

BACTERIAL MUTATION; TYPES, MECHANISMS AND MUTANT DETECTION METHODS: A REVIEW

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Abstract

Mutation is a very important concept in biology today that leads to variations in genes. A mutation is a permanent alteration in the sequence of nitrogenous bases of a DNA molecule. The result of a mutation is generally a change in the end-product specified by that gene. In some cases, a mutation can be beneficial if a new metabolic activity arises in a microorganism, or it can be detrimental if a metabolic activity is lost. Mutations can be spontaneous, or induced by a mutagen in the environment. Mismatching is probably mostly due to cellular processes such as Tautomeric shift of bases , oxidative damage to DNA , Depurination and Deamination or caused by "environment", i.e. chemicals, radiation, viruses, diet and lifestyle (Mutagens). Substitution of a nucleotide and Deletion or addition of them is two mechanisms of mutation. Mutation in bacteria has some results such as missense, nonsense, silent, frameshift, lethal, suppressor and conditional lethal mutation. Identifying these mutations requires detection methods. Classic methods i.e. Replica plating, Penicillin enrichment, Ames test, Use of chromogenic substrate and novel tests such as Polymerase chain reaction (PCR) and Gel electrophoresis, Gene probes and Southern blotting, DNA sequencing and DNA microarray are some of these methods that are highlighted in this review.

Keywords: Mutation, Spontaneous and induced mutation, mechanisms of mutation and their results, detection methods

Introduction

Today bacteria are an important tool in the study of genetics and biotechnology, but for 40 years after the rediscovery of Mendel's work and the rebirth of genetics, they were considered too simple to have genes, undergo mutation, or reproduce sexually. This is not surprising - bacteria are so small that it's very difficult to study individuals. Scientists had long observed differences between bacterial colonies, but had never realized that these differences were the results of mutations. Mutations are a very important concept in biology today. Mutations lead to variations in genes. These genes can have a good or bad influence in the characteristics of an organism. Variations are also very important in evolution. Without variations evolution would not be possible, and changes in any part of the environment affecting the organism could make the organism become extinct [1,2,3].

A mutation is any heritable change in DNA sequence. This may, or may not, affect the phenotype of the organism [4,5,6,7,8]. The term "mutation" was coined by Hugo de Vries, which is derived from Latin word meaning "to change"[5].

The process of mutation is called mutagenesis and the agent inducing mutations is called mutagen. (Organisms selected as reference strains are called wild type, and their progeny with mutations are called mutants). Changes in the sequence of template DNA (mutations) can drastically affect the type of protein end product produced [4,7].

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Stanley Maloy, Kelly Hughes



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Cotton Breeding and Biotechnology Zulqurnain Khan,Zulfiqar Ali,Asif Ali Khan,2022-03-14 Cotton Breeding and Biotechnology presents information on one of the most economically important crops of the world cotton This book contains chapters on the history of cotton breeding approaches technologies for increasing germination crop growth and yield and fiber quality issues It emphasizes sustainable development in the cotton industry analysing the progress of breeding technologies under environmental adversity The book explores the national and global status of cotton crop including cotton production possible impacts of climate change and the vulnerability of cotton to pest infestations and disease attacks Features Focuses on cotton breeding and biotechnology Proposes ideas data and strategies to mount breeding programs for enhancing cotton production Details strategies for cotton quality improvement against abiotic and biotic stresses Emphasizes the revival of cotton in Pakistan and South Asian region This book is useful to researchers cotton breeders and growers farmers and the agriculture industry

Antimicrobial Resistance and Virulence Common Mechanisms Etienne Giraud,Ivan Rychlik,Axel Cloeckaert,2017-06-01 Multiple relationships exist between antimicrobial resistance and bacterial virulence and the spread of clones combining multiple antibiotic resistance and a high virulence level is an increasing problem It was previously described how mutation driven or horizontally acquired resistance mechanisms can also have effects on virulence It was also reported that mobile genetic elements often carry both resistance determinants and virulence modulating genes which favors the co selection of both traits In the present volume we present a collection of articles which document additional aspects of the interactions between antimicrobial resistance and virulence in bacteria and describe their potential therapeutic consequences

