cellular communication pogil

cellular communication pogil is an interactive instructional approach designed to deepen students' understanding of cellular communication processes through guided inquiry and collaborative learning. This method emphasizes active participation and critical thinking, enabling learners to explore complex biological signaling pathways systematically. Cellular communication pogil activities typically involve problem-solving tasks that illustrate how cells transmit and receive signals, which are fundamental to maintaining homeostasis and coordinating bodily functions. By engaging with these activities, students develop a clearer grasp of key concepts such as signal transduction, receptor function, and intracellular responses. This article will provide an in-depth overview of cellular communication pogil, examining its principles, applications, and educational benefits. The discussion will include the mechanisms of cellular signaling, the structure of pogil activities, and strategies for effective implementation in science education. Readers will gain a comprehensive understanding of how this approach enhances learning outcomes in cellular biology.

Understanding Cellular Communication

Cellular communication is a fundamental biological process that allows cells to detect and respond to signals in their environment. This complex system ensures that cells coordinate activities such as growth, immune responses, and metabolism. Signal transmission occurs through various mechanisms including chemical messengers like hormones, neurotransmitters, and growth factors. The process involves reception, signal transduction, and cellular response, all of which are critical for proper physiological function.

Signal Reception and Receptors

Signal reception is the initial step in cellular communication, where specific molecules known as ligands bind to receptors located on the cell surface or inside the cell. These receptors are typically proteins that undergo conformational changes upon ligand binding, triggering downstream signaling cascades. Understanding receptor types—such as G-protein-coupled receptors, ion channel receptors, and enzyme-linked receptors—is essential to grasp how cells interpret diverse signals.

Signal Transduction Pathways

Once a signal is received, the information is transmitted through intracellular signaling pathways, commonly called signal transduction pathways. These cascades involve a series of molecular interactions and modifications, including phosphorylation and second messenger production. Key pathways include the cAMP pathway, MAP kinase pathway, and calcium signaling, each mediating specific cellular responses based on the initial signal.

Principles and Structure of POGIL

Process Oriented Guided Inquiry Learning (POGIL) is an educational strategy that promotes active learning through structured group activities. The cellular communication pogil approach incorporates specific principles designed to foster student engagement and conceptual understanding. These principles include guided inquiry, collaborative learning, and the development of process skills such as critical thinking and problem-solving.

Guided Inquiry Approach

In a POGIL activity, students work through carefully designed questions and tasks that progressively build knowledge. The instructor acts as a facilitator rather than a lecturer, encouraging learners to explore concepts independently and collaboratively. This scaffolding supports students in constructing their understanding of cellular communication mechanisms.

Collaborative Learning Environment

POGIL emphasizes teamwork, with students typically organized into small groups. Each member assumes specific roles, such as manager or recorder, to ensure effective collaboration. This structure enhances communication skills and allows diverse perspectives to contribute to problem-solving, making the learning process more dynamic and inclusive.

Applications of Cellular Communication POGIL in Education

Cellular communication pogil activities are widely used in biology and biochemistry courses to introduce complex topics in an accessible way. These activities facilitate exploration of signaling pathways, receptor functions, and cellular responses through interactive exercises rather than passive memorization. Incorporating pogil into the curriculum supports diverse learning styles and encourages deeper engagement with scientific material.

Integration in Biology and Biochemistry Curricula

Many educators integrate cellular communication pogil modules into units on cell biology, molecular biology, and physiology. These modules align well with learning objectives that focus on

understanding cellular signaling and its implications for health and disease. By providing hands-on inquiry activities, pogil enhances comprehension of intricate biological concepts.

Use in Laboratory and Classroom Settings

POGIL activities can be adapted for both classroom discussions and laboratory exercises. In laboratory settings, students might analyze experimental data related to signal transduction or receptor function, fostering practical applications of theoretical knowledge. In classrooms, pogil sessions encourage group dialogue and conceptual mastery through guided questions and problem sets.

Key Concepts Explored in Cellular Communication POGIL

Cellular communication pogil exercises explore a range of essential concepts within cell signaling. These include the types of signaling molecules, receptor-ligand interactions, signaling cascades, and the cellular outcomes triggered by these processes. The activities often challenge students to apply their knowledge to real-world biological scenarios.

