what is cotransport

what is cotransport is a fundamental concept in cellular biology and physiology, describing a process by which two substances are simultaneously transported across a membrane. This mechanism is essential for maintaining cellular homeostasis, nutrient uptake, and ion balance in various organisms. Cotransport involves the coupling of the movement of one molecule against its concentration gradient with the movement of another molecule down its gradient, utilizing energy stored in the electrochemical gradient. Understanding cotransport is crucial for comprehending how cells regulate substances like glucose, sodium, and amino acids. This article explores the definition, types, mechanisms, biological significance, and examples of cotransport systems. The detailed discussion also highlights the differences between cotransport and other transport mechanisms, such as active and passive transport.

Definition and Overview of Cotransport

Cotransport, also known as coupled transport, refers to the simultaneous movement of two different molecules or ions across a biological membrane via a transporter protein. One molecule typically moves down its electrochemical gradient, releasing energy, which is used to drive the transport of the second molecule against its gradient. This process does not require direct ATP hydrolysis, distinguishing it from primary active transport. Instead, the energy is indirectly derived from the gradient established by primary active transport mechanisms.

Basic Principles of Cotransport

The core principle behind cotransport is the coupling of the downhill movement of one solute to the uphill movement of another. This coupling allows cells to import essential nutrients and export waste products efficiently. Transport proteins involved in cotransport recognize specific substrates and undergo conformational changes to move these molecules across the membrane.

Difference from Other Transport Mechanisms

Cotransport differs from simple diffusion and facilitated diffusion as it involves movement against a concentration gradient, which requires energy. Unlike primary active transport, which uses ATP directly, cotransport relies on the energy stored in ion gradients. This concept distinguishes cotransport as a form of secondary active transport.

Types of Cotransport

Cotransport systems are broadly categorized based on the direction in which the coupled molecules move relative to each other. The two primary types are symport and antiport.

Symport (Cotransport)

Symporters transport two or more molecules in the same direction across the membrane. One molecule moves down its electrochemical gradient, providing the energy necessary for the simultaneous movement of the second molecule against its gradient. This type of cotransport is common in nutrient absorption processes.

Antiport (Counter-transport)

Antiporters move two molecules in opposite directions across the membrane. Similar to symporters, one molecule travels down its gradient, driving the transport of the other molecule against its gradient but in the reverse direction. This mechanism plays a critical role in ion exchange and pH regulation within cells.

Summary of Cotransport Types

- **Symport:** Both molecules move in the same direction.
- **Antiport:** Molecules move in opposite directions.

Mechanism of Cotransport

The cotransport mechanism involves transporter proteins embedded in the cell membrane, which bind to the molecules being transported. The process can be broken down into several key steps.

Step 1: Binding of Substrates

The transporter protein binds to the molecule moving down its concentration gradient first. This binding induces a conformational change that increases the affinity for the second molecule, which is often transported against its gradient.

Step 2: Conformational Change and Transport

Once both substrates are bound, the transporter undergoes a conformational change that exposes the binding sites to the opposite side of the membrane. This change allows the molecules to be released into the intracellular or extracellular space, depending on the transport direction.

Step 3: Resetting the Transporter

After releasing the substrates, the transporter returns to its original conformation, ready to bind new molecules and repeat the cycle. The energy driving this cycle is derived from the electrochemical gradient of the molecule moving downhill.

Biological Importance of Cotransport

Cotransport plays a vital role in numerous physiological processes across different organisms. It is essential for nutrient uptake, ion balance, and cellular signaling, making it fundamental to life functions.

Nutrient Absorption

In the human intestine, cotransporters facilitate the absorption of glucose and amino acids by coupling their transport with sodium ions moving down their gradient. This mechanism enables efficient uptake of nutrients even when their concentrations are low outside the cell.

Ion Homeostasis and pH Regulation

Antiporters help maintain ion balance by exchanging ions such as sodium and hydrogen across membranes. This exchange is critical for regulating intracellular pH and volume, which affects enzyme activities and cellular metabolism.

Neuronal Function

Cotransport is involved in neurotransmitter reuptake and ion movement in neurons. For example, sodium-potassium-chloride symporters contribute to maintaining the ionic environment necessary for nerve impulse transmission.

Examples of Cotransport in Cells

Several well-studied examples illustrate the significance and variety of cotransport mechanisms in biological systems.

Sodium-Glucose Cotransporter (SGLT)

The sodium-glucose cotransporter is a symporter found in the epithelial cells of the small intestine and kidneys. It uses the sodium gradient established by the sodium-potassium pump to transport glucose into cells against its concentration gradient, enabling glucose absorption from the digestive tract.

Sodium-Calcium Exchanger (NCX)

The sodium-calcium exchanger is an antiporter that removes calcium ions from cells by exchanging them for sodium ions. This exchanger is crucial in cardiac muscle cells to regulate calcium levels and maintain proper heart function.

Chloride-Bicarbonate Exchanger

This antiporter facilitates the exchange of chloride and bicarbonate ions across the red blood cell membrane, playing a key role in carbon dioxide transport and pH balance in blood.

