induce the transcription of cyclins and S phase factors, right before START appears to be crucial for the progression from G1 to S phase.
<b>Question</b>	Whi5 is a regulator of SBF, a protein involved in the transcription of the G1 cyclins Cln1 & Cln2, as well as S phase factors. In an experiment, budding yeast was mutated such that all the potential phosphorylation sites of Whi5 were removed. When comparing the cell size of these mutants to the one of wildtype cells, mutants were found to be significantly larger. How can this difference in size be explained?

<b>Choice 1</b>	Whi5 is a kinase that needs to be phosphorylated in order to phosphorylate & activate its target SBF. When Whi5 is not phosphorylated, SBF cannot be activated. Hence, the genes that allow progression into S phase are not expressed and the cells remain in G1.
<b>Choice 2</b>	Phosphorylated Whi5 binds to SBF and enhances the expression of the genes that allow progression into S phase. When Whi5 is not phosphorylated, progression into S phase is inhibited and the cells stay in G1.
<b>Choice 3</b>	Whi5 and SBF compete for the binding to promoter regions of S phase genes. When Whi5 is not phosphorylated, it binds to these promoters, and thereby represses their expression. The cells stay in G1.
<b>Choice 4</b>	Unphosphorylated Whi5 binds to SBF and represses SBF. Phosphorylation of Whi5 would lead to its dissociation from SBF and the expression of S phase genes. Because Whi5 cannot be phosphorylated, the expression of S phase genes remains repressed and the cells remain in G1.

<b>Feedback Choice 1</b>	INCORRECT – Whi5 is a transcriptional repressor and has no phosphorylation activity. SBF does not need to be phosphorylated to induce gene expression and is inhibited by Whi5.
<b>Feedback Choice 2</b>	INCORRECT – Whi5 does indeed bind SBF, but not when phosphorylated. The Whi5-SBF complex cannot induce gene expression of target genes.
<b>Feedback Choice 3</b>	INCORRECT – Whi5 does not bind to the promoters of S phase genes, whereas SBF does. The binding of SBF to the promoters induces the expression of genes that lead to progression into S phase. Whi5 binds to and inhibits SBF.
<b>Feedback Choice 4</b>	CORRECT – Whi5 cannot bind to SBF when it is phosphorylated, and therefore SBF can induce the transcription of the genes that lead to progression into S phase. The unphosphorylated Whi5 blocks the progression into S phase, which leads to larger cells.