

# 17.2 Evolution as Genetic Change in Populations

**THINK ABOUT IT** Ever since humans began farming, they have battled insects that eat crops. Many farmers now use chemicals called pesticides to kill crop-destroying insects. When farmers first used modern pesticides such as DDT, the chemicals killed most insects. But after a few years, many pesticides stopped working. Today, farmers fight an ongoing “arms race” with insects. Scientists constantly search for new chemicals to control pests that old chemicals no longer control. How do insects fight back? By evolving.

At first, individual pesticides kill almost all insects exposed to them. But a few individual insects usually survive. Why? Because insect populations often contain enough genetic variation that a few individuals, just by chance, are resistant to a particular pesticide. By killing most of the susceptible individuals, farmers increase the relative fitness of the few individuals that can resist the poison. Those insects survive and reproduce, passing their resistance on to their offspring. After a few generations, the descendants of the original, resistant individuals dominate the population.

To understand completely how pesticide resistance develops, you need to know the relationship between natural selection and genetics.



## How Natural Selection Works

**How does natural selection affect single-gene and polygenic traits?**

Pesticide-resistant insects have a kind of fitness that protects them from a harmful chemical. In genetic terms, what does fitness mean? Each time an organism reproduces, it passes copies of its genes on to its offspring. We can, therefore, view evolutionary fitness as success in passing genes to the next generation. In the same way, we can view an evolutionary adaptation as any genetically controlled trait that increases an individual's ability to pass along its alleles.

### Key Questions

**How does natural selection affect single-gene and polygenic traits?**

**What is genetic drift?**

**What conditions are required to maintain genetic equilibrium?**

### Vocabulary

directional selection  
stabilizing selection  
disruptive selection  
genetic drift  
bottleneck effect  
founder effect  
genetic equilibrium  
Hardy-Weinberg principle  
sexual selection

### Talking Notes

**Preview Visuals** Before you read, look at Figure 17-6. What evolutionary trend does it seem to show?

## Getting Started

### Objectives

**17.2.1 Explain** how natural selection affects single-gene and polygenic traits.

**17.2.2 Describe** genetic drift.

**17.2.3 Explain** how different factors affect genetic equilibrium.

### Student Resources

**Study Workbooks A and B**, 17.2 Worksheets

**Spanish Study Workbook**, 17.2 Worksheets

**Lab Manual B**, 17.2 Data Analysis Worksheet, Hands-On Activity Worksheet

**Student Resources** Lesson Overview • Lesson Notes • Activity: Art in Motion • Assessment: Self-Test, Lesson Assessment

For corresponding lesson in the **Foundation Edition**, see pages 409–413.

### Activate Prior Knowledge

Based on what they learned in Chapter 16 about Darwin's theory of evolution, have several students in turn state a fact about, or give an example of, natural selection.

**Ask:** If Darwin had known what you know about genes, how do you think he would have defined fitness? (Sample answers: possession of genes that enhance survivability; ability of an individual to pass copies of its genes to its offspring)



### NATIONAL SCIENCE EDUCATION STANDARDS

#### UNIFYING CONCEPTS AND PROCESSES

1, 2, 3, 4

#### CONTENT

C.2.c, C.3.a, C.3.b, C.3.c

#### INQUIRY

A.1.b, A.1.c, A.2.a, A.2.d

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## U2D Teach for Understanding

**ENDURING UNDERSTANDING** The diversity of life is the result of ongoing evolutionary change. Species alive today have evolved from ancient common ancestors.

**GUIDING QUESTION** What causes a population's gene pool to change?

**EVIDENCE OF UNDERSTANDING** After the lesson, give students the following assessment to determine whether they understand the role of chance events in the evolution of small populations. Have pairs of students use coin tosses to simulate the effects of chance on the allele frequencies in a population of 10 individuals. In the first generation, there are 10 “heads” alleles and 10 “tails” alleles. Students should assume that there are 10 individuals in the next generation. Students should toss the coin twice for each individual in the next generation and record the outcomes of the tosses. After pairs compare their new allele frequencies, have each student write a brief explanation of whether genetic drift has occurred.