Summary of Key Cotransport Examples

- **Sodium-Glucose Cotransporter (SGLT):** Symport of sodium and glucose.
- **Sodium-Calcium Exchanger (NCX):** Antiport of sodium and calcium.
- **Chloride-Bicarbonate Exchanger:** Antiport of chloride and bicarbonate ions.

Frequently Asked Questions

What is cotransport in biological systems?

Cotransport is a type of membrane transport where two substances are simultaneously moved across a membrane by a single protein, often using the gradient of one molecule to drive the transport of another against its gradient.

How does cotransport differ from simple diffusion?

Unlike simple diffusion, cotransport involves the movement of molecules through a protein transporter and can move substances against their concentration gradient by coupling their transport with another molecule moving down its gradient.

What are the two main types of cotransport?

The two main types of cotransport are symport, where both substances move in the same direction across the membrane, and antiport, where the substances move in opposite directions.

Can you give an example of cotransport in cells?

An example of cotransport is the sodium-glucose symporter in intestinal cells, which moves glucose into the cell against its concentration gradient by coupling it with the movement of sodium ions down their gradient.

Why is cotransport important for cellular function?

Cotransport is essential for nutrient uptake, ion balance, and energy efficiency in cells, allowing them to import or export substances that cannot freely diffuse across membranes.

Is cotransport an active or passive transport mechanism?

Cotransport is considered a form of secondary active transport because it utilizes the energy stored in the gradient of one molecule (usually created by primary active transport) to drive the movement of another molecule.

How does cotransport contribute to nutrient absorption in the intestines?

Cotransporters in intestinal cells use the sodium ion gradient to import glucose and amino acids efficiently from the gut lumen into the cells, enabling nutrient absorption even when concentrations are low.

What role does cotransport play in kidney function?

In the kidneys, cotransporters help reabsorb essential ions and nutrients like sodium, potassium, and glucose from the filtrate back into the bloodstream, maintaining homeostasis.

Are cotransport mechanisms found only in animal cells?

No, cotransport mechanisms are found in a variety of organisms including plants, bacteria, and fungi, where they serve similar functions in nutrient uptake and ion regulation.

Additional Resources

1. *Membrane Transport: Cotransport Mechanisms in Cells*
This book provides a comprehensive overview of membrane transport processes, focusing on the principles and mechanisms of cotransport. It explains how cells use cotransporters to move substances across membranes against concentration gradients by coupling with ion gradients. Detailed illustrations and examples from various cell types make it accessible to both students and researchers.

2. *Cell Physiology and Cotransport Systems*
Exploring the physiological relevance of cotransport systems, this book delves into how cotransport affects cellular function and homeostasis. It covers key cotransporters like the sodium-glucose linked transporter (SGLT) and the sodium-potassium-chloride cotransporter (NKCC). Readers will gain insight into the molecular basis and regulatory mechanisms underlying cotransport.

3. *Ion Channels and Cotransporters: Molecular Perspectives*
Focusing on the molecular biology of ion channels and cotransporters, this title examines their structure, function, and role in cellular signaling. It discusses the interplay between ion gradients and cotransport activities, highlighting recent advances in structural biology. This book is ideal for readers interested in the detailed biochemistry and biophysics of cotransport.

4. *Principles of Membrane Transport: Cotransport and Beyond*
This textbook offers a foundational understanding of membrane transport, with a special emphasis on cotransport mechanisms. It integrates theoretical concepts with experimental data to explain how cotransport contributes to nutrient uptake, ion balance, and drug delivery. The book also includes problem sets to reinforce learning.

5. *Physiology of Epithelial Cotransport*
Dedicated to epithelial tissues, this book explores how cotransporters function in organs such as the kidney, intestine, and lungs. It describes how cotransport maintains fluid and electrolyte balance critical for physiological health. Case studies on diseases linked to cotransporter dysfunction provide clinical context.

6. *Cotransport and Cellular Metabolism*

This title investigates the relationship between cotransport processes and cellular metabolic pathways. It explains how cotransport helps cells acquire essential nutrients and remove waste products efficiently. The book also discusses how metabolic states influence cotransporter activity and vice versa.

7. *Transport Proteins: The Role of Cotransporters in Health and Disease*
Focusing on transport proteins, this book highlights the importance of cotransporters in maintaining cellular and systemic health. It reviews genetic mutations and diseases associated with cotransporter malfunction, including cystic fibrosis and hypertension. Therapeutic approaches targeting cotransporters are also examined.

8. *Biophysics of Cotransport: Experimental and Theoretical Approaches*
This specialized book combines experimental findings with theoretical models to explain cotransport phenomena at the biophysical level. It covers techniques such as electrophysiology, fluorescence imaging, and computational simulations. The text is suited for researchers aiming to deepen their understanding of cotransport kinetics and dynamics.

9. *Molecular Mechanisms of Secondary Active Transport*
Focusing on secondary active transport, this book elaborates on how cotransporters utilize energy stored in ion gradients to transport molecules. It discusses various classes of cotransporters and their role in physiological processes. The book also examines recent discoveries in transporter structure and function using cutting-edge technologies.

