

**Biology 103 Lecture  
Mitosis and Meiosis Study Guide  
(Cellular Basis of Reproduction - Chapter 8)**

**Like begets like, more or less**

- does sexual reproduction and genetics allow for a maple tree to produce a sea star?
- do offspring inherit genetic material from both parents in asexual reproduction?
- do offspring inherit genetic material from both parents in sexual reproduction?
- what is the name of structures that contain most of an organism's DNA?

**Cells arise only from preexisting cells**

- what two main roles does cell division play in perpetuating the life cycle of animals and other multicellular organisms?

**Prokaryotes reproduce by binary fission**

- what is the name of the type of cell division used by prokaryotes to reproduce themselves?
- do prokaryotes have DNA?
- do prokaryotes replicate their chromosome prior to division?
- is binary fission considered asexual or sexual reproduction and why?

**The large, complex chromosomes of eukaryotes duplicate with each cell division**

- in what structure of the eukaryotic cell do most of the genes occur?
- what are genes and where are they located?
- what is chromatin and how is it different from chromosomes?
- understand chromosome duplication and distribution

**The cell cycle multiplies cells**

- define cell cycle
- what are the major components of the cell cycle?
- in what phase of the cell cycle does the cell spend the most time?
- what occurs during cytokinesis?

**Cell division is a continuum of dynamic changes**

- know that the main things that occur during the four stages of mitosis are formation of mitotic spindle, fragmentation of nuclear envelope, orientation of chromosomes at metaphase plate, movement of chromosomes to opposite poles of cell, disappearance of mitotic spindle, re-formation of nuclear envelopes, pinching of cell into two daughter cells
- how many cell divisions occur in mitosis?
- how many times are the chromosomes replicated in mitosis?
- how many daughter cells are produced in mitosis?

- how many chromosomes do the daughter cells of mitosis contain relative to the number of chromosomes that the parent cell had?
- are the daughter cells of mitosis diploid or haploid?

### **Cytokinesis differs for plant and animal cells**

- does cytokinesis occur in exactly the same way in plant and animal cells?
- what is the role of microfilaments in cytokinesis in animal cells?
- what is the role of membrane-bound vesicles in cytokinesis in plant cells?
- what is the name of the membrane-bound disc that forms in the middle of a dividing plant cell?
- what is the name of the groove that forms in the surface of an animal cell in the process of dividing?

### **Review of the functions of mitosis: Growth, cell replacement, and asexual reproduction**

- what are the functions of mitosis?
- is mitosis involved in asexual or sexual reproduction?

### **Chromosomes are matched in homologous pairs**

- what is a somatic cell?
- how many chromosomes would a human somatic cell have?
- do all species have the same number of chromosomes? (do dogs and humans and oak trees all have the same number of chromosomes?)
- do homologous chromosomes each carry genes controlling the same inherited trait?
- the name of the location on a chromosome where a particular gene is located is called what?
- what are autosomal chromosomes (or autosomes)?
- what are sex chromosomes?
- how many pairs of autosomes do humans have?
- how many pairs of sex chromosomes do humans have?
- how many chromosomes do we inherit from our mother and how many do we inherit from our father?

### **Gametes have a single set of chromosomes**

- what do we call cells that have two sets of chromosomes?
- what do we call cells that have one set of chromosomes?
- what is the diploid chromosome number for humans?
- what is the haploid chromosome number for humans?
- if a dog's somatic cells have 66 chromosomes then what would we say is the dog's diploid chromosome number and its haploid chromosome number?
- what term do we use to collectively refer to reproductive cells such as sperm and eggs?
- in a human gamete cell, how many autosomal chromosomes are present and how many sex chromosomes are present?
- how do we define fertilization?
- what is another term used to refer to a fertilized egg?

- is a sperm cell haploid or diploid?
- is an egg cell haploid or diploid?
- is a fertilized egg haploid or diploid?
- is a zygote haploid or diploid?
- are gametes produced by mitosis or by meiosis?

### **Meiosis reduces the chromosome number from diploid to haploid**

- what is the purpose of meiosis?
- in what ways are mitosis and meiosis similar?
- in what ways are mitosis and meiosis different?
- how many times are the chromosomes replicated in meiosis?
- how many cell divisions occur in meiosis?
- how many daughter cells are produced in meiosis?
- how many chromosomes do the daughter cells of meiosis contain relative to the number of chromosomes that the parent cell had?
- are the daughter cells of meiosis diploid or haploid?

### **Review: A comparison of mitosis and meiosis**

- know comparison points in following table

	<b>Mitosis</b>	<b>Meiosis</b>
Purpose	Growth, cell replacement, asexual reproduction	Sexual reproduction
Type of cells produced	Somatic cells	Reproductive cells (Gametes)
Parent cell	Diploid (2n)	Diploid (2n)
# of divisions	One	Two
# times chromosomes are replicated	One	One
Number of daughter cells produced	Two	Four
Chromosome # in daughter cells	Diploid (2n)	Haploid (n)

- know comparison points in figure 8.15

### **Independent orientation of chromosomes in meiosis and random fertilization lead to varied offspring**

- understand how independent orientation of chromosomes at metaphase can lead to additional combination of chromosomes in gametes
- understand the general concept of the vast number of possible chromosome combinations that can result with large haploid chromosome numbers (for example, when  $n=4$  there are four possible combinations of chromosomes in gametes but when  $n=23$  (as in humans) there are 8 million possible combinations of chromosomes in gametes)
- understand that random fertilization of egg by sperm introduces even more genetic variability

### **Homologous chromosomes carry different versions of genes**

- be able to determine the possible gene combinations in a gamete if you are given the information for the tetrad of one chromosome (as in figure 8.17A) that has not crossed over

### **Crossing over further increases genetic variability**

- what is crossing over?
- where does crossing over occur?
- what is a chiasma?
- what is a recombinant chromosome?
- what is genetic recombination?
- how does crossing over further increase genetic variability?
- be able to determine the possible gene combinations in a gamete if you are given the information for the tetrad of one chromosome (as in figure 8.18B) that has crossed over