

Lab # : Virtual Lab – Population Biology

Problem How does competition affect population growth?

Background (Read the background in order to answer the Pre-Lab Questions that follow)

The genus *Paramecium* includes several species of one-celled protists that live in freshwater. When there is enough food, water, and space, populations of these species grow rapidly and follow a pattern known as exponential growth, in which the total number of potentially reproducing organisms increases with each generation. However, populations of any organism will not increase indefinitely. Eventually, limitations on food, water, and other resources will cause the population to stop increasing.



When a population arrives at the point where its size remains stable, it has reached the *carrying capacity* of the environment. The carrying capacity is the greatest number of individuals a given environment can sustain. Competition for resources among members of a population (*intraspecific competition*) places limits on population size.

Competition for resources among members of two or more different species (*interspecific competition*) also affects population size. In a classic series of experiments in the 1930s, a Russian ecologist, G.F. Gause, formulated his *principle of competitive exclusion*. This principle states that if two species are competing for the same resource, the species with a more rapid growth rate will outcompete the other. In other words, no two species can occupy the same niche.

In competing populations of organisms, genetic variations that reduce competition are favored through natural selection. Suppose two species (A and B) compete for the same food source. Individuals of species A can also use another food source, which reduces the competition over the food source needed by species B. The individuals of species A that can use another food source survive because they do not have to compete with individuals of species B for that food. In nature, organisms frequently invade unoccupied habitats simply to avoid intense competition. Once the organism is in a new habitat, any variations that allow it to use the available resources will tend to be perpetuated through the population. In this way, the genetic makeup of the population may slowly change, and the species will become adapted to a new niche.

Objectives

- Conduct an experiment on two species of the protozoan *Paramecium*, growing each alone and then growing them together.
- Graph and compare growth curves of the populations of each species, alone and together.
- Show how competition for natural resources in the environment can affect population growth.
- Explain how availability of resources, such as food, can be limiting factors for populations.

Materials: cultures of *Paramecium caudatum* and *P. Aurelia*

Procedure: See Virtual Lab at web site http://glencoe.mcgraw-hill.com/sites/dl/free/0078757134/383928/BL_04.html

Population Biology Virtual Lab Answer

Michael Brown



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Table of Contents Population Biology Virtual Lab Answer

1. Understanding the eBook Population Biology Virtual Lab Answer
 - The Rise of Digital Reading Population Biology Virtual Lab Answer
 - Advantages of eBooks Over Traditional Books
2. Identifying Population Biology Virtual Lab Answer
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Population Biology Virtual Lab Answer
 - User-Friendly Interface
4. Exploring eBook Recommendations from Population Biology Virtual Lab Answer
 - Personalized Recommendations
 - Population Biology Virtual Lab Answer User Reviews and Ratings
 - Population Biology Virtual Lab Answer and Bestseller Lists

5. Accessing Population Biology Virtual Lab Answer Free and Paid eBooks
 - Population Biology Virtual Lab Answer Public Domain eBooks
 - Population Biology Virtual Lab Answer eBook Subscription Services
 - Population Biology Virtual Lab Answer Budget-Friendly Options
6. Navigating Population Biology Virtual Lab Answer eBook Formats
 - ePub, PDF, MOBI, and More
 - Population Biology Virtual Lab Answer Compatibility with Devices
 - Population Biology Virtual Lab Answer Enhanced eBook Features
7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Population Biology Virtual Lab Answer
 - Highlighting and Note-Taking Population Biology Virtual Lab Answer
 - Interactive Elements Population Biology Virtual Lab Answer
8. Staying Engaged with Population Biology Virtual Lab Answer
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Population Biology Virtual Lab Answer
9. Balancing eBooks and Physical Books Population Biology Virtual Lab Answer
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Population Biology Virtual Lab Answer
10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
11. Cultivating a Reading Routine Population Biology Virtual Lab Answer
 - Setting Reading Goals Population Biology Virtual Lab Answer
 - Carving Out Dedicated Reading Time
12. Sourcing Reliable Information of Population Biology Virtual Lab Answer
 - Fact-Checking eBook Content of Population Biology Virtual Lab Answer
 - Distinguishing Credible Sources
13. Promoting Lifelong Learning

- Utilizing eBooks for Skill Development
- Exploring Educational eBooks

14. Embracing eBook Trends

- Integration of Multimedia Elements
- Interactive and Gamified eBooks

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