What Is Cotransport

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What is Cotransport? A Deep Dive into Coupled Membrane Transport

Introduction:

Ever wondered how cells move substances across their membranes against their concentration gradient – a process that requires energy? It's not always about direct energy expenditure like ATP hydrolysis. Sometimes, cells utilize a clever trick called cotransport, a fascinating mechanism of

membrane transport. This comprehensive guide will unravel the intricacies of cotransport, explaining its mechanisms, types, importance, and real-world applications. We'll delve into the specifics, leaving no stone unturned in our exploration of this crucial cellular process. Prepare to gain a thorough understanding of what cotransport is and its significance in biological systems.

1. Understanding Membrane Transport: A Quick Recap

Before diving into cotransport, let's briefly review the fundamental principles of membrane transport. Cell membranes are selectively permeable, meaning they control the passage of substances in and out. This control is vital for maintaining cellular homeostasis. Transport mechanisms are broadly categorized into:

Passive Transport: Movement of substances across the membrane without energy expenditure. This includes simple diffusion, facilitated diffusion, and osmosis.
Active Transport: Movement of substances against their concentration gradient, requiring energy, typically in the form of ATP. This often involves protein pumps.

Cotransport occupies a unique niche between these categories. While it's a form of active transport because it moves a substance against its concentration gradient, it doesn't directly use ATP. Instead, it cleverly couples the movement of one substance with the movement of another, leveraging the energy stored in the concentration gradient of the second substance.

2. The Mechanics of Cotransport: How it Works

Cotransport, also known as coupled transport or secondary active transport, involves the simultaneous movement of two different substances across a cell membrane via a single membrane protein – a cotransporter or symporter. One substance moves down its concentration gradient (from high to low concentration), providing the energy for the other substance to move against its concentration gradient (from low to high concentration). This coupling is the key to the mechanism. Think of it like a water wheel: the downhill flow of water (one substance) turns the wheel, providing the energy to lift a bucket uphill (the other substance).

There are two main types of cotransport:

Symport: Both substances move in the same direction across the membrane. For example, glucose and sodium ions are often cotransported into intestinal epithelial cells using a sodium-glucose linked transporter (SGLT). The movement of sodium ions down their concentration gradient drives the uptake of glucose against its gradient.

Antiport: The two substances move in opposite directions across the membrane. A classic example is the sodium-calcium exchanger (NCX) in cardiac muscle cells. The influx of sodium ions (down its gradient) drives the efflux of calcium ions (against its gradient), helping regulate calcium levels within the cell.

3. Key Players: The Cotransporter Proteins

Cotransporter proteins are integral membrane proteins with specific binding sites for both transported substances. Their structure and conformation change during the transport process,

ensuring the coupled movement of both substances. The affinity of the cotransporter for each substance is crucial for the efficiency of the transport. These proteins are highly regulated, responding to cellular needs and environmental signals. Mutations or malfunctions in cotransporter proteins can lead to various diseases.

4. Physiological Significance of Cotransport

Cotransport plays a vital role in various physiological processes across different organisms:

Nutrient Absorption: The absorption of glucose and amino acids in the intestines relies heavily on cotransport mechanisms, ensuring efficient nutrient uptake from the diet.
Ion Regulation: Maintaining the proper balance of ions like sodium, potassium, calcium, and chloride within cells and tissues depends on cotransport systems. This is particularly crucial for nerve impulse transmission, muscle contraction, and overall cellular function.
Renal Function: The kidneys utilize cotransport to regulate the excretion of various substances in urine, controlling fluid and electrolyte balance.
Plant Physiology: Cotransport plays a crucial role in nutrient uptake in plant roots, enabling efficient absorption of minerals from the soil.

5. Clinical Relevance: Cotransport and Disease

Disruptions in cotransport mechanisms can have significant clinical consequences. Mutations in cotransporter genes or the malfunction of cotransporter proteins can lead to various disorders, including:

Diabetes Mellitus: Impaired glucose absorption due to SGLT dysfunction.
Cardiac Arrhythmias: Dysregulation of the NCX can contribute to cardiac arrhythmias.
Inherited Metabolic Disorders: Defects in cotransport systems for amino acids and other metabolites can lead to severe metabolic imbalances.

6. Future Research Directions

Research into cotransport continues to advance, with ongoing investigations focusing on:

Structural elucidation of cotransporters: Determining the 3D structure of cotransporter proteins will provide deeper insight into their mechanism and regulation.
Drug targeting of cotransporters: Cotransporters are emerging as potential drug targets for various diseases, opening new avenues for therapeutic interventions.
Understanding the regulation of cotransport: Further research is needed to fully understand the intricate regulatory mechanisms controlling cotransport activity.

Article Outline: What is Cotransport?

I. Introduction: Hooking the reader and providing a brief overview of the topic.
II. Membrane Transport Basics: A quick refresher on passive and active transport.
III. The Mechanics of Cotransport: Explaining symport and antiport mechanisms.
IV. Key Players: Cotransporter Proteins: Describing the structure and function of these proteins.

