CHAPTER 4

Heredity and Reproduction

KEY CONCEPTS

After completing this chapter you will be able to

- describe how inherited characteristics are passed from generation to generation in the form of genetic information in chromosomes

- explain how asexual reproduction produces offspring that are genetically identical to the parent

- describe and explain how sexual reproduction results in genetic variation from generation to generation

- demonstrate an understanding of the processes and characteristics of asexual and sexual reproduction

- identify and discuss the many important applications of asexual and sexual reproduction, including those related to human health, agriculture, and the environment

- create biological drawings of cells undergoing meiosis

- construct and interpret chromosome arrangements (karyotypes)

What Is the Value of Variety?

No two people are exactly alike. Not even identical twins share the same set of facial features, hair colour, height, personality, and talents. Indeed, our uniqueness as individuals is one of our most valued qualities: it is what makes us special. This high degree of variation extends to most, if not all, other species. Virtually all species exhibit some degree of variation.

Variety is of great value. Breeders of dogs, cats, tropical fish, livestock, and other animals are very aware of the demand for variety. Consider the variety among dog breeds as an example. Chihuahuas, Labrador retrievers, and sled dogs all have very different characteristics. Chihuahuas are small and noisy house pets; retrievers have a built-in compulsion to fetch things; sled dogs have thick, warm coats, a desire to pull, and extraordinary endurance. Yet they are all dogs. Dog breeders are very aware of the demand for variety and will carefully mate selected individuals of the same breed to produce offspring that have specific characteristics desired by consumers. Similarly, cats, aquarium fish, and farm animals come in a dizzying array of shapes, sizes, colours, and temperaments.

Plant breeders face the same demands for variety. They breed fruits and vegetables with different qualities—flavour, size, hardiness, nutritional value, and disease resistance. Variation among ornamental plants is also in high demand. Horticulturists and home gardeners demand different colours, shapes, and sizes in the plants. They also need plants that are suited to their particular growing conditions. A type of rose that can flourish in Florida may not survive a winter in Ontario.

Amid all this diversity and variation there is also predictability and consistency. In fact, offspring often resemble their parents. Animal and plant breeders depend on this predictability to produce consistent varieties.

What is it about living things that enables them to exhibit tremendous variability, yet also causes them to bear such a strong resemblance to their parents? The answer lies in both the chemical nature of heritable information and the ways in which organisms reproduce.

In this chapter you will examine the role of asexual and sexual reproduction in passing on genetic information from one generation to the next. You will learn how these processes give rise to both the unity and the diversity of life. You will also explore some of the ways in which our understanding of inherited information can be used to benefit society and the environment.

STARTING POINTS

Answer the following questions using your current knowledge. You will have a chance to revisit these questions later, applying concepts and skills from the chapter.

1. How do you think genetic information gets passed on from generation to generation?

2. Do you think there are any biological advantages or disadvantages of asexual versus sexual reproduction?

3. How might an understanding of genetic processes and the inheritance of biological characteristics be of value to individuals and to society?