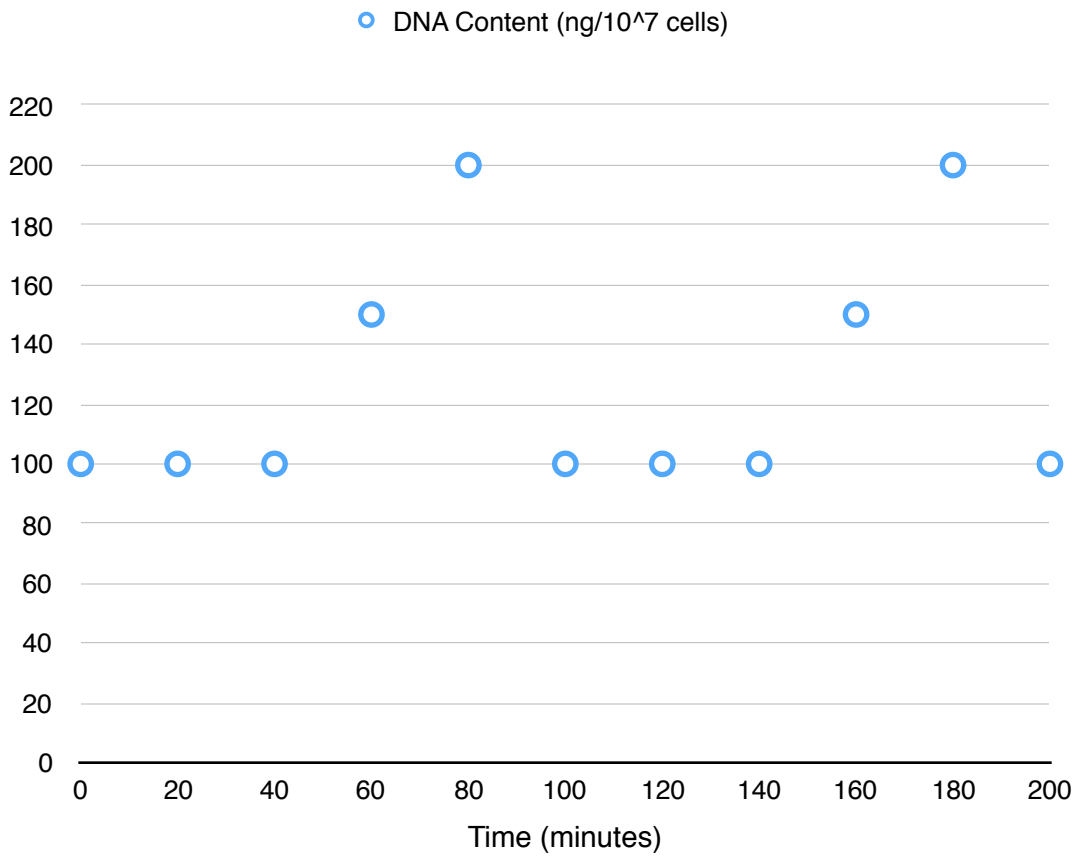
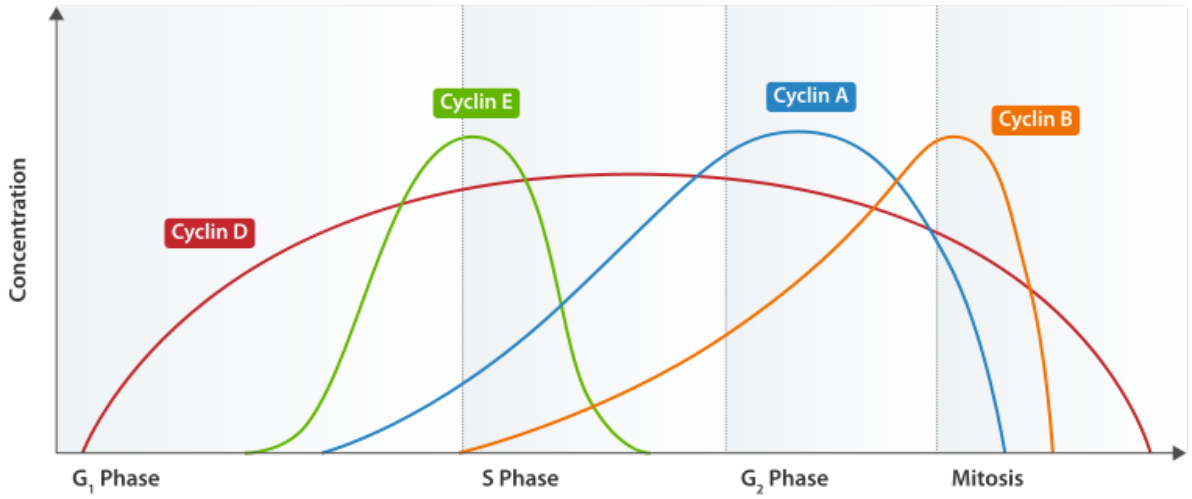
Cell Cycle and Mitosis Practice Questions:

It is possible to synchronize yeast so that they are all in the same point of the cell cycle at the same time with mating pheromone (which makes the cells arrest their cell cycle). The figure shows the amount of DNA in 10^7 yeast cells at different times after the pheromone is washed out.

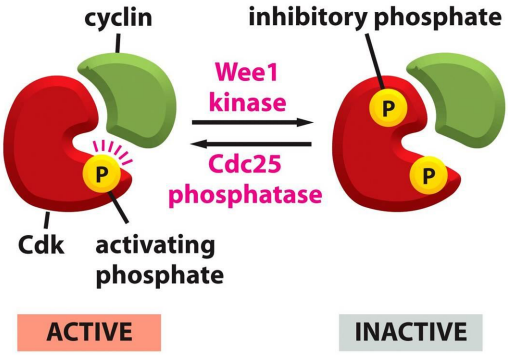


1. How many cell cycles are depicted?
2. Approximately how long is the yeast cell cycle?
3. When are the cells in “S” phase?
4. Approximately when does “M” occur?
5. One of the standard phases of the cell cycle is very short in this species. Which one?

Below is a figure showing levels of some “cyclin” proteins throughout the cell cycle. Note the proteins are now classified because of structural similarities, the “cyclin box.” Not all of them show the increase/abrupt decrease pattern.



A graduate student finds a temperature-sensitive mutant form of yeast which arrests just before mitosis. Which of the cyclins shown is most likely mutant in this strain? Justify your conclusion.



The image shows a model for the regulation of cyclin/ CDK in yeast. It shows that more than just the presence of the cyclin is required for full activation of the CDK/Cyclin complex.
As I have said before, all eukaryotes have similar regulation of the cell cycle. The human version of Cdc25 has been found over expressed in many cancer cells, and is considered a potential target of new drugs to treat cancer. Offer a hypothesis to explain the role of Cdc25 in cancer.

Researchers have found that the active cyclin/CDK complex activates many other proteins. Among the things that get activated by the cyclinb/CDK complex is something called the "ubiquitin ligase" proteasome pathway. Ubiquitin is a small protein, which, as its name implies, is found everywhere. Ubiquitin ligase adds a chain of ubiquitin molecules to a target protein. A proteasome recognizes the targeted protein and degrades it. It's sort of like a flag telling the proteasome to degrade whatever displays it. Cyclin B gets ubiquitinated (has strings of ubiquitin added).

In your own words, speculate on how ubiquitination of cyclins might play a role in regulating cell cycle.

Another major target of ubiquitin ligase is something called "cohesin," a protein that holds together sister chromatids during prophase and metaphase. Read the first section (through "Function" of this entry in Wikipedia:

https://en.wikipedia.org/wiki/Anaphase-promoting_complex

Discuss with your partner and write in your own words the roles this pathway has in regulating mitosis.

When would you expect to find ubiquitin ligase most active: Prophase; prophase-to-metaphase transition; metaphase-to-anaphase transition; telophase? Justify your conclusion.