V. Physiological Significance: Exploring the roles of cotransport in various bodily functions.
VI. Clinical Relevance: Cotransport and Disease: Discussing the link between cotransport dysfunction and disease.
VII. Future Research Directions: Highlighting current and future research areas.
VIII. Conclusion: Summarizing key concepts and emphasizing the importance of cotransport.
IX. FAQs: Addressing common questions about cotransport.

(The detailed explanation of each point is provided above in the main article.)

9 Unique FAQs:

1. What is the difference between symport and antiport? (Answered above)
2. How does cotransport differ from primary active transport? (Explained in the introduction and body)
3. What are some examples of cotransporters in the human body? (Provided in the article)
4. Can cotransport be inhibited? If so, how? (Implied in the clinical relevance section; can be expanded upon)
5. What are the potential therapeutic applications of targeting cotransporters? (Mentioned in future research directions)
6. How are cotransporter proteins regulated? (Requires further expansion based on current research)
7. What are some common diseases associated with cotransport dysfunction? (Examples are given)
8. How do cotransport mechanisms differ in plants and animals? (Can be added as a subsection)
9. What techniques are used to study cotransport? (Mention patch clamping, etc.)

9 Related Articles:

1. Active Transport Mechanisms: Explores the various types of active transport beyond cotransport.
2. Membrane Transport Proteins: A detailed overview of different membrane transport proteins and their functions.
3. Sodium-Potassium Pump: Focuses on the primary active transporter responsible for maintaining sodium and potassium gradients.
4. Glucose Metabolism: Explores the role of cotransport in glucose absorption and metabolism.
5. Renal Physiology: Expands on the role of cotransport in kidney function.
6. Cardiac Electrophysiology: Discusses the involvement of cotransport in heart rhythm regulation.
7. Cellular Homeostasis: Broader context on the importance of maintaining cellular balance, including transport mechanisms.
8. Pharmacology of Membrane Transporters: Covers the therapeutic targeting of membrane transporters.
9. Molecular Biology of Membrane Proteins: Provides an in-depth look at the structure and function of membrane proteins at a molecular level.

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• Membranes and Disease. Biochemistry of Cell Membranes should serve as a benchmark for indicating the most important lines for future research in these areas.

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the duct cell, are responsible for digestive enzyme and fluid secretion, respectively, of the exocrine pancreas. This chapter describes the neurohumoral pathways that mediate the pancreatic response to a meal as well as details of the cellular mechanisms that are necessary for the organ responses, including protein synthesis and transport and ion transports, and the regulation of these responses by intracellular signaling systems. Examples of pancreatic diseases resulting from dysfunction in cellular mechanisms provide emphasis of the importance of the normal physiologic mechanisms.

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channels and transporters, kinases and gene expression. Several chapters elaborate on how cell volume regulatory mechanisms participate in the regulation of epithelial transport, urinary concentration, metabolism, migration, cell proliferation and apoptosis. Last but not least, this publication is an excellent guide to the role of cell volume in the pathophysiology of hypercatabolism, diabetes mellitus, brain edema, hemoglobinopathies, tumor growth and metastasis, to name just a few. Providing deeper insights into an exciting area of research which is also of clinical relevance, this publication is a valuable addition to the library of those interested in cell volume regulation.

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what is cotransport: Renaissance Of Sickle Cell Disease Research In The Genome Era Betty Pace, 2007-01-24 The Human Genome Project has spawned a Renaissance of research faced with the daunting expectation of personalized medicine for individuals with sickle cell disease in the Genome Era. This book offers a comprehensive and timeless account of emerging concepts in clinical and basic science research, and community concerns of health disparity to educate professionals, students and the general public about meeting this challenging expectation. Contributions from physicians, research scientists, scientific administrators and community workers make Renaissance of Sickle Cell Disease Research in the Genome Era unique among the catalogue of books on this genetic disorder.Part 1 offers detailed review of the National Heart Lung and Blood Institute's leadership role in funding sickle cell research, as well as developing progressive research initiatives and the predicted impact of the Human Genome Project. Part 2 gives an account of several clinical research perspectives based on the Cooperative Study of Sickle Cell Disease. These include recommendations for newborn screening, pain management, stroke, transfusion therapy and pediatric and adult healthcare. Part 3 offers novel insights into basic science research progress and

the impact of the Human Genome Project on the direction of hemoglobinopathy research, including hemoglobin switching, bone marrow transplantation and gene therapy. Part 4 engages the reader in a culture-based discussion of the stigma attached to sickle cell disease in the African American community and the apprehensions about genetic research in this community. It concludes with a global perspective on sickle cell disease from African, European and American experiences. For readers seeking a definitive account of sickle cell disease appropriate for students, researchers and community workers, this collaborative effort is an ideal textbook./a

what is cotransport: *Ionic Channels of Excitable Membranes* Bertil Hille, 1992 This new, fully revised and expanded edition of Ionic Channels of Excitable Membranes includes new chapters on fast chemical synapses, modulation through G protein coupled receptors and second messenger systems, molecules cloning, site directed mutagenesis, and cell biology. It begins with the classical biophysical work of Hodgkin and Huxley and then weaves a description of the known ionic channels together with their biological functions. The book continues by developing the physical and molecular principles needed for explaining permeation, gating, pharmacological modification, and molecular diversity, and ends with a discussion of channel evolution. Ionic Channels of Excitable Membranes is written to be accessible and interesting to biological and physical scientists of all kinds.