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Brenner's Encyclopedia of Genetics Stanley Maloy,Kelly Hughes,2013-03-03 The explosion of the field of genetics over the last decade with the new technologies that have stimulated research suggests that a new sort of reference work is needed to keep pace with such a fast moving and interdisciplinary field Brenner s Encyclopedia of Genetics Second Edition Seven Volume Set builds on the foundation of the first edition by addressing many of the key subfields of genetics that were just in their infancy when the first edition was published The currency and accessibility of this foundational content will be unrivalled making this work useful for scientists and non scientists alike Featuring relatively short entries on genetics topics written by experts in that topic Brenner s Encyclopedia of Genetics Second Edition Seven Volume Set provides an effective way to quickly learn about any aspect of genetics from Abortive Transduction to Zygotes Adding to its utility the work provides short entries that briefly define key terms and a guide to additional reading and relevant websites for further study Many of the entries include figures

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Toxicological Testing Handbook Jacobson-Kram David, 2000-11-21 Designed to aid toxicology testing study design this text provides data on issues such as species selection dose level and dosing regimes animal models routes of exposure statistical evaluation data interpretation fulfillment of regulatory requirements and adherence to good laboratory practices

Laboratory Techniques in Plant Bacteriology Suresh G. Borkar, 2017-12-12 Laboratory Techniques in Plant Bacteriology is ideal for scientists and students who seek a career in plant pathogenic bacteria This book contains 41 chapters comprising practicable techniques from isolation of bacterial plant pathogens to their identification up to species and race biotype level It includes identification protocols of morphological biochemical immunological and molecular based techniques This book comprises all technological aspects of plant bacteriological studies Its content is ideal for graduate students and research scholars including bacteriological professionals or technicians The book ultimately provides working technologies useful for controlling bacterial disease pathogens

OECD Series on Testing and Assessment Overview on genetic toxicology TGs OECD, 2017-04-13 Following a general update of the Genetic Toxicology TGs in 2015 the present Document was written to provide succinct and useful information to individuals unfamiliar with genetic toxicology testing as well as experienced individuals wishing to obtain an overview of the recent changes that

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Toxicological Testing Handbook David Jacobson-Kram, Kit A. Keller, 2016-04-19 Furnishing essential data on all areas of toxicity testing this Second Edition provides guidance on the design and evaluation of product safety studies to help ensure regulatory acceptance Every chapter highlights regulatory requirements specific to the United

States Europe and Japan and in addition to expanded information on da **Environmental Contaminants in Food** United States. Congress. Office of Technology Assessment,1979 *Challenges in Inflammatory Bowel Disease* Derek P. Jewell,Neil J. Mortensen,A. Hillary Steinhart,John A. Pemberton,Bryan F. Warren,2008-04-15 Reviews focused topics both clinical and basic science in the fast moving area of IBD providing emphasis on the current challenges faced in the successful management of the disease Turn to *Challenges in Inflammatory Bowel Disease* IBD when you need an expert opinion on the new unusual or controversial areas of IBD and not just the tried and tested information Current and concise reviews of the latest scientific discoveries are translated into cutting edge clinical guidance to address those challenging cases faced by every medical team caring for patients with IBD Refer to this book to answer burning questions to read an in depth review of the controversial topics and to provide a clear explanation of issues **Molecular Mechanisms of Bacterial Disease in Cultured Fishes** Lixing Huang,Huanying Pang,Ha Thanh Dong,Najiah Musa,2022-12-08 [Insights in Diabetes: Molecular Mechanisms 2021](#) Undurti Narasimha Das,Gundu H. R. Rao,Denis Baranenko,2022-12-23 **General Microbiology** Roger Y. Stanier,1987 The fifth edition of this successful text continues to present microbiology within the framework of general biology Brief chapters on history and methods are followed by detailed treatment of structure metabolism growth environmental factors and microbial genetics An introductory section dealing with bacterial classifications prefaces 13 chapters concerned with characteristics of groups of micro organisms [The Microbial World](#) Roger Y. Stanier,1986

