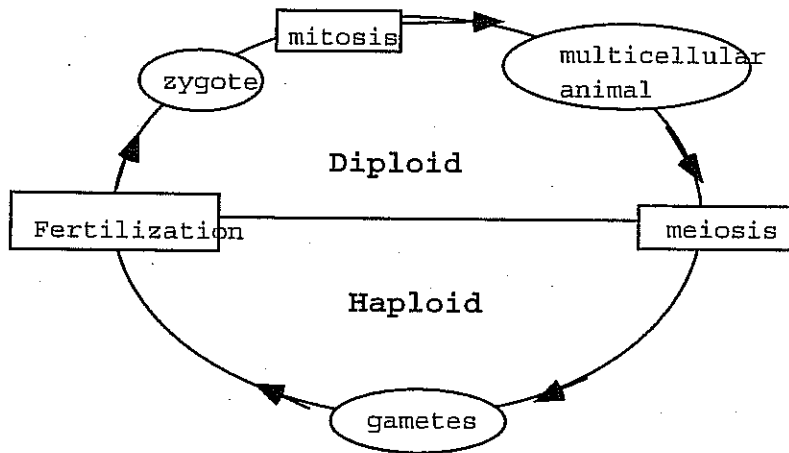


In animals gametes are formed by sex cells. Gametes are haploid cells produced following meiosis. Two haploid cells unite to form a diploid cell called a zygote, which undergoes mitosis. During cell division, diploid cells are formed from other diploid cells. During maturation some of the cells specialize and become gamete-producing cells. These gamete-producing cells undergo meiosis and form haploid cells, bringing the life cycle full circle, as shown below.



Sections 3.8 Questions (page 116)

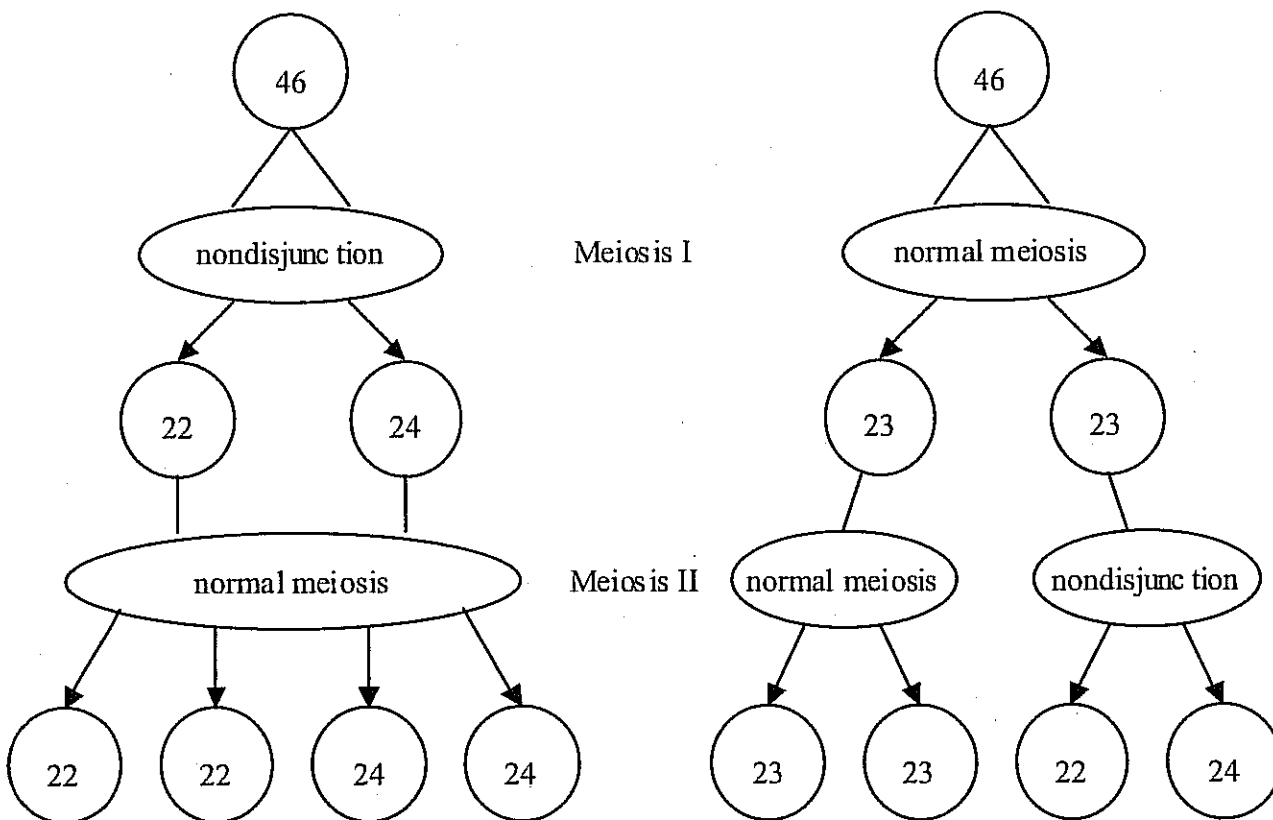
- The cells labelled B and C would have a haploid chromosome number.
 - Cell A would have 24 chromosomes; cell C would have 12 chromosomes.
- Process Z shows the zygote divide by mitosis to become a multicellular organism.
 - Process W (oogenesis) and process X (spermatogenesis) represent the stage where haploid sex cells are formed (meiosis).
- The male determines the sex of the child. A sperm cell carrying an X chromosome produces a girl, while one that carries a Y chromosome produces a male child.
- The offspring are female. They are identical to the mother.