Types of Signaling Molecules

Understanding the diversity of signaling molecules is crucial in cellular communication pogil. These molecules include hormones, neurotransmitters, cytokines, and growth factors, each with distinct roles and modes of action. Activities often require students to classify these molecules based on their properties and signaling mechanisms.

Receptor-Ligand Interactions and Specificity

The specificity of receptor-ligand binding is a foundational concept in cellular signaling. POGIL activities guide students through the biochemical basis of this specificity, including molecular recognition and affinity. Exploring how mutations or inhibitors affect these interactions helps illustrate their biological significance.

Signal Amplification and Cellular Responses

Signal transduction often involves amplification steps, enabling a small number of ligand molecules to elicit significant cellular responses. POGIL tasks encourage learners to analyze mechanisms of amplification, such as second messenger systems, and to understand how different responses like gene expression or metabolic changes are regulated.

Benefits of Using POGIL for Cellular Communication

Employing pogil in the study of cellular communication offers numerous educational benefits. It promotes active learning, improves retention of complex material, and enhances critical thinking skills. The collaborative nature of pogil also fosters communication and teamwork, essential skills for scientific inquiry and professional development.

- Enhances conceptual understanding through active engagement
- Develops analytical and problem-solving skills
- Encourages collaboration and communication among students
- Supports diverse learning preferences with hands-on activities
- Improves retention and transfer of knowledge

Strategies for Effective Implementation

Successful implementation of cellular communication pogil requires thoughtful planning and facilitation. Educators should design activities aligned with learning objectives, provide clear instructions, and foster an inclusive environment that encourages student participation. Monitoring group dynamics and providing timely feedback are also critical to maximizing the effectiveness of pogil sessions.

Designing Engaging POGIL Activities

Activity design should balance challenge and accessibility, ensuring that tasks are intellectually stimulating yet achievable. Incorporating real-world examples and data enhances relevance and student interest. Clear, scaffolded questions guide learners through complex concepts without overwhelming them.

Facilitating Group Work and Discussion

Facilitators play a vital role in supporting group interactions and maintaining focus. Effective facilitation involves prompting discussions, clarifying misconceptions, and encouraging all students to contribute. Establishing group roles and norms at the outset helps maintain productive collaboration.

Frequently Asked Questions

What is the main purpose of cellular communication in multicellular organisms?

The main purpose of cellular communication in multicellular organisms is to coordinate activities and responses among different cells, ensuring proper functioning, development, and homeostasis.

What are the key components involved in cellular communication?

Key components of cellular communication include signaling molecules (ligands), receptors on target cells, and the intracellular signaling pathways that transmit the signal to elicit a response.

How do cells use signal transduction pathways in cellular communication?

Cells use signal transduction pathways to convert an external signal, such as a ligand binding to a receptor, into a specific intracellular response, often involving a cascade of molecular events leading to changes in gene expression or cellular activity.

What role do receptors play in cellular communication?

Receptors detect and bind signaling molecules, initiating the communication process by triggering intracellular signaling pathways that result in a cellular response.

How do gap junctions facilitate cellular communication?

Gap junctions allow direct cytoplasmic exchange of ions and small molecules between adjacent cells, enabling rapid and coordinated communication especially in tissues like cardiac muscle.

What is the difference between autocrine, paracrine, and endocrine signaling?

Autocrine signaling affects the same cell that releases the signal, paracrine signaling affects nearby cells, and endocrine signaling involves hormones traveling through the bloodstream to reach distant target cells.

Why is cellular communication important for immune responses?

Cellular communication enables immune cells to recognize pathogens, activate defense mechanisms, and coordinate their actions to effectively respond to infections.

How does the POGIL approach enhance understanding of cellular communication?

The POGIL (Process Oriented Guided Inquiry Learning) approach promotes active learning through

guided questions and collaborative work, helping students deeply understand cellular communication concepts by constructing knowledge themselves.

What types of molecules commonly serve as signaling ligands in cellular communication?

Common signaling ligands include hormones, neurotransmitters, growth factors, and cytokines, each facilitating communication between cells in various contexts.