# Populations Vocabulary Review Labeling Diagrams

**Maria G. Dove,Andrea  
Honigsfeld,Carrie McDermott Goldman**



## **Populations Vocabulary Review Labeling Diagrams:**

**Strategies for Building Academic Vocabulary in Social Studies** Christine Dugan,2010-01-01 Boost students social studies vocabulary with easy to implement effective strategies Sample lessons using each strategy are included for grade spans K 2 3 5 6 8 and 9 12 using vocabulary words from standards based content specific units of study **Ss98 World Regions Pupils Edition** ,1997-03 **Living Things for Grades 3-5** Jennifer E. Lawson,2021-09-13 Living Things for Grades 3 5 from Hands On Science for British Columbia An Inquiry Approach completely aligns with BC s New Curriculum for science Grounded in the Know Do Understand model First Peoples knowledge and perspectives and student driven scientific inquiry this custom written resource emphasizes Core Competencies so students engage in deeper and lifelong learning develops Curricular Competencies as students explore science through hands on activities fosters a deep understanding of the Big Ideas in science Using proven Hands On features Living Things for Grades 3 5 contains information and materials for both teachers and students including Curricular Competencies correlation charts background information on the science topics complete easy to follow lesson plans digital reproducible student materials and materials lists Innovative new elements have been developed specifically for the new curriculum a multi age approach a five part instructional process Engage Explore Expand Embed Enhance an emphasis on technology sustainability and personalized learning a fully developed assessment plan for summative formative and student self assessment a focus on real life Applied Design Skills and Technologies learning centres that focus on multiple intelligences and universal design for learning UDL place based learning activities Makerspaces and Loose Parts In Living Things for Grades 3 5 students investigate plants and animals Core Competencies and Curricular Competencies will be addressed while students explore the following Big Ideas Plants and animals have observable features Living things have features and behaviours that help them survive in their environment Living things have life cycles adapted to their environment **Mapping Skills with Google Earth:** **Population Maps** Paul Bramley,2013-10-01 This is the chapter slice Population Maps from the full lesson plan Mapping Skills with Google Earth Move on from a basic understanding of map reading to a more complex one with our engaging resource designed for students in grades six to eight Students will further develop their ability to read and understand maps by looking at weather and population maps Then students will engage in mapping their country in detail including states provinces capitals cultural and geographical features Finally students will move on to mapping their continent and then the world Comprised of reading passages map activities crossword word search and comprehension quiz our resource incorporates curriculum based lessons with Google Earth so students can further understand the complexities of map reading with the help of visual and interactive technology All of our content meets the Common Core State Standards and are written to Bloom s Taxonomy **Nine Dimensions of Scaffolding for Multilingual Learners** Maria G. Dove,Andrea Honigsfeld,Carrie McDermott Goldman,2025-07-24 Create a rigorous learning environment with strategic and inclusive

scaffolding practices Today s classrooms are more linguistically diverse than ever but many educators still feel underprepared to support multilingual learners in accessing grade level academic content Without intentional scaffolding these students miss opportunities to thrive alongside their peers Through nine scaffolded approaches instructional linguistic multimodal multisensory graphic digital interactive collaborative social emotional and environmental this resource offers content area teachers research based practical strategies to meet the linguistic social emotional and academic needs of multilingual learners Key features of this book include Detailed vignettes and authentic examples from classrooms to illustrate scaffolding in action Research based strategies for integrating scaffolds into lessons across content areas Self assessment tools and reflection questions for personal and professional growth Practical templates to help educators tailor their scaffolding techniques to individual student needs Scaffolding instruction is not just another teaching approach to learning it is a critical non negotiable for multilingual learners providing a lifeline to language mastery academic achievement and a profound sense of belonging Dove Honigsfeld and McDermott Goldman offer the guidance and inspiration educators need to cultivate equitable engaging learning opportunities that truly help multilingual students to soar

**Microsoft Office 2003** Pasewark and Pasewark LTD.,William R. Pasewark,2005      **Microsoft Office XP** Pasewark and Pasewark Staff,2001-09      Forum ,1982      A Population Health Approach to Health Disparities for Nurses Faye Gary,Marilyn Lotas,2022-10-14 Awarded second place in the 2023 AJN Book of the Year Awards in Public and Population Health Offers vivid narratives illuminating the challenges and opportunities health professionals and policymakers face Distinguished by abundant patient and health provider narratives highlighting the impact of health disparities on health outcomes worldwide this scholarly yet practical text prepares RN BSN DNP and PhD students to work toward improving community health for a variety of underserved and vulnerable populations Grounded in the population health approach addressed in AACN Essentials the text delivers practical steps nurses can take to address population health goals including the improvement of quality of care access to healthcare improved outcomes and cost management The resource is also unique in its reflection of the interconnected points of view of the patient the provider and the health system Written by lawyers physicians social workers statisticians and economists psychologists ethicists finance experts population health specialists anthropologists and nurses the text emphasizes an interdisciplinary approach to learning and all components of health care delivery of care policy research and teaching It examines demographic differences chronic and acute health conditions and the health needs of the unserved underserved across the life cycle The book emphasizes the importance of understanding the social determinants of health and discusses ways to address health disparities through changes in public policy attitudes beliefs education research and advocacy Objectives key terms discussion questions and exercises facilitate group discussion about best practices Key Features Delivers practical knowledge with detailed narratives and case studies of specific populations from experienced interprofessional authors Highlights the interwoven perspectives of patients health

providers and health systems to promote cultural competence Pinpoints health disparities including a discussion of COVID 19 Presents selected historical landmarks and cases that influence population health outcomes among vulnerable groups Interdisciplinary approach includes the perspectives of other health and social science disciplines *Houghton Mifflin Mathematics* ,2002