Biology of the Prokaryotes Joseph W. Lengeler,Gerhart Drews,Hans G. Schlegel,2009-07-10 Designed as an upper level textbook and a reference for researchers this important book concentrates on central concepts of the bacterial lifestyle Taking a refreshingly new approach it present an integrated view of the prokaryotic cell as an organism and as a member of an interacting population Beginning with a description of cellular structures the text proceeds through metabolic pathways and metabolic reactions to the genes and regulatory mechanisms At a higher level of complexity a discussion of cell differentiation processes is followed by a description of the diversity of prokaryotes and their role in the biosphere A closing section deals with man and microbes ie applied microbiology The first text to adopt an integrated view of the prokaryotic cell as an organism and as a member of a population Vividly illustrates the diversity of the prokaryotic world nearly all the metabolic diversity in living organisms is found in microbes New developments in applied microbiology highlighted Extensive linking between related topics allows easy navigation through the book Essential definitions and conclusions highlighted Supplementary information in boxes *The Quintessence of Basic and Clinical Research and Scientific Publishing* Gowraganahalli Jagadeesh,Pitchai Balakumar,Fortunato Senatore,2023-09-30 The book intended for biomedical researchers attempts to foster a comprehensive understanding of the elements that impact scientific research such as clinical trial design communication and publication methods It introduces the process of idea generation and creative critical thinking leading to the development of key concepts that coalesce into theoretical constructs and working hypotheses The book systematically

delineates research phases associated with a bench to bedside translational approach providing the full depth and breadth of drug discovery and development design synthesis and optimization of drug candidates interacting with targets linked to diseases as well as clinical trial design to acquire substantial evidence of efficacy and safety for candidate drugs in the target patient population New and evolving topics such as artificial intelligence machine and deep learning drug repurposing approaches and bioinformatics are incorporated into the text as these features are becoming integrated into drug research and development Additionally it covers publication strategies including literature search manuscript preparation data presentation relevant discussion editorial processes elements of peer review and bibliometrics Finally the book addresses grantsmanship key strategies for building effective networks mentorships maintaining research integrity and forging career advancement opportunities including entrepreneurship

Evolution, Molecular Mechanisms and the Strategies to Combat Antimicrobial Resistance (AMR): A One Health Approach Nayeem Ahmad,Vineet Kumar,Mohammad Shahid,Ronni Mol Joji ,Leonardo Pagani,2025-02-21 Humanity animals and the ecosystem are seriously threatened by antimicrobial resistance A significant reason is the inappropriate use of antimicrobials in the human animal and environmental sectors as well as the global spread of resistant bacteria and resistance genes Lately the use of antimicrobials in animals raised for human consumption has become a significant public health issue The environment also has a big impact in the interface between human and animal health through biodiversity loss climate change and pollution A sustainable balance and optimization of the health of people animals and ecosystems are the goals of the comprehensive unifying approach known as One Health To battle and contain antimicrobial resistance within a One Health strategy rigorous antimicrobial resistance surveillance along with strict execution of the core plan and action should be carried out at various sectors individually and collectively at the national and worldwide level

Microbiology David R. Wessner,Dave Wessner,Christine Dupont,Trevor Charles,Josh D. Neufeld,2022 Microbiology is a comprehensive textbook that facilitates a thorough understanding of the scope nature and complexity of the science of microscopic organisms It gives a balanced presentation of foundational concepts real world applications and current research and experimentation The text approaches the subject within the context of exploration and experimentation integrating a wealth of classroom tested pedagogical features The material is organized around the three pillars of physiology ecology and genetics helping students appreciate the interconnected and dynamic nature of microbiology and explore the relationship between different types of microbes other organisms and the environment This international adaptation contains up to date coverage of topics including DNA replication and gene expression viral pathogenesis microbial biotechnology adaptive immunity the control of infectious diseases and the microbiology of food and water It also offers integrated coverage of SARS CoV 2 and the impacts of COVID 19 relating it to the importance of an interdisciplinary response to a global pandemic It also focuses on strengthening the organization of the content and updating the end of chapter problems

Safety Evaluation of Drugs & Chemicals W. Eugene Lloyd,1986-02-01

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