How can disruptions in cellular communication lead to diseases?

Disruptions in cellular communication, such as faulty receptors or signaling pathways, can lead to diseases like cancer, diabetes, and autoimmune disorders by causing cells to behave abnormally.

Additional Resources

1. *Cellular Communication POGIL: An Interactive Approach to Cell Signaling*
This book offers a hands-on, inquiry-based learning experience focused on cellular communication processes. Designed for students and educators, it uses Process Oriented Guided Inquiry Learning (POGIL) strategies to explore cell signaling pathways, receptor functions, and signal transduction mechanisms. The activities encourage critical thinking and collaborative learning to deepen understanding of how cells communicate.

2. *Exploring Cell Signaling through POGIL Activities*
A comprehensive resource that introduces core concepts of cellular communication using POGIL methodology. The book presents structured activities that guide learners through complex topics such as second messengers, phosphorylation cascades, and feedback regulation. It's ideal for high school and undergraduate biology courses aiming to enhance interactive learning.

3. *POGIL for Molecular and Cellular Biology: Focus on Communication Networks*
This title integrates POGIL strategies with molecular and cellular biology topics, emphasizing cellular communication networks. Students engage in problem-solving exercises that elucidate receptor-ligand interactions, intracellular signaling pathways, and gene expression regulation. The book fosters a deeper conceptual grasp necessary for advanced biology studies.

4. *Interactive Learning in Cellular Communication: POGIL Activities for Biology Educators*
Targeted at biology educators, this book provides ready-to-use POGIL activities centered on cellular communication. It includes lesson plans designed to promote active learning and student engagement in topics such as hormone signaling, neurotransmission, and immune cell communication. The resource supports diverse classroom settings and encourages collaborative inquiry.

5. *Signal Transduction Pathways: A POGIL-Based Approach*
Focusing on signal transduction, this book uses POGIL techniques to help students dissect complex cellular communication pathways. Detailed activities guide learners through key concepts like receptor activation, second messengers, and downstream effects on cellular responses. It’s a valuable tool for reinforcing theoretical knowledge with practical application.

6. *Cell Communication and POGIL: Enhancing Understanding of Intercellular Signaling*
This instructional text emphasizes the principles of intercellular signaling through interactive POGIL exercises. It covers various communication modes including paracrine, autocrine, and endocrine signaling, highlighting their physiological relevance. The book encourages students to analyze data and construct models of cellular communication processes.

7. *Foundations of Cellular Communication: POGIL Activities for Life Science Students*
Designed for life science students, this book introduces foundational concepts of cellular communication using POGIL frameworks. It explores membrane receptors, signal amplification, and cellular responses through guided inquiry. The activities are structured to build critical thinking and facilitate mastery of essential biology concepts.

8. *Collaborative Learning in Cell Signaling: POGIL Strategies and Applications*
This resource details how POGIL can be effectively applied to teach cell signaling and communication. It offers collaborative exercises that promote teamwork and conceptual understanding of signaling molecules, pathways, and cellular outcomes. Educators can use this book to create an engaging and interactive learning environment.

9. *Advanced Cellular Communication: A POGIL Workbook for Undergraduate Biology*
Aimed at undergraduate students, this workbook presents advanced topics in cellular communication through POGIL activities. It covers complex signaling networks, cross-talk between pathways, and regulatory mechanisms. The workbook challenges students to apply knowledge in problem-solving scenarios, enhancing their analytical skills in cell biology.

Cellular Communication Pogil

Cellular Communication POGIL

Name: Unlocking the Secrets of Cellular Communication: A POGIL Approach

Contents:

Unlocking the Secrets of Cellular Communication: A POGIL Approach

Introduction: The Language of Life

Cellular communication is the intricate dance of signals and responses that orchestrate the functions of life. From the simplest unicellular organism to the most complex multicellular being, cells must constantly communicate to coordinate their activities, maintain homeostasis, and respond to their environment. This communication is not a haphazard process; it follows precise, highly regulated pathways that are essential for health and survival. Understanding these pathways is crucial for advancements in medicine, biotechnology, and our basic understanding of biology.