what is cotransport: Dietary Reference Intakes for Vitamin A, Vitamin K, Arsenic, Boron, Chromium, Copper, Iodine, Iron, Manganese, Molybdenum, Nickel, Silicon, Vanadium, and Zinc Institute of Medicine, Food and Nutrition Board, Standing Committee on the Scientific Evaluation of Dietary Reference Intakes, Subcommittee of Interpretation and Uses of Dietary Reference Intakes, Subcommittee on Upper Reference Levels of Nutrients, Panel on Micronutrients, 2002-07-19 This volume is the newest release in the authoritative series issued by the National Academy of Sciences on dietary reference intakes (DRIs). This series provides recommended intakes, such as Recommended Dietary Allowances (RDAs), for use in planning nutritionally adequate diets for individuals based on age and gender. In addition, a new reference intake, the Tolerable Upper Intake Level (UL), has also been established to assist an individual in knowing how much is too much of a nutrient. Based on the Institute of Medicine's review of the scientific literature regarding dietary micronutrients, recommendations have been formulated regarding vitamins A and K, iron, iodine, chromium, copper, manganese, molybdenum, zinc, and other potentially beneficial trace elements such as boron to determine the roles, if any, they play in health. The book also: Reviews selected components of food that may influence the bioavailability of these compounds. Develops estimates of dietary intake of these compounds that are compatible with good nutrition throughout the life span and that may decrease risk of chronic disease where data indicate they play a role. Determines Tolerable Upper Intake levels for each nutrient reviewed where adequate scientific data are available in specific population subgroups. Identifies research needed to improve knowledge of the role of these micronutrients in human health. This book will be important to professionals in nutrition research and education.

what is cotransport: Cell Physiology Source Book Nicholas Sperelakis, 2012-12-02 This authoritative book gathers together a broad range of ideas and topics that define the field. It provides clear, concise, and comprehensive coverage of all aspects of cellular physiology from fundamental concepts to more advanced topics. The Third Edition contains substantial new material. Most chapters have been thoroughly reworked. The book includes chapters on important topics such as sensory transduction, the physiology of protozoa and bacteria, the regulation of cell division, and programmed cell death. - Completely revised and updated - includes 8 new chapters on such topics as membrane structure, intracellular chloride regulation, transport, sensory receptors, pressure, and olfactory/taste receptors - Includes broad coverage of both animal and plant cells - Appendixes review basics of the propagation of action potentials, electricity, and cable properties - Authored by leading experts in the field - Clear, concise, comprehensive coverage of all aspects of cellular physiology from fundamental concepts to more advanced topics

what is cotransport: Ion Channels and Transporters of Epithelia in Health and Disease Kirk L.

Hamilton, Daniel C Devor, 2015-12-15 This book sheds new light on the physiology, molecular biology and pathophysiology of epithelial ion channels and transporters. It combines the basic cellular models and functions by means of a compelling clinical perspective, addressing aspects from the laboratory bench to the bedside. The individual chapters, written by leading scientists and clinicians, explore specific ion channels and transporters located in the epithelial tissues of the kidney, intestine, pancreas and respiratory tract, all of which play a crucial part in maintaining homeostasis. Further topics include the fundamentals of epithelial transport; mathematical modeling of ion transport; cell volume regulation; membrane protein folding and trafficking; transepithelial transport functions; and lastly, a discussion of transport proteins as potential pharmacological targets with a focus on the pharmacology of potassium channels.

what is cotransport: Blood Glucose Levels Leszek Szablewski, 2020-01-08 The main source of energy for the body is glucose. Its low blood concentrations can cause seizures, loss of consciousness and death. Long lasting high glucose levels can cause blindness, renal failure, cardiac and peripheral vascular disease, and neuropathy. Blood glucose concentrations need to be maintained within narrow limits. The process of maintaining blood glucose at a steady state is called glucose homeostasis. This is achieved through a balance of the rate of consumption of dietary carbohydrates, utilization of glucose by peripheral tissues, and the loss of glucose through the kidney tubule. The liver and kidney also play a role in glucose homeostasis. This book aims to provide an overview of blood glucose levels in health and diseases.

what is cotransport: An Introduction to Biological Membranes William Stillwell, 2013-04-20 An Introduction to Biological Membranes: From Bilayers to Rafts covers many aspects of membrane structure/function that bridges membrane biophysics and cell biology. Offering cohesive, foundational information, this publication is valuable for advanced undergraduate students, graduate students and membranologists who seek a broad overview of membrane science. - Brings together different facets of membrane research in a universally understandable manner - Emphasis on the historical development of the field - Topics include membrane sugars, membrane models, membrane isolation methods, and membrane transport

