

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

**Mitsuko Aramaki, Keiji Hirata, Tetsuro
Kitahara, Richard Kronland-
Martinet, Sølvi Ystad**

Population Biology Virtual Lab Answer:

E-Learning as a Socio-Cultural System: A Multidimensional Analysis Zuzevičiūtė, Vaiva, Butrimė, Edita, Vitkutė-Adžgauskienė, Daiva, Vladimirovich Fomin, Vladislav, Kikis-Papadakis, Kathy, 2014-06-30 Information and communication technologies play a crucial role in a number of modern industries Among these education has perhaps seen the greatest increases in efficiency and availability through Internet based technologies E Learning as a Socio Cultural System A Multidimensional Analysis provides readers with a critical examination of the theories models and best practices in online education from a social perspective evaluating blended distance and mobile learning systems with a focus on the interactions of their practitioners Within the pages of this volume teachers students administrators policy makers and IT professionals will all find valuable advice and enriching personal experiences in the field of online education **K-12 STEM Education: Breakthroughs in Research and Practice** Management Association, Information Resources, 2017-10-31 Education is vital to the progression and sustainability of society By developing effective learning programs this creates numerous impacts and benefits for future generations to come K 12 STEM Education Breakthroughs in Research and Practice is a pivotal source of academic material on the latest trends techniques technological tools and scholarly perspectives on STEM education in K 12 learning environments Including a range of pertinent topics such as instructional design online learning and educational technologies this book is an ideal reference source for teachers teacher educators professionals students researchers and practitioners interested in the latest developments in K 12 STEM education

Revolutionizing K-12 Blended Learning through the i2Flex Classroom Model Avgerinou, Maria D., Gialamas, Stefanos P., 2016-06-20 Blended learning has gained significant attention recently by educational leaders practitioners and researchers i Flex a variation of blended learning is based on the premise that certain non interactive teaching activities such as lecturing can take place by students without teachers direct involvement Classroom time can then be used for educational activities that fully exploit teacher student and student student interactions allowing for meaningful personalized feedback and scaffolding on demand Revolutionizing K 12 Blended Learning through the i Flex Classroom Model presents a well rounded discussion on the i Flex model highlighting methods for K 12 course design delivery and evaluation in addition to teacher performance assessment in a blended i Flex environment Emphasizing new methods for improving the classroom and learning experience in addition to preparing students for higher education and careers this publication is an essential reference source for pre service and in service teachers researchers administrators and educational technology developers

The SAGE Encyclopedia of Online Education Steven L. Danver, 2016-04-15 Online education both by for profit institutions and within traditional universities has seen recent tremendous growth and appeal but online education has many aspects that are not well understood The SAGE Encyclopedia of Online Education provides a thorough and engaging reference on all aspects of this field from the theoretical dimensions of teaching online to the technological aspects of implementing online

courses with a central focus on the effective education of students Key topics explored through over 350 entries include Technology used in the online classroom Institutions that have contributed to the growth of online education Pedagogical basis and strategies of online education Effectiveness and assessment Different types of online education and best practices The changing role of online education in the global education system [FormaMente n. 1-2/2012](#) AA.

VV.,2012-07-25T00:00:00+02:00 RICERCA Jet momentum dependence of jet quenching in PbPb collisions at SNN 2 76 TeV The CMS Collaboration Modeling the metaverse a theoretical model of effective team collaboration in 3D virtual environments Sarah van der Land Alexander P Schouten Bart van den Hooff Frans Feldberg The capture of moving object in video image Weina Fu Zhiwen Xu Shuai Liu Xin Wang Hongchang Ke Visual metaphors in virtual worlds The example of NANEC 2010 11 Dolors Capdet Von Neuromancer zu Second Life Raumsimulationen im Cyberspace Steffen Kr mer APPLICAZIONI APPLICAZIONI Sensor models and localization algorithms for sensor networks based on received signal strength Fredrik Gustafsson Fredrik Gunnarsson David Lindgren Interactive lab to learn radio astronomy microwave antenna engineering at the Technical University of Cartagena Jos Luis Gomez Tornero David Calate Rebenaque Fernando Daniel Quesada Pereira Alejandro lvarez Melc n **The Dynamics of Physiologically Structured Populations** Johan A. Metz,Odo Diekmann,2014-03-11 [Forensic Biology](#) Max M. Houck,2015-01-08 Forensic Biology provides coordinated expert content from world renowned leading authorities in forensic biology Covering the range of forensic biology this volume in the Advanced Forensic Science Series provides up to date scientific learning on DNA analysis Technical information written with the degreed professional in mind brings established methods together with newer approaches to build a comprehensive knowledge base for the student and practitioner alike Like each volume in the Advanced Forensic Science Series review and discussion questions allow the text to be used in classrooms training programs and numerous other applications Sections on fundamentals of forensic science history safety and professional issues provide context and consistency in support of the forensic enterprise Forensic Biology sets a new standard for reference and learning texts in modern forensic science Advanced articles written by international forensic biology experts Covers the range of forensic biology including methods and interpretation Includes entries on history safety and professional issues Useful as a professional reference advanced textbook or training review *Overcoming Challenges in Online Learning* Areej ElSayary,Abdulrasheed Olowoselu,2023-03-03 This book examines four distinct areas of education that suffered as a result of the COVID 19 pandemic in Asian and African regions and tackles the challenges and barriers that came as a result of the shift to online learning Presenting perspectives from China Malaysia Nigeria and the UAE chapters frame research within the context of innovation experiences to explore transformative learning theory and set out the ways in which leaders educators students and parents adapted to learning during the pandemic Foregrounding four central topics challenges and barriers teaching and learning assessment educational technology and interactive learning environments the volume provides globally

relevant findings and implications for the effects of the pandemic on learning in these regions and furthers the field of educational technology more broadly Topics covered range from teaching and leading in the online learning environment to educational technology and the interactive learning space Sharing innovative experiences to aid progression and share best practice for online learning moving forward the book will be highly relevant to researchers academics and students in the fields of higher education online and eLearning and technology in education