This POGIL (Process Oriented Guided Inquiry Learning) approach provides a student-centered, active learning experience, encouraging critical thinking and problem-solving skills. Unlike passive learning methods, POGIL emphasizes collaboration and discussion, leading to a deeper and more lasting understanding of complex biological processes. The focus will be on applying concepts, analyzing data, and drawing conclusions through guided exercises and collaborative activities.

Chapter 1: Signal Transduction Pathways – The Cellular Relay Race

Signal transduction pathways are the molecular mechanisms cells use to convert one type of signal or stimulus into another. This often involves a cascade of events, where the initial signal is amplified and relayed through a series of molecular interactions. The process typically begins with a ligand (signaling molecule) binding to a specific receptor protein on the cell surface or within the cell. This binding event triggers a chain reaction involving various proteins and secondary messengers, ultimately leading to a cellular response.

Several key components are crucial:

Receptors: These proteins bind to specific ligands, initiating the signaling cascade. Different types of receptors, including G-protein-coupled receptors (GPCRs), receptor tyrosine kinases (RTKs), and ligand-gated ion channels, exist, each with unique mechanisms of action.
Second Messengers: These small molecules (e.g., cAMP, calcium ions, IP3) amplify the initial signal and relay it further downstream in the pathway.
Protein Kinases: These enzymes add phosphate groups to other proteins, often activating or inactivating them.
Protein Phosphatases: These enzymes remove phosphate groups, reversing the effects of protein kinases and regulating the duration and intensity of the signal.

Understanding the intricacies of signal transduction pathways is fundamental to understanding how cells respond to various stimuli, including hormones, neurotransmitters, and growth factors.

Chapter 2: Cell-Cell Communication – The Cellular Network

Cells communicate through various mechanisms, depending on the distance between the communicating cells and the nature of the signal.

Direct Contact: Gap junctions provide direct cytoplasmic connections between adjacent cells, allowing for the rapid exchange of small molecules and ions. Cell-cell recognition through cell adhesion molecules also plays a vital role in development and tissue organization.
Local Signaling: Paracrine signaling involves the release of signaling molecules that affect nearby cells. Autocrine signaling involves cells secreting signals that affect themselves. Synaptic signaling is a specialized form of paracrine signaling occurring between neurons, where neurotransmitters are released into the synapse to transmit signals rapidly.
Long-Distance Signaling: Endocrine signaling involves the release of hormones into the bloodstream, allowing for communication over long distances. Hormones travel throughout the body, affecting target cells with specific receptors.

The different modes of cell-cell communication are crucial for coordinating the activities of cells within tissues and organs, ensuring proper development and function.

Chapter 3: Specific Examples of Cellular Communication – Case Studies in Cellular Interaction

This chapter delves into specific examples, illustrating the diversity and importance of cellular communication in various biological processes:

Immune Response: The immune system relies heavily on cellular communication to identify and eliminate pathogens. Immune cells communicate using cytokines and other signaling molecules, coordinating their actions to mount an effective defense.
Neuronal Signaling: Neurons communicate via electrochemical signals, transmitting information rapidly across long distances. Neurotransmitters released at synapses trigger changes in the postsynaptic neuron, enabling complex neural computations.
Hormonal Regulation: Hormones regulate various physiological processes, including metabolism, growth, and reproduction. They bind to specific receptors on target cells, triggering intracellular signaling pathways that alter cellular function.
Apoptosis (Programmed Cell Death): Apoptosis is a regulated form of cell death that plays a crucial role in development and tissue homeostasis. Communication between cells is essential to initiate and regulate apoptosis.

Chapter 4: Dysregulation of Cellular Communication and Disease – When Communication Breaks Down

Failures in cellular communication can lead to various diseases.

Cancer: Cancer cells often exhibit dysregulated signaling pathways, leading to uncontrolled cell growth and division. Mutations in receptors, signaling proteins, or regulatory molecules can disrupt normal cellular communication, contributing to tumor formation and progression.
Diabetes: Diabetes involves defects in insulin signaling, leading to impaired glucose uptake and metabolism. Disruptions in insulin receptor function or downstream signaling pathways can cause hyperglycemia and other metabolic complications.
Autoimmune Diseases: Autoimmune diseases result from the immune system attacking the body's own tissues. Disruptions in immune cell communication and regulation can lead to chronic inflammation and tissue damage.

