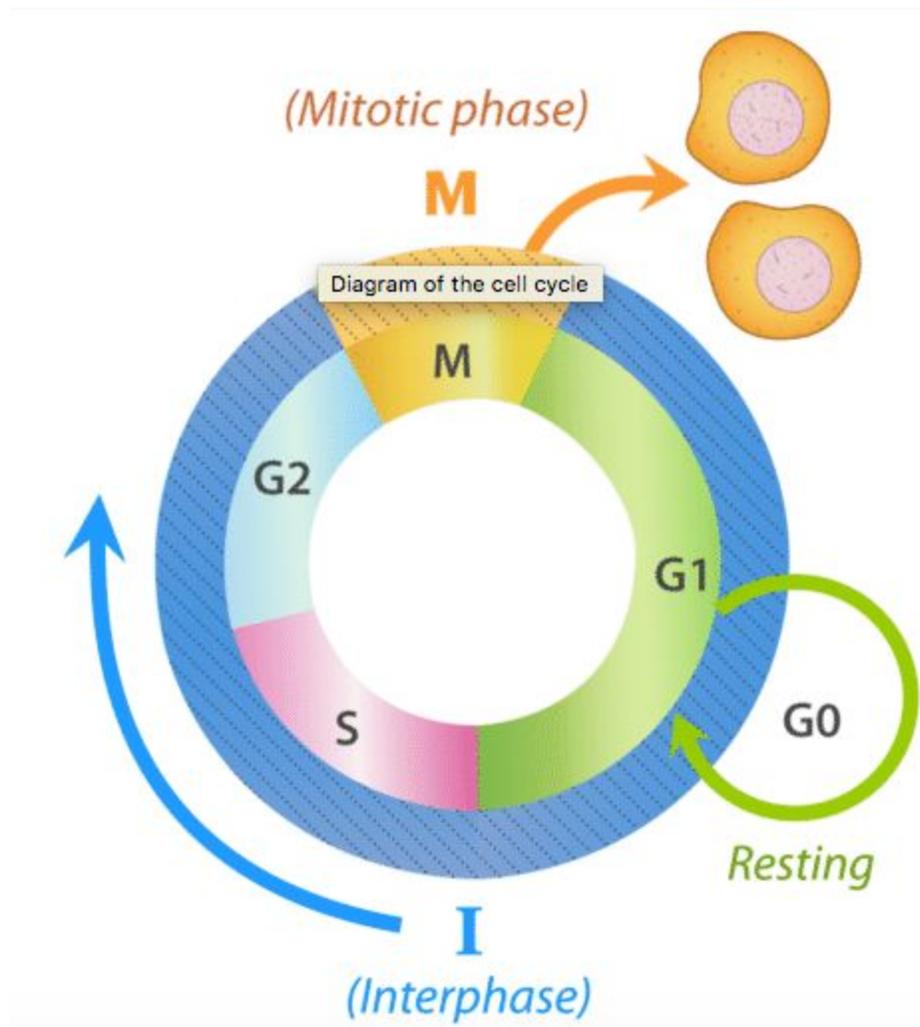


Cell Cycle Progress: How does it proceed?

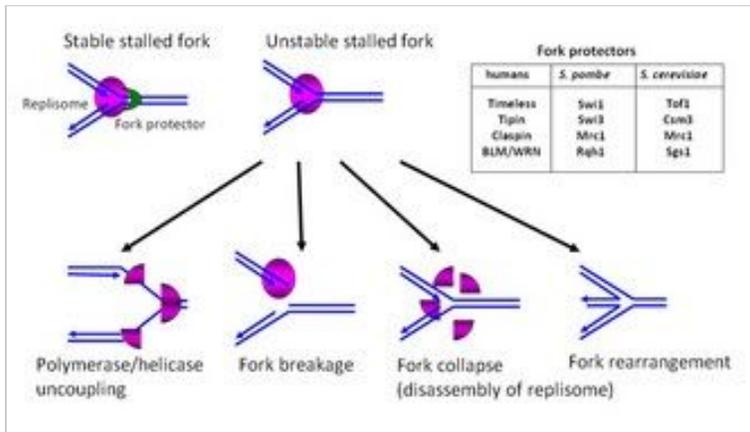


We chatted briefly about how the cell "knows" what stage of the cycle it is supposed to go into. What initiates and/or monitors this progress? This [popular article](#) and this [peer-reviewed journal article reveal](#) what we know so far. These findings are only about 12-13 years old.

According to the first article, "The cell must also pass through a series of **checkpoints** that ensure conditions are favorable for division. . . In order to move from one phase of its life cycle to the next, a cell must pass through numerous **checkpoints**. At each checkpoint, specialized proteins determine whether the necessary conditions exist. If so, the cell is free to enter the next phase. If not, progression through the cell cycle is halted. Errors in these checkpoints can have catastrophic consequences, including cell death or the unrestrained growth that is cancer."

According to the article in Nature Education from 2010,

“ In 1989, Leland Hartwell and Ted Weinert proposed that a cell possesses dedicated quality control systems that monitor problems on DNA templates. These systems are referred to as **cell cycle checkpoints** and are regulated by a number of proteins (Figure 3) (Hartwell & Weinert 1989). The checkpoints detect various issues found on DNA. Once checkpoint proteins identify these issues, the cell activates signal **transduction** pathways in order to arrest the progression of the cell cycle and allow adequate time to fix the problems on DNA. We also know that the checkpoints activate **DNA repair** programs to coordinate with cell cycle arrest (Branzei & Foiani 2008; Paulsen & Cimprich 2007; Aguilera & Gomez-Gonzalez 2008).



Among the several checkpoints that are known to detect various obstacles on DNA, the DNA replication checkpoint is the master surveillance system that steps in when a cell has problems during DNA replication. What does the DNA replication checkpoint really monitor? This checkpoint monitors the most important site when the cell is replicating DNA. That is the DNA replication fork, which contains the replication machinery performing DNA synthesis. When the fork stalls due to an obstacle on the DNA (Figure 1), the cell activates the replication checkpoint to send a signal to arrest the progression of the cell cycle.