what is cotransport: *Chloride Movements Across Cellular Membranes* , 2007-01-22 All living cells are surrounded by a lipidic membrane that isolates them from the often harsh environment. However, to take up nutrients, to excrete waste, and to communicate among each other, Nature has invented an incredibly diverse set of transmembrane transport proteins. Specialized transporters exist to shuttle electrically charged ions, positive cations like sodium or negative anions like chloride, across the membrane. In the recent years, tremendous progress has been made in the field of chloride transport. The present book presents the state of the art of this rapidly expanding and interest-gaining field of membrane transport. It is addressed at a broad medically, physiologically, biologically, and biophysically interested readership. Describes the state-of-the-art in anion transport research Written by leaders in the field Presents a timely discussion of this rapidly emerging and expanding field

what is cotransport: Membrane Transport in Plants U. Zimmermann, J. Dainty, 2012-12-06 In February, 1974, an 'International Workshop on Membrane Transport in Plants' was held at the Nuclear Research Centre, JLiI ich, West Germany. More than two hundred and fifty people, from fourteen countries, took part in this highly successful meeting. A somewhat similar meeting took place in Liverpool, England, two years ago and it became clear there that progress in the field of membrane transport in plants was now so marked that a second, and wider, meeting in Germany was more than fully justified. The members of our pro gramme committee (U. Zimmermann, Chairman, JLilich (FRG); J. Dainty,

what is cotransport: Seldin and Giebisch's The Kidney Robert J. Alpern, Steven C. Hebert, 2007-10-10 A classic nephrology reference for over 20 years, Seldin & Giebisch's The Kidney, is the acknowledged authority on renal physiology and pathophysiology. The fourth edition follows the changed focus of nephrology research to the study of how individual molecules work together to affect cellular and organ function, emphasizing the mechanisms of disease. With over 40 new

chapters and over 1000 illustrations, this edition offers the most in-depth discussion anywhere of the physiologic and pathophysiologic processes of renal disease. Comprehensive, authoritative coverage progresses from molecular biology and cell physiology to clinical issues regarding renal function and dysfunction. If you research the development of normal renal function or the mechanisms underlying renal disease, Seldin & Giebisch's The Kidney is your number one source for information.* Offers the most comprehensive coverage of fluid and electrolyte regulation and dysregulation in 51 completely revised chapters unlike Brenner & Rector's The Kidney which devotes only 7 chapters to this topic.* Includes 3 sections, 31 chapters, devoted to regulation and disorders of acid-base homeostasis, and epithelial and nonepithelial transport regulation. Brenner & Rector's only devotes 5 chapters to these topics.* Previous three editions edited by Donald Seldin and Gerhard Giebisch, world renowned names in nephrology. The title for the fourth edition has been changed to reflect their considerable work on previous editions and they have also written the forward for this edition. * Over 20 million adults over age 20 have chronic kidney disease with the number of people diagnosed doubling each decade making it America's ninth leading cause of death.

what is cotransport: Oxford Textbook of Clinical Nephrology Neil N. Turner, Norbert Lameire, David J. Goldsmith, Christopher G. Winearls, Jonathan Himmelfarb, Giuseppe Remuzzi, 2015-10-29 This fourth edition of the Oxford Textbook of Clinical Nephrology builds on the success and international reputation of the publication as an important resource for the practising clinician in the field. It provides practical, scholarly, and evidence-based coverage of the full spectrum of clinical nephrology, written by a global faculty of experts. The most relevant and important reference to clinical nephrology, this is an authoritative and comprehensive textbook combining the clinical aspects of renal disease essential to daily clinical practice with extensive information about the underlying basic science and current evidence available. Each section of the textbook has been critically and comprehensively edited under the auspices of a leading expert in the field. This new edition has been significantly expanded and reapportioned to reflect developments and new approaches to topics, and includes treatment algorithms to aid and enhance patient care where possible. The fourth edition offers increased focus on the medical aspects of transplantation, HIV-associated renal disease, and infection and renal disease, alongside entirely new sections on genetic topics and clinical and physiological aspects of fluid/electrolyte and tubular disorders. The emphasis throughout is on marrying advances in scientific research with clinical management. Richly illustrated throughout in full colour, this is a truly modern and attractive edition which reinforces the Oxford Textbook of Clinical Nephrology's position as an indispensable reference work of consistent quality and reliability. Enriched and refined by careful revision, this new edition continues the tradition of excellence. This print edition of The Oxford Textbook of Clinical Nephrology comes with a year's access to the online version on Oxford Medicine Online. By activating your unique access code, you can read and annotate the full text online, follow links from the references to primary research materials, and view, enlarge and download all the figures and tables. Oxford Medicine Online is mobile optimized for access when and where you need it.

what is cotransport: Concepts of Biology Samantha Fowler, Rebecca Roush, James Wise, 2023-05-12 Black & white print. Concepts of Biology is designed for the typical introductory biology course for nonmajors, covering standard scope and sequence requirements. The text includes interesting applications and conveys the major themes of biology, with content that is meaningful and easy to understand. The book is designed to demonstrate biology concepts and to promote scientific literacy.

