The Cell cycle

1. What is meant by the cell cycle or cell division cycle?
   ** Series of events that take place in a eukaryotic cell between its formation and the moment it replicates itself.

2. In what type of cells --- prokaryotes or eukaryotes --- does the cell cycle occur?

3. Name the 2 main PHASES of the cell cycle. Interphase & Mitotic Phase

4. Mitotic phase is in between the times when a cell is dividing.

5. What is occurring in a cell during interphase? The cell is forming and carries on with its normal metabolic functions.

6. What is happening during the mitosis phase? The cell is replicating itself

7. A fertilized egg develops into a mature organism during the cell cycle.

8. Name three things that form during the cycle. Hair, skin, blood cells

Interphase

9. What process NEVER occurs in interphase? Division

10. Cells obtain nutrients and duplicate or copy their chromatids or genetic material during interphase.

11. Where are chromatids found in a cell? Nucleus
12. Chromatids are made of a molecule called **chromatin**.

13. Label this chromosome.

   1. Chromosome
   2. centromere
   3. short arm (chromatid)
   4. long arm chromatid

14. In what PHASE do most cells spend the majority of their lifetime?  **interphase**

15. How often do human skin cells divide each day?  **Once a day**

16. How many hours per day is a human skin cell in interphase?  **22**

17. What type of cell may spend decades in interphase instead of dividing?  **nerve cells**

18. Name the 3 stages in interphase.  **G1, S, G2**

19. What does **G1** stand for and what occurs in this stage?  
   **Growth- creates cell organelles & begins metabolism**

20. What does **S** stand for and what occurs in this stage?  
   **Synthesis- chromosomes of the cell are copied**
21. What does $G_2$ stand for and what occurs in this stage? 
   *Growth- cell grows and prepares for cell division*

22. From which stage of the cell cycle do cells sometimes EXIT?
   *Usually from G1*

23. What happens to cells that enter the $G_0$ stage? *Cells are alive and metabolically active, but do not divide.*

24. Name 3 types of cells that enter the $G_0$ phase when they are mature?
   *Heart muscle, eyes & brain*

25. What happens if these cells are damaged during your lifetime?
   *They cannot be replaced*

26. What stage occurs after cytokinesis?
   *G1*

27. What part of the cell is divided during cytokinesis?
   *Cytoplasm*

28. What are the new cells called and how do they compare with each other?
   *Daughter cells and they are identical*

29. What major thing is happening to a cell during G1?
   *Cell growth*

30. What cell structures are made in G1?
   *New organelles*

31. Since proteins and enzymes are being made during G1, there is a great amount of protein synthesis occurring.

32. What does the S phase stand for? *Synthesis phase*
33. What happens during the S phase? Each chromosome is copied.

34. Each chromosome originally is made of how many DNA molecules and how does this molecule appear in the chromosome? One coiled double helix - chromatid

35. At the end of S phase each chromosome has how many coiled DNA molecules? 2 identical double helices

36. What structure holds the duplicated chromosomes together and is also copied during the S phase? Centrosomes

37. What is the final and shortest phase of interphase? G2

38. About how long would a typical cell be in the G2 phase? Four to five hours

39. How is the cell prepared for mitosis during the G2 phase? The cell grows

40. What follows the G2 phase? Mitosis

41. What part of the cell is actually dividing in mitosis? Nucleus and nuclear material

42. What is another name for mitosis? Karyokinesis
Cell Cycle and Mitosis

THE CELL CYCLE

The cell cycle, or cell-division cycle, is the series of events that take place in a eukaryotic cell between its formation and the moment it replicates itself. These events can be divided into two main parts: interphase (in between divisions phase grouping G₁ phase, S phase, G₂ phase), during which the cell is forming and carries on with its normal metabolic functions; the mitotic phase (M mitosis), during which the cell is replicating itself. Thus, cell-division cycle is an essential process by which a single-cell fertilized egg develops into a mature organism and the process by which hair, skin, blood cells, and some internal organs are formed.

INTERPHASE

Interphase is a phase of the cell cycle, defined only by the absence of cell division. During interphase, the cell obtains nutrients, and duplicates (copies) its chromatids (genetic material). The genetic material or chromatids are located in the nucleus of the cell and are made of the molecule DNA.

Chromatids are connected by the centromere and have a long and short arm.

Most eukaryotic cells spend most of their time in interphase. For example, human skin cells, which divide about once a day, spend roughly 22 hours in interphase. About 90 percent of cells are in interphase. Some cells, such as nerve cells, can stay in interphase for decades. There are 3 parts of interphase: G₁ (growth 1 in which the cell creates organelles and begins metabolism), S phase (DNA synthesis in which the chromosomes of the cell are copied) and G₂ (growth 2 in which the cell grows in preparation for cell division). Find the cell cycle drawing on this worksheet and draw an additional line in red around those parts of the cell cycle diagram that are included in interphase.

Sometimes the cells exit the cell cycle (usually from G₁ phase) and enter the G₀ phase. In the G₀ phase, cells are alive and metabolically active, but do not divide. In this phase cells do not copy their DNA and do not prepare for cell division. Many cells in the human body, including those in heart muscle, eyes, and brain are in the G₀ phase. If these cells are damaged they cannot be replaced. Again find the cell
cycle drawing on this worksheet and draw an arrow in black on the cell cycle showing where a cell would enter the $G_0$ phase.

The $G_1$ phase is a period in the cell cycle during interphase, after cytokinesis (process whereby a single cell is divided into two identical daughter cells whenever the cytoplasm is divided) and before the S phase. For many cells, this phase is the major period of cell growth during its lifespan. During this stage new organelles are being synthesized (made), so the cell requires both structural proteins and enzymes, resulting in great amount of protein synthesis. Color the $G_1$ phase green on the cell cycle drawing.

The S phase, short for synthesis phase, is a period in the cell cycle during interphase, between G1 phase and the G2 phase. Following G1, the cell enters the S stage, when DNA synthesis or replication occurs. At the beginning of the S stage, each chromosome is composed of one coiled DNA double helix molecule, which is called a chromatid. At the end of this stage, each chromosome has two identical DNA double helix molecules, and therefore is composed of two sister chromatids. During S phase, the centrosome is also duplicated. Color the S phase orange.

$G_2$ phase is the third, final, and usually the shortest subphase during interphase within the cell cycle in which the cell undergoes a period of rapid growth to prepare for mitosis. It follows successful completion of DNA synthesis and chromosomal replication during the S phase, and occurs during a period of often four to five hours. Although chromosomes have been replicated they cannot yet be distinguished individually because they are still in the form of loosely packed chromatin fibers. The $G_2$ phase continues growth of the cell and prepares the cell for mitosis (M phase) by producing all of the enzymes that the cell will need in order to divide. Color the $G_2$ phase light blue.

After the $G_2$ phase of interphase, the cell is ready to start dividing. The nucleus and nuclear material (chromosomes made of DNA) divide first during stage known as MITOSIS. Mitosis is also called KARYOKINESIS (karyon means nucleus) because only the nucleus is dividing. Color the Mitosis stage purple.