Neurological Disorders: Neurological disorders often involve dysregulation of neuronal signaling, leading to impaired neuronal function and communication. Mutations in ion channels, neurotransmitter receptors, or signaling proteins can contribute to various neurological diseases.

Chapter 5: Therapeutic Interventions Targeting Cellular Communication – Restoring the Balance

Understanding the mechanisms of cellular communication allows for the development of therapeutic interventions targeting specific signaling pathways:

Drug Development: Many drugs target specific receptors or signaling molecules, modulating cellular responses to treat diseases.
Gene Therapy: Gene therapy can be used to correct genetic defects that affect cellular communication, potentially curing or mitigating the effects of genetic diseases.
Immunotherapy: Immunotherapy harnesses the power of the immune system to fight cancer and other diseases by targeting or modulating specific aspects of cellular communication within the immune system.

Conclusion: A Continuing Conversation

Cellular communication is a dynamic and multifaceted field of research. As our understanding of these complex processes deepens, we can expect further advancements in the development of new therapies and treatments for a wide range of diseases. The POGIL approach, by emphasizing active learning and problem-solving, empowers students to become active participants in this ongoing scientific conversation.

FAQs:

1. What is the difference between paracrine and endocrine signaling? Paracrine signaling affects nearby cells, while endocrine signaling uses hormones transported via the bloodstream to affect distant cells.

2. How do second messengers amplify a signal? Second messengers activate multiple downstream targets, resulting in a larger response than the initial signal alone.

3. What role do receptor tyrosine kinases play in cellular communication? RTKs are crucial in many signaling pathways, often leading to changes in gene expression and cell growth.

4. How can dysregulation of cellular communication lead to cancer? Mutations or dysregulation in signaling pathways can lead to uncontrolled cell growth and division.

5. What are some examples of therapeutic interventions that target cellular communication? Examples include drugs targeting specific receptors, gene therapy correcting genetic defects in signaling pathways, and immunotherapy enhancing immune cell communication.

6. How does the POGIL method enhance learning in cellular communication? The POGIL method uses collaborative activities and problem-solving to deepen understanding compared to passive

learning.

7. What is the significance of apoptosis in cellular communication? Apoptosis involves regulated communication between cells, crucial for development and tissue homeostasis.

8. How does cellular communication relate to autoimmune diseases? Immune cell communication dysregulation can lead to an immune attack on the body's own tissues.

9. What are the future directions in cellular communication research? Future research may focus on personalized medicine targeting specific signaling pathways and developing novel therapies for currently incurable diseases.

Related Articles:

1. G-Protein Coupled Receptors (GPCRs) in Cellular Signaling: A detailed explanation of GPCR structure, function, and their role in various signaling pathways.
2. Receptor Tyrosine Kinases (RTKs) and Cancer: A focus on the role of RTKs in cancer development and the development of targeted therapies.
3. The Role of Second Messengers in Signal Transduction: An in-depth look at the diverse roles of second messengers (cAMP, Ca2+, IP3) in amplifying and diversifying cellular responses.
4. Cell Junctions and Intercellular Communication: Exploring different types of cell junctions and their roles in facilitating direct communication between cells.
5. Hormonal Regulation of Metabolism: Focus on how hormones regulate metabolic processes and the implications of dysregulation in metabolic diseases.
6. Immune System Signaling and Immune Response: A detailed explanation of the complex signaling networks involved in immune system activation and regulation.
7. Synaptic Transmission and Neuronal Communication: Focusing on the mechanisms of neurotransmitter release, receptor binding, and signal transduction in neurons.
8. Apoptosis: The Molecular Mechanisms of Programmed Cell Death: A detailed explanation of the molecular pathways involved in apoptosis and its regulation.
9. Therapeutic Targeting of Signal Transduction Pathways: Discussing various strategies for developing drugs and therapies that target specific signaling pathways involved in disease.

