Key Concept 4: Asexual and Sexual Passing of Genes

Learning Objectives *Students will be able to ...*	Essential Knowledge *Students need to know that ...*
Asexual Reproduction	
GEN 4.1(a) Explain why asexual reproductive strategies do not lead to genetic diversity. **GEN 4.1(b)** Explain the advantage(s) of asexual reproduction strategies for organisms.	**GEN 4.1.1 Most unicellular and some multicellular organisms can reproduce through asexual processes that do not increase genetic variation in the population.** **a.** Binary fission is a form of asexual cell division that results in a symmetrical genetic clone of the parent cell (e.g., bacteria, amoebas). **b.** Budding is a form of asexual cell division that results in a diploid, asymmetrical genetic clone of the parent cell (e.g., corals, yeast). **c.** Some forms of parthenogenesis are a form of asexual reproduction in some species, where offspring are produced by females without the genetic contribution of a male (e.g., bees, lizards, sharks). **d.** Asexual reproduction can be performed without the need to find mates and can lead to rapid proliferation of a population over time.
Sexual Reproduction (Meiosis)	
GEN 4.2(a) Explain why reduction division must occur to produce gametes. **GEN 4.2(b)** Explain how meiotic cellular division followed by fertilization leads to genetic diversity within a population. **GEN 4.2(c)** Create and/or use models to explain how chromosome number is halved during meiosis.	**GEN 4.2.1 Some unicellular and most eukaryotic organisms reproduce sexually, requiring a process called meiosis that results in genetic variation in the population.** **a.** Meiotic division requires two distinct nuclear divisions in order to reduce one diploid (2N) cell into four haploid (N) cells. **1.** During the first division in meiosis, homologous chromosomes pair together in a tetrad and crossing-over occurs, which increases genetic variation. **2.** At the end of the first division (meiosis I), homologous chromosomes are separated and two daughter cells are formed. **3.** At the end of the second meiotic division (meiosis II), the two cells are separated into four genetically diverse haploid cells, which in animals differentiate into gametes. **b.** Sexual reproduction occurs via fertilization, when sperm and egg gametes fuse and form a zygote, restoring the diploid number of chromosomes.

Learning Objectives *Students will be able to ...*	Essential Knowledge *Students need to know that ...*
Chromosomal Disorders	
GEN 4.3(a) Describe how some organisms have an altered number of chromosomes in their genome. **GEN 4.3(b)** Predict how altered chromosome numbers may affect organisms.	**GEN 4.3.1 Chromosomal disorders can occur during meiosis if chromosomes are altered, duplicated, or missing.** **a.** Unequal crossing-over events can lead to chromosomal disorders. **b.** Random nondisjunction events may occur in meiosis when chromosomes fail to separate. This may result in viable offspring with an abnormal number of chromosomes.

Content Boundary: Students will not be assessed on the molecular details of the asexual reproductive strategies of budding and binary fission, nor on which organisms utilize asexual reproduction. The *focus* here is on how this reproductive strategy leads to the genetic clone of the parent cell, the impact on gene pool diversity, and why that process is advantageous for the organism at that time.

Cross Connections: Students should make *connections to key concepts* in Unit 1: Ecological Systems and Unit 2: Evolution, recognizing how changes in the environment and natural selection act on variation in traits that emerge through meiosis. These processes lead to phenotypic variation in species and populations.