

# Mechanisms of Evolution

## Reflecting Questions

- How does an understanding of genetics help explain how changes within a species can occur?
- How can we measure genetic variation in a population?
- What are the mechanisms that result in genetic variation?

## Prerequisite Concepts and Skills

Before you begin this chapter, review the following concepts and skills:

- understanding how mutations occur (Chapter 9, section 9.1),
- understanding the mechanism of natural selection (Chapter 10, section 10.1),
- explaining the relationship between variation and natural selection (Chapter 10, section 10.1), and
- explaining how molecular biology contributes to the scientific study of evolution (Chapter 10, section 10.3).

Each fall, swarms of monarch butterflies leave southern Canada and begin their southward migration. Along the route of their incredible journey — which, for most, will end in the mountains of southern Mexico — populations of monarchs will be eagerly awaited and counted by keen observers. Monarch butterflies are one of the few migratory insects, and their migratory routes are well-studied. Every year, biologists and volunteer observers monitor monarch butterfly populations. These observers have found that populations shift dramatically from year to year. Numbers rise some years, then fall other years. During their migration and during their time in Canada, the United States, and Mexico, populations of monarchs (like populations of all organisms) are subjected to variable environmental conditions. There can be a drought one year, an early snowfall the next, or the loss of valuable habitat in another year. Populations peak following favourable conditions, while adverse conditions can result in precipitous declines. Populations continue to shift naturally from one generation to the next.

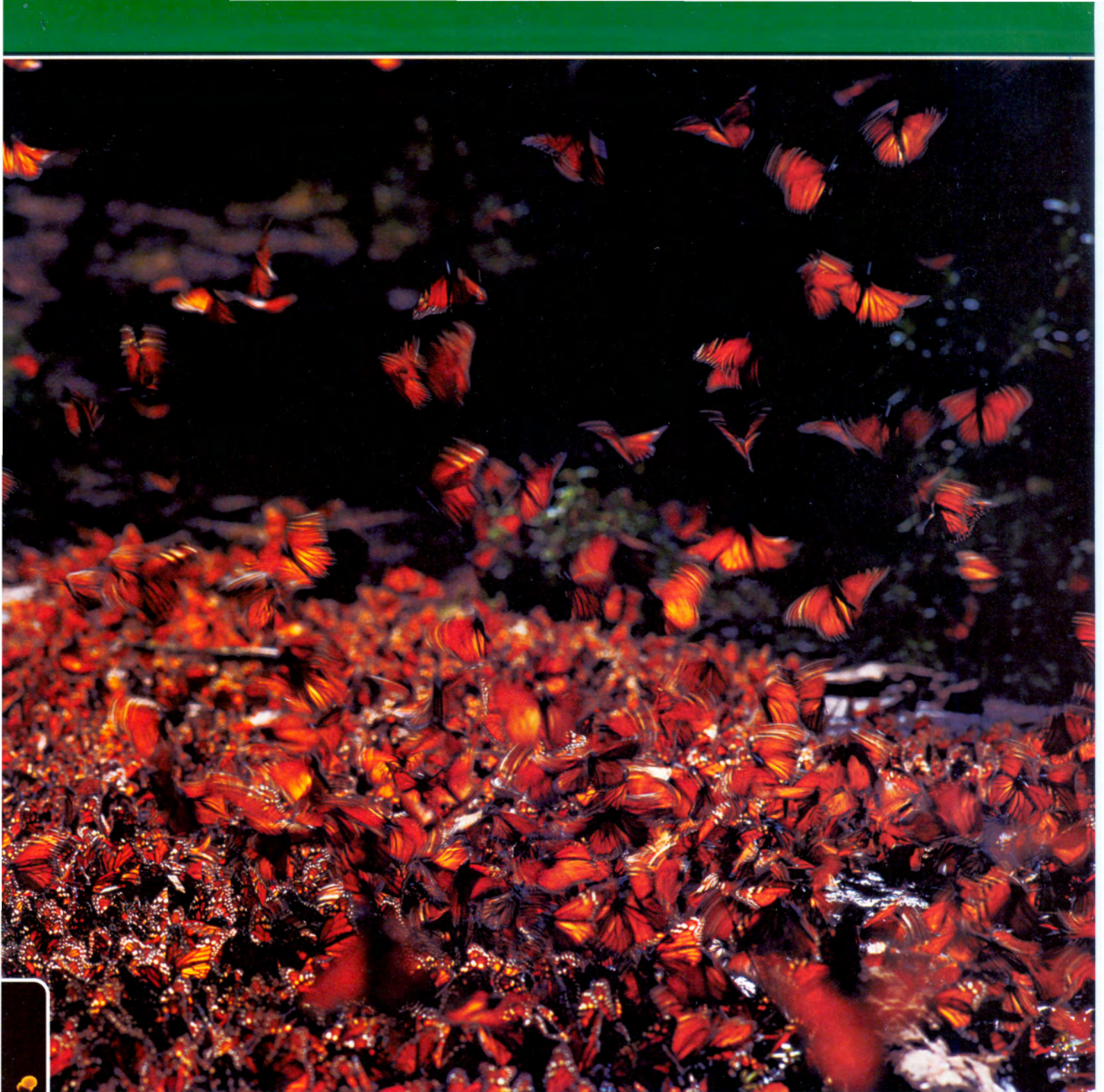
Monarch butterfly populations are estimated to total over 120 million individuals and, for now, their populations are large enough to ensure a sizeable gene pool that can withstand many challenges. But what would happen if a small population became isolated from the larger group? If the smaller population's

gene pool changed, how might the smaller population itself change? Would the organisms start to look different? How does population size and the genetic variation within the population affect the evolution of the monarch butterfly population?

As you have learned, evolution is the shift in the frequency of genes in the gene pool of a population from one generation to the next. Genetic variation within a population allows changes to occur within a species. You will examine the relationship between genetics and evolution in greater detail in this chapter. You will also learn about some of the mechanisms that affect genetic variation and learn how to measure this variation.

How does genetic variety, such as the variety that exists in this population of bacteria, make evolution possible?





## Chapter Contents

<b>11.1 Population Genetics</b>	<b>364</b>	Investigation 11-A: Population Genetics and the Hardy-Weinberg Principle	374	Thinking Lab: An Evolving Disease: Tuberculosis	379
<b>11.2 The Hardy-Weinberg Principle</b>	<b>371</b>			Thinking Lab: Genetic Diversity and Fish Hatcheries	382
		<b>11.3 Mechanisms for Genetic Variation</b>	<b>377</b>		