cellular communication pogil: *POGIL* Shawn R. Simonson, 2023-07-03 Process Oriented Guided Inquiry Learning (POGIL) is a pedagogy that is based on research on how people learn and has been shown to lead to better student outcomes in many contexts and in a variety of academic disciplines. Beyond facilitating students' mastery of a discipline, it promotes vital educational outcomes such as communication skills and critical thinking. Its active international community of practitioners provides accessible educational development and support for anyone developing related courses.Having started as a process developed by a group of chemistry professors focused on helping their students better grasp the concepts of general chemistry, The POGIL Project has grown into a dynamic organization of committed instructors who help each other transform classrooms and improve student success, develop curricular materials to assist this process, conduct research expanding what is known about learning and teaching, and provide professional development and collegiality from elementary teachers to college professors. As a pedagogy it has been shown to be effective in a variety of content areas and at different educational levels. This is an introduction to the process and the community.Every POGIL classroom is different and is a reflection of the uniqueness of the particular context – the institution, department, physical space, student body, and instructor – but follows a common structure in which students work cooperatively

in self-managed small groups of three or four. The group work is focused on activities that are carefully designed and scaffolded to enable students to develop important concepts or to deepen and refine their understanding of those ideas or concepts for themselves, based entirely on data provided in class, not on prior reading of the textbook or other introduction to the topic. The learning environment is structured to support the development of process skills –– such as teamwork, effective communication, information processing, problem solving, and critical thinking. The instructor's role is to facilitate the development of student concepts and process skills, not to simply deliver content to the students. The first part of this book introduces the theoretical and philosophical foundations of POGIL pedagogy and summarizes the literature demonstrating its efficacy. The second part of the book focusses on implementing POGIL, covering the formation and effective management of student teams, offering guidance on the selection and writing of POGIL activities, as well as on facilitation, teaching large classes, and assessment. The book concludes with examples of implementation in STEM and non-STEM disciplines as well as guidance on how to get started. Appendices provide additional resources and information about The POGIL Project.

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classroom, doesn’t cost much to implement, and helps foster self-directed learning. Once you flip, you won’t want to go back!

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we teach, how we teach it, and how we assess what our children learn. The book uses exemplary teaching to illustrate how approaches based on what we now know result in in-depth learning. This new knowledge calls into question concepts and practices firmly entrenched in our current education system. Topics include: How learning actually changes the physical structure of the brain. How existing knowledge affects what people notice and how they learn. What the thought processes of experts tell us about how to teach. The amazing learning potential of infants. The relationship of classroom learning and everyday settings of community and workplace. Learning needs and opportunities for teachers. A realistic look at the role of technology in education.

cellular communication pogil: Discipline-Based Education Research National Research Council, Division of Behavioral and Social Sciences and Education, Board on Science Education, Committee on the Status, Contributions, and Future Directions of Discipline-Based Education Research, 2012-08-27 The National Science Foundation funded a synthesis study on the status, contributions, and future direction of discipline-based education research (DBER) in physics, biological sciences, geosciences, and chemistry. DBER combines knowledge of teaching and learning with deep knowledge of discipline-specific science content. It describes the discipline-specific difficulties learners face and the specialized intellectual and instructional resources that can facilitate student understanding. Discipline-Based Education Research is based on a 30-month study built on two workshops held in 2008 to explore evidence on promising practices in undergraduate science, technology, engineering, and mathematics (STEM) education. This book asks questions that are essential to advancing DBER and broadening its impact on undergraduate science teaching and learning. The book provides empirical research on undergraduate teaching and learning in the sciences, explores the extent to which this research currently influences undergraduate instruction, and identifies the intellectual and material resources required to further develop DBER. Discipline-Based Education Research provides guidance for future DBER research. In addition, the findings and recommendations of this report may invite, if not assist, post-secondary institutions to increase interest and research activity in DBER and improve its quality and usefulness across all natural science disciples, as well as guide instruction and assessment across natural science courses to improve student learning. The book brings greater focus to issues of student attrition in the natural sciences that are related to the quality of instruction. Discipline-Based Education Research will be of interest to educators, policy makers, researchers, scholars, decision makers in universities, government agencies, curriculum developers, research sponsors, and education advocacy groups.