what is cotransport: Liquid Membranes Vladimir S Kislik, 2009-08-31 Liquid Membranes: Principles and Applications in Chemical Separations and Wastewater Treatment discusses the principles and applications of the liquid membrane (LM) separation processes in organic and inorganic chemistry, analytical chemistry, biochemistry, biomedical engineering, gas separation, and wastewater treatment. It presents updated, useful, and systematized information on new LM separation technologies, along with new developments in the field. It provides an overview of LMs and LM processes, and it examines the mechanisms and kinetics of carrier-facilitated transport

through LMs. It also discusses active transport, driven by oxidation-reduction, catalytic, and bioconversion reactions on the LM interfaces; modifications of supported LMs; bulk aqueous hybrid LM processes with water-soluble carriers; emulsion LMs and their applications; and progress in LM science and engineering. This book will be of value to students and young researchers who are new to separation science and technology, as well as to scientists and engineers involved in the research and development of separation technologies, LM separations, and membrane reactors. - Provides comprehensive knowledge-based information on the principles and applications of a variety of liquid membrane separation processes - Contains a critical analysis of new technologies published in the last 15 years

what is cotransport: Basic Concepts in Biochemistry: A Student's Survival Guide Hiram F. Gilbert, 2000 Basic Concepts in Biochemistry has just one goal: to review the toughest concepts in biochemistry in an accessible format so your understanding is through and complete.--BOOK JACKET.

what is cotransport: Comprehensive Biophysics , 2012-04-12 Biophysics is a rapidly-evolving interdisciplinary science that applies theories and methods of the physical sciences to questions of biology. Biophysics encompasses many disciplines, including physics, chemistry, mathematics, biology, biochemistry, medicine, pharmacology, physiology, and neuroscience, and it is essential that scientists working in these varied fields are able to understand each other's research. Comprehensive Biophysics, Nine Volume Set will help bridge that communication gap. Written by a team of researchers at the forefront of their respective fields, under the guidance of Chief Editor Edward Egelman, Comprehensive Biophysics, Nine Volume Set provides definitive introductions to a broad array of topics, uniting different areas of biophysics research - from the physical techniques for studying macromolecular structure to protein folding, muscle and molecular motors, cell biophysics, bioenergetics and more. The result is this comprehensive scientific resource - a valuable tool both for helping researchers come to grips quickly with material from related biophysics fields outside their areas of expertise, and for reinforcing their existing knowledge. Biophysical research today encompasses many areas of biology. These studies do not necessarily share a unique identifying factor. This work unites the different areas of research and allows users, regardless of their background, to navigate through the most essential concepts with ease, saving them time and vastly improving their understanding The field of biophysics counts several journals that are directly and indirectly concerned with the field. There is no reference work that encompasses the entire field and unites the different areas of research through deep foundational reviews. Comprehensive Biophysics fills this vacuum, being a definitive work on biophysics. It will help users apply context to the diverse journal literature offering, and aid them in identifying areas for further research Chief Editor Edward Egelman (E-I-C, Biophysical Journal) has assembled an impressive, world-class team of Volume Editors and Contributing Authors. Each chapter has been painstakingly reviewed and checked for consistent high quality. The result is an authoritative overview which ties the literature together and provides the user with a reliable background information and citation resource

what is cotransport: Plant ABC Transporters Markus Geisler, 2014-09-06 This book is devoted to the fascinating superfamily of plant ATP-binding cassette (ABC) transporters and their variety of transported substrates. It highlights their exciting biological functions, covering aspects ranging from cellular detoxification, through development, to symbiosis and defense. Moreover, it also includes a number of chapters that center on ABC transporters from non-Arabidopsis species. ABC proteins are ubiquitous, membrane-intrinsic transporters that catalyze the primary (ATP-dependent) movement of their substrates through biological membranes. Initially identified as an essential aspect of a vacuolar detoxification process, genetic work in the last decade has revealed an unexpectedly diverse variety of ABC transporter substrates, which include not only xenobiotic conjugates, but also heavy metals, lipids, terpenoids, lignols, alkaloids and organic acids. The discovery that members of the ABCB and ABCG family are involved in the movement of phytohormones has further sparked their exploration and provided a new understanding of the whole family. Accordingly, the trafficking, regulation and structure-function of ABCB-type auxin

transporters are especially emphasized in this book.

what is cotransport: Ion Channel Diseases , 2011-09-06 Ion channel dysfunction in humans leads to impairment of the excitable processes necessary for the normal function of several tissues, such as muscle and brain. It follows that an increasing number of human diseases have been associated with malfunctioning ion channels, many of which have a genetic component. This volume of Advances in Genetics presents a broad and comprehensive overview of the inherited channelopathies in humans, including clinical, genetic and molecular aspects of these conditions. Keeping true to the scope of the serial, novel genomic and modeling research approaches and a review of potential therapeutic approaches for each of these conditions are also incorporated.

what is cotransport: *Ion Channels in Health and Sickness* Fatima Shad Kaneez, 2018-10-10 Ion channels are proteins that make pores in the membranes of excitable cells present both in the brain and the body. These cells are not only responsible for converting chemical and mechanical stimuli into the electrical signals but are also liable for monitoring vital functions. All our activities, from the blinking of our eyes to the beating of our heart and all our senses from smell to sight, touch, taste and hearing are regulated by the ion channels. This book will take us on an expedition describing the role of ion channels in congenital and acquired diseases and the challenges and limitations scientist are facing in the development of drugs targeting these membrane proteins.