Artificial Intelligence in Education C.-K. Looi,G. McCalla,B. Bredeweg,2005-07-14 The field of Artificial Intelligence in Education includes research and researchers from many areas of technology and social science This study aims to open opportunities for the cross fertilization of information and ideas from researchers in the many fields that make up this interdisciplinary research area

Carolina Science and Math Carolina Biological Supply Company,2003

Nuclear Science Abstracts ,1969

Computer and Computing Technologies in Agriculture Daoliang Li,Yingyi Chen,2012-01-12 The three volume set IFIP AICT 368 370 constitutes the refereed post conference proceedings of the 5th IFIP TC 5 SIG 5 1 International Conference on Computer and Computing Technologies in Agriculture CCTA 2011 held in Beijing China in October 2011 The 189 revised papers presented were carefully selected from numerous submissions They cover a wide range of interesting theories and applications of information technology in agriculture including simulation models and decision support systems for agricultural production agricultural product quality testing traceability and e commerce technology the application of information and communication technology in agriculture and universal information service technology and service systems development in rural areas The 68 papers included in the second volume focus on GIS GPS RS and precision farming

Carcinogenesis Abstracts ,1978

Internet Literacy Fred Thomas Hofstetter,2001 Textbook with CD ROM providing tutorials on understanding the Internet and World Wide Web

Creating Project-Based STEM Environments Jennifer Wilhelm,Ronald Wilhelm,Merryn Cole,2019-02-05 This book models project based environments that are intentionally designed around the United States Common Core State Standards CCSS 2010 for Mathematics the Next Generation Science Standards NGSS Lead States 2013 for Science and the National Educational Technology Standards ISTE 2008 The primary purpose of this book is to reveal how middle school STEM classrooms can be purposefully designed for 21st Century learners and provide evidence regarding how situated learning experiences will result in more advanced learning This Project Based Instruction PBI resource illustrates how to design and implement interdisciplinary project based units based on the REAL Realistic Explorations in Astronomical Learning Unit 1 and CREATES Chemical Reactions Engineered to Address Thermal Energy Situations Unit 2 The content of the book details these two PBI units with authentic student work explanations and research behind each lesson including misconceptions students might hold regarding STEM content pre post research results of unit implementation with over 40 teachers and thousands of students In addition to these two units there are chapters describing how to design one s own research based PBI units incorporating teacher commentaries regarding strategies obstacles

overcome and successes as they designed and implemented their PBI units for the first time after learning how to create PBI STEM Environments the REAL way **Soviet Life** ,1980 Music in the AI Era Mitsuko Aramaki,Keiji Hirata,Tetsuro Kitahara,Richard Kronland-Martinet,Sølvi Ystad,2023-06-21 This book constitutes the refereed proceedings and revised selected papers from the 15th International Symposium on Music in the AI Era CMMR 2021 which took place during November 15 19 2021 as a virtual event The 24 full papers included in this book were carefully reviewed and selected from 48 submissions The papers are grouped in thematical sessions on Music technology in the IA era Interactive systems for music Music Information Retrieval and Modeling and Music and Performance Analysis **Dis/ability in Media, Law and History** Micky Lee, Frank Rudy Cooper, Patricia Reeve, 2022-06-17 This book explores how being disabled originates in the physical world social representations and rules and historical power relations the interplay of which render bodies normal or not Do parking signs that represent people in wheelchairs as self propelling influence how we view dis ability How do wheelchair users understand their own bodies and an environment not built for them By asking questions like these the authors reveal how normalization has informed people s experiences of their bodies and their fight for substantive equality Understanding these processes requires acknowledging the tension between social construction and embodiment as well as centering the intersection of dis abilities with other identities such as race class gender sex orientation citizen status and so on Scholars and researchers will find that this book provides new avenues for thinking about dis ability A wider audience will find it accessible and informative Computational Intelligence Methods for Bioinformatics and Biostatistics Andrea Bracciali, Giulio Caravagna, David Gilbert, Roberto Tagliaferri, 2017-10-14 This book constitutes the thoroughly refereed post conference proceedings of the 13th International Meeting on Computational Intelligence Methods for Bioinformatics and Biostatistics CIBB 2016 held in Stirling UK in September 2016 The 19 revised full papers and 6 keynotes abstracts presented were carefully reviewed and selected from 61 submissions The papers deal with the application of computational intelligence to open problems in bioinformatics biostatistics systems and synthetic biology medicalinformatics computational approaches to life sciences in general **Oceanic Abstracts** ,1995-02

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