cellular communication pogil: *Barriers and Opportunities for 2-Year and 4-Year STEM Degrees* National Academies of Sciences, Engineering, and Medicine, National Academy of Engineering, Policy and Global Affairs, Board on Higher Education and Workforce, Division of Behavioral and Social Sciences and Education, Board on Science Education, Committee on Barriers and Opportunities in Completing 2-Year and 4-Year STEM Degrees, 2016-05-18 Nearly 40 percent of the students entering 2- and 4-year postsecondary institutions indicated their intention to major in science, technology, engineering, and mathematics (STEM) in 2012. But the barriers to students realizing their ambitions are reflected in the fact that about half of those with the intention to earn a STEM bachelor's degree and more than two-thirds intending to earn a STEM associate's degree fail to earn these degrees 4 to 6 years after their initial enrollment. Many of those who do obtain a degree take longer than the advertised length of the programs, thus raising the cost of their education. Are the STEM educational pathways any less efficient than for other fields of study? How might the losses be stemmed and greater efficiencies realized? These questions and others are at the heart of this study. Barriers and Opportunities for 2-Year and 4-Year STEM Degrees reviews research on the roles that people, processes, and institutions play in 2-and 4-year STEM degree production. This study pays special attention to the factors that influence students' decisions to enter, stay in, or leave STEM majorsâ€quality of instruction, grading policies, course sequences, undergraduate learning environments, student supports, co-curricular activities, students' general academic preparedness and competence in science, family background, and governmental and institutional policies that affect STEM educational pathways. Because many students do not take the

traditional 4-year path to a STEM undergraduate degree, Barriers and Opportunities describes several other common pathways and also reviews what happens to those who do not complete the journey to a degree. This book describes the major changes in student demographics; how students, view, value, and utilize programs of higher education; and how institutions can adapt to support successful student outcomes. In doing so, Barriers and Opportunities questions whether definitions and characteristics of what constitutes success in STEM should change. As this book explores these issues, it identifies where further research is needed to build a system that works for all students who aspire to STEM degrees. The conclusions of this report lay out the steps that faculty, STEM departments, colleges and universities, professional societies, and others can take to improve STEM education for all students interested in a STEM degree.

cellular communication pogil: Assessing and Improving Value in Cancer Care Institute of Medicine, Board on Health Care Services, National Cancer Policy Forum, 2009-11-30 Unlike many other areas in health care, the practice of oncology presents unique challenges that make assessing and improving value especially complex. First, patients and professionals feel a well-justified sense of urgency to treat for cure, and if cure is not possible, to extend life and reduce the burden of disease. Second, treatments are often both life sparing and highly toxic. Third, distinctive payment structures for cancer medicines are intertwined with practice. Fourth, providers often face tremendous pressure to apply the newest technologies to patients who fail to respond to established treatments, even when the evidence supporting those technologies is incomplete or uncertain, and providers may be reluctant to stop toxic treatments and move to palliation, even at the end of life. Finally, the newest and most novel treatments in oncology are among the most costly in medicine. This volume summarizes the results of a workshop that addressed these issues from multiple perspectives, including those of patients and patient advocates, providers, insurers, health care researchers, federal agencies, and industry. Its broad goal was to describe value in oncology in a complete and nuanced way, to better inform decisions regarding developing, evaluating, prescribing, and paying for cancer therapeutics.

cellular communication pogil: EBOOK: Foundations of Problem-based Learning Maggi Savin Baden, Claire Howell Major, 2004-08-16 “This book closes a gap in the PBL literature. It is a thoroughly researched, well documented and engagingly written three part harmony addressing conceptual frames, recurring themes, and broadening horizons. An essential addition to your library.” Professor Karl A. Smith, University of Minnesota “…a comprehensive guide for those new to PBL, and suitable for those new to teaching or for the more experienced looking for a new challenge.” Dr Liz Beaty, Director (Learning and Teaching), HEFCE “This book vividly articulates the key ideas of PBL and provides new PBL practitioners with key guiding posts for its implementation. It is an excellent contribution to the art of using PBL.” Associate Professor Oon-Seng Tan, Nanyang Technological University, Singapore ·What is problem-based learning? ·How can it be used in teaching? · How does problem-based learning affect staff and students? · How do we assess and evaluate it? Despite the growth in the use of problem-based learning since it was first popularised, there have been no resources to examine the foundations of the approach and offer straightforward guidance to those wishing to explore, understand, and implement it. This book describes the theoretical foundations of problem-based learning and is a practical source for staff wanting to implement it. The book is designed as a text that not only explores the foundations of problem-based learning but also answers many of the frequently-asked questions about its use. It has also been designed to develops the reader's understanding beyond implementation, including issues such as academic development, cultural, diversity, assessment, evaluation and curricular models of problem-based learning. Foundations of Problem-based Learning is a vital resource for lecturers in all disciplines who want to understand problem-based learning and implement it effectively in their teaching.