3.9 Practice (page 120)

- Nondisjunction can occur during either meiosis or mitosis. In meiosis I, nondisjunction results when both homologous chromosomes move to the same pole, and in meiosis II it results when both chromatids move to the same pole.
- Monosomy is a condition where a zygote has one homologous chromosome instead of two. Trisomy is a condition where a zygote has three homologous chromosomes instead of two.
- Down syndrome results from trisomy of chromosome pair #21.
- A karyotype chart is a pictorial representation of homologous chromosomes.
- Turner syndrome results from monosomy (XO) of sex chromosomes.

Section 3.9 Questions (page 122)

- Meiosis I involves a reduction division while Meiosis II involves the division of chromatids.



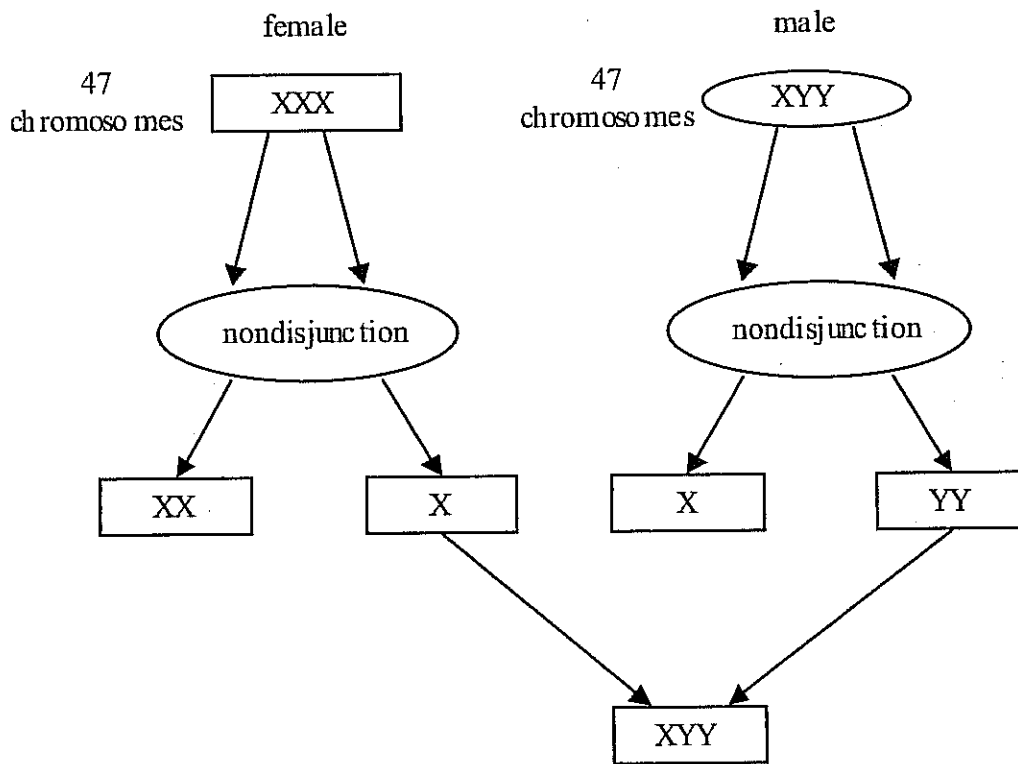
- Amniocentesis permits prenatal diagnosis of genetic disorders. Risks include infection, loss of amniotic fluid, and physiological stress to the mother.
- Amniocentesis permits prenatal diagnosis of genetic disorders, mainly by chemical analysis. It is cheap and easy to perform. Risks are listed in the answer to question 2, above. Ultrasound is safer, but expensive. Ultrasound shows the features of the fetus as it develops, but not its chemical makeup.

Chapter 3 Review (pages 124–127)

- Stage A depicts metaphase, stage B shows anaphase, stage C shows telophase and stage D shows prophase.
- (a) A and B are plant cells, C and D are animal cells. The cells can be differentiated by looking for a cell wall. Plant cells have cell walls, animal cells do not.
(b) A shows metaphase, B shows telophase, C shows anaphase and D shows telophase.
- Cell specialization does not occur for single-cell organisms. All of your offspring would likely be identical unless conjugation took place.
- Nerve cells and muscle cells all came from the same zygote by mitosis and thus they all carry the same number of chromosomes and the same genetic information.