**Pervasive Computing** Jadwiga Indulska,2008-04-29 This book constitutes the refereed proceedings of the 6th International Conference on Pervasive Computing PERVASIVE 2008 held in Sydney Australia in May 2008 The 18 revised full papers presented were carefully selected during two rounds of reviewing and improvement The papers are organized in topical sections on sensing and activity recognition applications for mobile devices location in pervasive systems platforms for pervasive computing lessons learned from displays games and health applications as well as privacy and security *Resources in Education* ,1999-10

*Instructional Design* S. Dijkstra,1997 Instructional design theory and practice has evolved over the past 30 years from an initial narrow focus on programmed instruction to a multidimensional field of study integrating psychology technology evaluation measurement and management The growth of instructional design ID has occurred because of direct needs problems and goals from society Its application in planning instruction first developed in the United States with the Department of Defense during World War II with the purpose of meeting immediate concerns for effective training of larger numbers of military personnel From the beginning ID has rapidly expanded into applications in industrial and executive training vocational training classroom learning and professional education Although ID has its roots in the U S applications and theoretical growth is an international activity However literature at the international level is still limited to either individual author contributions or collections primarily represented by single countries As a result there is no standard reference source that contains the rich variety of theories and applications to form the international foundation for the field The goal of this two volume set is to establish international foundations for ID theory research and practice within the framework of the two following objectives to identify and define the theoretical research and model foundations for ID and to bridge the gap between ID foundations and application Volume I includes chapters on philosophical and theoretical issues on learning theory and ID models Volume II provides an overview of the state of the art of solving ID problems The contributors offer contrasting points of view which provide a rare opportunity to see the diversity and complexity in the field The editorial committee has selected a wide range of internationally known authors to make presentations in the topic areas of the field

**Food and Nutrition Information and Educational Materials Center catalog** Food and Nutrition Information Center (U.S.),1976 *CLIL Activities with CD-ROM* Liz Dale,Rosie Tanner,2012-03-15 Innovative activities for Content and Language Integrated Learning CLIL teachers and trainee teachers CLIL Activities is organised into five chapters Activating Guiding understanding Focus on language Focus on speaking and Focus on writing A further chapter provides practical ideas for assessment review and feedback The Background to CLIL section offers a clear explanation of what CLIL is and its benefits and challenges The book contains a wide range of easily

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Sharon Vaughn,2015-01-01 This guide includes lessons that allow you to focus on the foundational skills that are so important to emergent readers as they connect sounds to letters decode words and develop a bank of sight words and academic vocabulary In this guide you will find tools to provide students with explicit and systematic phonemic awareness and phonics instruction Each lesson links to an engaging studentbook that introduces phonics skills and provides a strong text to photo match in order to reinforce comprehension and build content area knowledge **STEM Labs for Life**

**Science, Grades 6 - 8** Schyrlet Cameron,Carolyn Craig,2017-01-03 STEM Labs for Life Science by Mark Twain includes 26 fun integrated labs that help students understand concepts such as life human body systems ecosystems This middle school life science book encourages students to collaborate and communicate to solve real world problems The STEM Labs for Life Science book for sixth eighth grades features introductory materials to explain STEM education concepts and provides materials for instruction and assessment Correlated to meet current state standards each lab combines the following essential STEM concepts communication creativity teamwork critical thinking The Mark Twain Publishing Company provides classroom decorations and supplemental books for middle grade and upper grade classrooms These products are designed by leading educators and cover science math behavior management history government language arts fine arts and social studies

**Conducting Health Research** Frederick J. Kviz,2019-02-20 Conducting Health Research Principles Process and Methods presents an integrated and practical introduction to the principles and strategies for planning implementing reporting and assessing health sciences research Comprehensive in its breadth and depth with an accessible writing style this text prepares students in public health and related fields to be adept researchers and consumers of health research Through real world examples and step by step guidance Frederick J Kviz provides students with the skills they need to identify and evaluate research strengths and limitations as practitioners to actually perform the various core aspects of research and to choose among alternative methods when making decisions about health practice policy and future research needs

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secondary connects to the r terminal on the control board and the other leg connects to the c terminal in this example there s actually a c terminal present but that will not always be the case especially in old models

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