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Creech, 2017 The Principles of Biology sequence (BI 211, 212 and 213) introduces biology as a scientific discipline for students planning to major in biology and other science disciplines. Laboratories and classroom activities introduce techniques used to study biological processes and provide opportunities for students to develop their ability to conduct research.

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cellular communication pogil: *The Power of Problem-based Learning* Barbara J. Duch, Susan E. Groh, Deborah E. Allen, 2001-01-01 Problem-based learning is a powerful classroom process, which uses real world problems to motivate students to identify and apply research concepts and information, work collaboratively and communicate effectively. It is a strategy that promotes life-long habits of learning.The University of Delaware is recognized internationally as a center of excellence in the use and development of PBL. This book presents the cumulative knowledge and practical experience acquired over nearly a decade of integrating PBL in courses in a wide range of disciplines.This how to book for college and university faculty. It focuses on the practical questions which anyone wishing to embark on PBL will want to know: Where do I start????How do you find problems????What do I need to know about managing groups????How do you grade in a PBL course?The book opens by outlining how the PBL program was developed at the University of Delaware--covering such issues as faculty mentoring and institutional support--to offer a model for implementation for other institutions.The authors then address the practical questions involved in course transformation and planning for effective problem-based instruction, including writing problems, using the Internet, strategies for using groups, the use of peer tutors and assessment. They conclude with case studies from a variety of disciplines, including biochemistry, pre-law, physics, nursing, chemistry, political science and teacher educationThis introduction for faculty, department chairs and faculty developers will assist them to successfully harness this powerful process to improve learning outcomes.

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remain much the same as they were before these fundamental changes came on the scene. This new volume provides a blueprint for bringing undergraduate biology education up to the speed of today's research fast track. It includes recommendations for teaching the next generation of life science investigators, through: Building a strong interdisciplinary curriculum that includes physical science, information technology, and mathematics. Eliminating the administrative and financial barriers to cross-departmental collaboration. Evaluating the impact of medical college admissions testing on undergraduate biology education. Creating early opportunities for independent research. Designing meaningful laboratory experiences into the curriculum. The committee presents a dozen brief case studies of exemplary programs at leading institutions and lists many resources for biology educators. This volume will be important to biology faculty, administrators, practitioners, professional societies, research and education funders, and the biotechnology industry.

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cellular communication pogil: *Scientific Teaching* Jo Handelsman, Sarah Miller, Christine Pfund, 2007 Seasoned classroom veterans, pre-tenured faculty, and neophyte teaching assistants alike will find this book invaluable. HHMI Professor Jo Handelsman and her colleagues at the Wisconsin Program for Scientific Teaching (WPST) have distilled key findings from education, learning, and cognitive psychology and translated them into six chapters of digestible research points and practical classroom examples. The recommendations have been tried and tested in the National Academies Summer Institute on Undergraduate Education in Biology and through the WPST. Scientific Teaching is not a prescription for better teaching. Rather, it encourages the reader

to approach teaching in a way that captures the spirit and rigor of scientific research and to contribute to transforming how students learn science.

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Safety Controls (engineering controls, administrative controls, personal protective equipment, maintenance of controls).· Addressing general safety, biological and biotechnology, chemical, and physical hazards.· How to deal with various emergency situations.· Planning and design considerations for a safer makerspace, Fab Lab and STEM lab.· Recommended room sizes and equipment for makerspaces, Fab Labs and STEM labs.· Example makerspace, Fab Lab and STEM lab floor plans.· Descriptions and pictures of exemplar makerspaces, Fab Labs and STEM labs.· Special section answering frequently asked safety questions!

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