5. They are identical in genetic makeup.
6. Immature stem cells can divide more readily than mature, highly-specialized cells, such as nerve cells. By understanding the mechanism that "turns on" cell division (for example, in stem cells), scientists can attempt to replicate it in mature cells, including those in the limbs.
7. A callus is a growth of skin cells in response to injury. Skin becomes thicker if cells are damaged due to abrasion.
8. Sexual reproduction allows for new combinations of the genes from each parent.
9. (d)
10. (a) 18 chromosomes would be in each cell.
 (b) 18 chromosomes would be in each cell.
 (c) Stage A would contain cells with a diploid chromosome number.
 (d) Stages B and C would contain cells with a haploid chromosome number.
11. (a) 22 chromosomes were in the sperm cell.
 (b) Nondisjunction occurred. One pair of homologous chromosomes did not separate, so one gamete did not receive this type of chromatid.
 (c) If the zygote were a female, it would contain 22 pairs of homologous chromosomes.
 (d) Following mitosis, each cell would contain 45 chromosomes.
12. (a) The person is a male.
 (b) No, a sperm cell would only have 23 chromosomes, with no pairs.
 (c) Trisomy of chromosome pairs 22 and 21 (Down's syndrome).
13. A trisomic XXX female could result from nondisjunction in meiosis I where both homologous X chromosomes move to the same pole or nondisjunction during meiosis II where both chromatids for an X chromosome move to the same pole and are duplicated.

14.



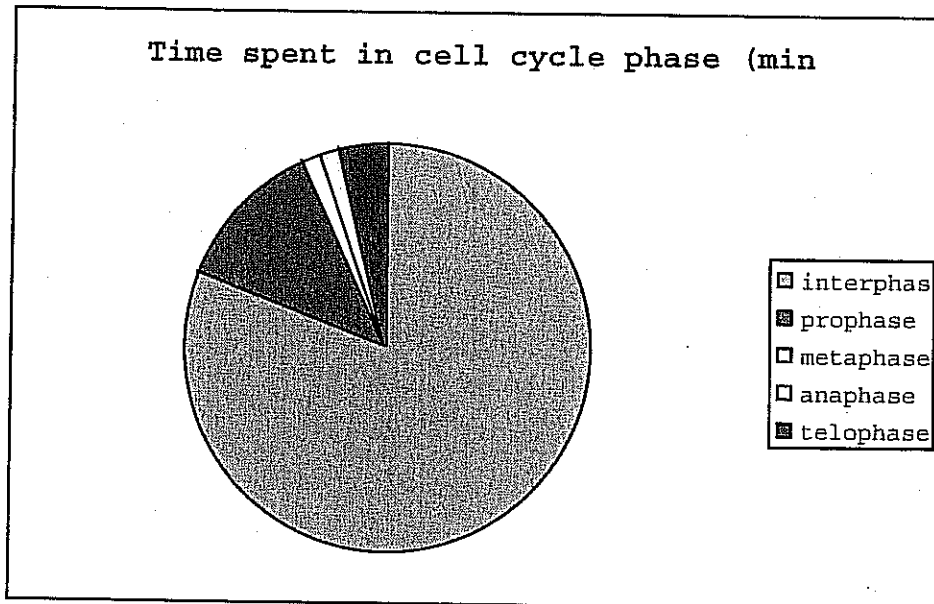
15. Student answers will vary.

- Apply various concentrations of herbicide to germinating seedlings and measure the growth of the shoots from the seedlings over time.
- The control is the seedling(s) without the herbicide.
- In the experiment described above, the independent variable is the amount of herbicide added and the dependent variable is the growth of the seedling.
- Measure the growth of the shoot from the seedling or the growth of the plant.

16 (a)

Cell phase	Area #1	Area #2	Total cell count	Time spent in phase (min)
interphase	91	70	161	533
prophase	10	14	24	79.6
metaphase	2	1	3	10
anaphase	2	1	3	10
telophase	4	4	8	26.5

(b)



17. (a) The body shows the most growth after birth.
(b) Puberty accounts for the rapid change in the development of the heart.
18. A cutting will be exactly the same as the original, whereas seeds often have new combinations of genes.
19. (a) Graph A represents the data collected; cell growth rate is exponential and faster than normal.
(b) The normal cells acted as a control.
(d) Student answers will vary.
The researcher needed to control temperature of the cultures; nutrients available for growth in each culture; age of the cells; number of cells in each of the cultures.
20. (a) Nondisjunction occurred in female A.
(b) Zygote D would contain 9 chromosomes; zygote E would contain 8; zygote F would contain 7.
(c) Process X is fertilization.
(d) Zygote E is most likely to be healthy, because it has the normal diploid chromosome number.
(e) Zygote D has trisomy; zygote F has monosomy.

21. Table 2

Descriptor	Fraternal twins	Identical twins
They have the same blood type.	not always	yes
They are the same sex.	not always	yes
They like the same hockey team.	not always	not always
They are the same weight.	not always	not always
They have the same hair colour.	not always	if it isn't coloured or bleached by the sun
They know what the other one is thinking.	not always	not always