

FRQ Friday #16

2019 #6

The yeast *Saccharomyces cerevisiae* is a single-celled organism. Amino acid synthesis in yeast cells occurs through metabolic pathways, and enzymes in the synthesis pathways are encoded by different genes. The synthesis of a particular amino acid can be prevented by mutation of a gene encoding an enzyme in the required pathway.

A researcher conducted an experiment to determine the ability of yeast to grow on media that differ in amino acid content. Yeast can grow as both haploid and diploid cells. The researcher tested two different haploid yeast strains (Mutant 1 and Mutant 2), each of which has a single recessive mutation, and a haploid wild-type strain. The resulting data are shown in Table 1.

	MEDIUM	STRAINS		
		Wild Type	Mutant 1	Mutant 2
Treatment I	All amino acids present	+	+	+
Treatment II	No amino acids present	+	-	-
Treatment III	All amino acids present EXCEPT methionine	+	-	+
Treatment IV	All amino acids present EXCEPT leucine	+	+	-

Table 1. The data show the growth of haploid *Saccharomyces cerevisiae* yeast strains on media that differ in amino acid content. A plus sign (+) indicates that the yeast strains grow, and a minus sign (-) indicates that the strains do not grow.



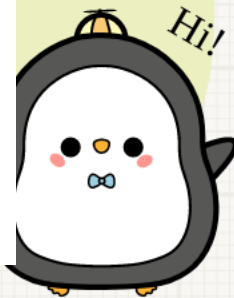
(a) Identify the role of treatment I in the experiment.

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Identification (1 point)

- (Positive) control (for yeast growth).
- To test the viability of all yeast strains.
- Treatment I allows the researcher to be confident that changes in experimental outcome are due to differences in treatments.



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Identification (1 point)

- (Positive) control (for yeast growth).
- To test the viability of all yeast strains.
- Treatment I allows the researcher to be confident that changes in experimental outcome are due to differences in treatments.

a) Treatment I is a control. It ensures that all of the yeasts can reproduce in a normal setting.

Hi!



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(b) Provide reasoning to explain how Mutant 1 can grow on treatment I medium but cannot grow on treatment III medium.

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Reasoning (1 point)

- Mutant 1 can use methionine when it is present in the medium, but Mutant 1 cannot synthesize methionine.



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(b) Provide reasoning to explain how Mutant 1 can grow on treatment I medium but cannot grow on treatment III medium.

Reasoning (1 point)

- Mutant 1 can use methionine when it is present in the medium, but Mutant 1 cannot synthesize methionine.

b) Mutant 1 has a single recessive mutation that prevents it from synthesizing methionine. It survives in treatment I because all of the amino acids are present but it cannot survive in treatment III because methionine is not present.



(c) Yeast mate by fusing two haploid cells to make a diploid cell. In a second experiment, the researcher mates the Mutant 1 and Mutant 2 haploid strains to produce diploid cells. Using the table provided, **predict** whether the diploid cells will grow on each of the four media. Use a plus sign (+) to indicate growth and a minus sign (-) to indicate no growth.

	MEDIUM	STRAINS			Diploid Cells Produced by Mating Mutant 1 and Mutant 2
		Wild Type (haploid)	Mutant 1 (haploid)	Mutant 2 (haploid)	
Treatment I	All amino acids present	+	+	+	+
Treatment II	No amino acids present	+	-	-	+
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Treatment IV	All amino acids present EXCEPT leucine	+	+	-	+



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