what is cotransport: *The Alkali Metal Ions: Their Role for Life* Astrid Sigel, Helmut Sigel, Roland K. O. Sigel, 2016-02-09 MILS-16 provides an up-to-date review of the impact of alkali metal ions on life. Their bioinorganic chemistry and analytical determination, the solid state structures of bio-ligand complexes and the properties of alkali metal ions in solution in the context of all kinds of biologically relevant ligands are covered, this includes proteins (enzymes) and nucleic acids (G-quadruplexes). Minerals containing sodium (Na+) and potassium (K+) are abundant in the Earth's crust, making Na+ and K+ easily available. In contrast, the alkali elements lithium (Li+), rubidium, and cesium are rare and the radioactive francium occurs only in traces. Since the intra- and extracellular, as well as the compartmental concentrations of Na+ and K+ differ significantly, homeostasis and active transport of these ions are important; this involves transporters/carriers and pore-forming ion channel proteins. Systems like Na+/K+-ATPases, H+/K+-ATPases or Na+/H+ antiporters are thoroughly discussed. The role of K+ in photosynthesis and the role of Na+ in charging the battery of life are pointed out. Also, the relationships between alkali metal ions and diseases (e.g., Parkinson or traumatic brain injury) are covered and the relevance of Li+ salts in medicine (pharmacology and mechanism) is reviewed. This and more is treated in an authoritative and timely manner in the 16 stimulating chapters of Volume 16, The Alkali Metal Ions: Their Role for Life, which are written by 44 internationally recognized experts from 12 nations. The impact of this vibrant research area is manifested in nearly 3000 references, over 30 tables and more than 150 illustrations (two thirds in color). MILS-16 also provides excellent information for teaching. Astrid Sigel, Helmut Sigel, and Roland K. O. Sigel have long-standing interests in Biological Inorganic Chemistry. Their research focuses on metal ion interactions with nucleotides and nucleic acids and on related topics. They edited previously 44 volumes in the series Metal Ions in Biological Systems.

what is cotransport: *PH and Brain Function* Kai Kaila, Bruce R. Ransom, 1998-09-15 PH and Brain Function offers thorough coverage of this increasingly important area of research, beginning with the fundamental concepts, which include methodological and theoretical issues such as the measurement of pH and the concept of pH in neurobiology. It explores aspects of regulation and modulation of intracellular pH in brain cells, surveys the changes in pH that occur with neural activity and how these changes affect neural activity, and discusses the role of pH in the pathophysiology of neurological diseases. pH and Brain Function is an important resource for researchers in all areas of neuroscience as well as cell biology and physiology. --Book Jacket.

what is cotransport: Hormones and Transport Systems , 2015-03-26 First published in 1943, Vitamins and Hormones is the longest-running serial published by Academic Press. The Series provides up-to-date information on vitamin and hormone research spanning data from molecular biology to the clinic. A volume can focus on a single molecule or on a disease that is related to

vitamins or hormones. A hormone is interpreted broadly so that related substances, such as transmitters, cytokines, growth factors and others can be reviewed. This volume focuses on hormone and transport systems. - Expertise of the contributors - Coverage of a vast array of subjects - In depth current information at the molecular to the clinical levels

what is cotransport: Radionuclide Behaviour in the Natural Environment Christophe Poinssot, Horst Geckeis, 2012-09-20 Understanding radionuclide behaviour in the natural environment is essential to the sustainable development of the nuclear industry and key to assessing potential environmental risks reliably. Minimising those risks is essential to enhancing public confidence in nuclear technology. Scientific knowledge in this field has developed greatly over the last decade.Radionuclide behaviour in the natural environment provides a comprehensive overview of the key processes and parameters affecting radionuclide mobility and migration.After an introductory chapter, part one explores radionuclide chemistry in the natural environment, including aquatic chemistry and the impact of natural organic matter and microorganisms. Part two discusses the migration and radioecological behavior of radionuclides. Topics include hydrogeology, sorption and colloidal reactions as well as in-situ investigations. Principles of modelling coupled geochemical, transport and radioecological properties are also discussed. Part three covers application issues: assessment of radionuclide behaviour in contaminated sites, taking Chernobyl as an example, estimation of radiological exposure to the population, performance assessment considerations related to deep geological repositories, and remediation concepts for contaminated sites.With its distinguished editors and international team of expert contributors, Radionuclide behaviour in the natural environment is an essential tool for all those interested or involved in nuclear energy, from researchers, designers and industrial operators to environmental scientists. It also provides a comprehensive guide for academics of all levels in this field. - Provides a comprehensive overview of the key processes and parameters affecting radionuclide mobility and migration - Explores radionuclide chemistry in the natural environment - Discusses the migration and radioecological behaviour of radionuclides

what is cotransport: The Na, K-ATPase Jean-Daniel Horisberger, 1994 This text addresses the question, How does the sodium pump pump'. A variety of primary structure information is available, and progress has been made in the functional characterization of the Na, K-pump, making the answer to this question possible, within reach of currently used techniques

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