Methods in Molecular Biology
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Generation of cDNA Libraries

Methods and Protocols

Edited by

Shao-Yao Ying



Stephen H. Powis, Robert W. Vaughan

Generation of cDNA Libraries Shao-Yao Ying, 2008-02-03 Since its invention and subsequent development nearly 20 years ago po merase chain reaction PCR has been extensively utilized to identify numerous gene probes in vitro and in vivo However attempts to generate complete and full length complementary cDNA libraries were for the most part fruitless and remained elusive until the last decade when simple and rapid methods were developed With current decoding and potential application of human genome information to genechips there are urgent needs for identification of functional significance of these decoded gene sequences Inherent in bringing these app cations to fruition is the need to generate a complete and full length cDNA library for potential functional assays of specific gene sequences Generation of cDNA Libraries Methods and Protocols serves as a laboratory manual on the evolution of generation of cDNA libraries covering both ba ground information and step by step practical laboratory recipes for which p tocols reagents operational tips instrumentation and other requirements are detailed The first chapter of the book is an overview of the basics of generating cDNA libraries which include the following a the definition of a cDNA library b different kinds of cDNA libraries c differences between methods for cDNA library generation using conventional approaches and novel stra gies including reverse generation of RNA repertoires Methods in Molecular Biology: Generation of cDNA from cDNA libraries and d the quality of cDNA libraries **libraries: methods and protocols** John M. Walker, 1984 Combinatorial Library Lisa B. English, 2008-02-04 The continued successes of large and small scale genome sequencing projects are increasing the number of genomic targets available for drug d covery at an exponential rate In addition a better understanding of molecular mechanisms such as apoptosis signal transduction telomere control of ch mosomes cytoskeletal development modulation of stress related proteins and cell surface display of antigens by the major histocompatibility complex m ecules has improved the probability of identifying the most promising genomic targets to counteract disease As a result developing and optimizing lead candidates for these targets and rapidly moving them into clinical trials is now a critical juncture in pharmaceutical research Recent advances in com natorial library synthesis purification and analysis techniques are not only increasing the numbers of compounds that can be tested against each specific genomic target but are also speeding and improving the overall processes of lead discovery and optimization There are two main approaches to combinatorial library production p allel chemical synthesis and split and mix chemical synthesis These approaches can utilize solid or solution based synthetic methods alone or in combination although the majority of combinatorial library synthesis is still done on solid support In a parallel synthesis all the products are assembled separately in their own reaction vessels or microtiter plates The array of rows and columns enables researchers to organize the building blocks to be c bined and provides an easy way to identify compounds in a particular well E. coli Gene Expression Protocols Peter E. Vaillancourt, 2008-02-02 Peter E Vaillancourt presents a collection of popular and emerging methodologies that take advantage of E coli s ability to quickly

and inexpensively express recombinant proteins The authors focus on two areas of interest the use of E coli vectors and strains for production of pure functional protein and the use of E coli as host for the functional screening of large collections of proteins and peptides Among the cutting edge techniques demonstrated are those for rapid high level expression and purification of soluble and functional recombinant protein and those essential to functional genomics proteomics and protein Superantigen Protocols Teresa Krakauer, 2008-02-05 Leading researchers in the biological chemical and physical investigation of superantigens describe in step by step detail their best experimental techniques to assess the physical characteristics and biological effects of superantigens Their protocols range from those for investigating the interactions of superantigens with cellular receptors to those for the analysis of their immunological and biological effects including methods for using BIOcore to determine binding kinetics and establishing various lymphocyte cell culture systems There are also accounts of such methods as the RNase protection assay cytokine ELISA FACS analysis and cytokine production at the single cell level MHC Protocols Stephen H. Powis, Robert W. Vaughan, 2008-02-05 The aim of MHC Protocols is to document protocols that can be used for the analysis of genetic variation within the human major histocompatibility complex MHC HLA region The human MHC encompasses approximately 4 million base pairs on the short arm of chromosome 6 at cytogenetic location 6p21 3 The region is divided into three subregions The telomeric class I region contains the genes that encode the HLA class I molecules HLA A B and C The centromeric class II region contains the genes encoding the HLA class II molecules HLA DR DQ and DP In between is the class III region originally identified because it contains genes encoding components of the complement pathway The entire human MHC has recently been sequenced 1 and each subregion is now known to contain many other genes a number of which have immunological functions The study of polymorphism within the MHC is well established because the region contains the highly polymorphic HLA genes HLA polymorphism has been used extensively in solid organ and bone marrow transplantation to match donors and recipients As a result large numbers of HLA alleles have been identified a process that has been further driven by recent interest in HLA gene diversity in ethnic populations The extreme genetic variation in HLA genes is believed to have been driven by the evolutionary response to infectious agents but relatively few studies have analyzed associations between HLA genetic variation and infectious disease which has been difficult to demonstrate **Generation of cDNA Libraries** Shao-Yao Ying, 2003-02-19 Since its invention and subsequent development nearly 20 years ago po merase chain reaction PCR has been extensively utilized to identify numerous gene probes in vitro and in vivo However attempts to generate complete and full length complementary cDNA libraries were for the most part fruitless and remained elusive until the last decade when simple and rapid methods were developed With current decoding and potential application of human genome information to genechips there are urgent needs for identification of functional significance of these decoded gene sequences Inherent in bringing these app cations to fruition is the need to generate a complete and full length cDNA library for potential functional

assays of specific gene sequences Generation of cDNA Libraries Methods and Protocols serves as a laboratory manual on the evolution of generation of cDNA libraries covering both ba ground information and step by step practical laboratory recipes for which p tocols reagents operational tips instrumentation and other requirements are detailed The first chapter of the book is an overview of the basics of generating cDNA libraries which include the following a the definition of a cDNA library b different kinds of cDNA libraries c differences between methods for cDNA library generation using conventional approaches and novel stra gies including reverse generation of RNA repertoires from cDNA libraries and d the quality of Protein Sequencing Protocols Bryan John Smith, 2008-02-02 Determination of the protein sequence is as cDNA libraries important today as it was a half century ago even though the techniques and purposes have changed over time Mass spectrometry has continued its recent rapid development to find notable application in the characterization of small amounts of protein for example in the field of proteomics The traditional chemical N terminal sequencing is still of great value in quality assurance of the increasing number of biopharmaceuticals that are to be found in the clinic checking processing events of recombinant proteins and so on It is joined in the armory of me ods of protein analysis by such techniques as C terminal sequencing and amino acid analysis These methods are continually developing The first edition of Protein Sequencing Protocols was a snapshot of methods in use in protein biochemistry laboratories at the time and this the second edition is likewise Methods have evolved in the intervening period and the content of this book has similarly changed the content of some chapters having been superceded and replaced by other approaches Thus in this edition there is inclusion of approaches to validation of methods for quality assurance work reflecting the current importance of biopharmaceuticals and also a guide to further analysis of protein sequence information acknowledging the importance of bioinformatics **Protocols** Sumitra Deb, Swati Palit Deb, 2008-02-02 Since the discovery of p53 as a tumor suppressor numerous methods have evolved to reveal the unique structural features and biochemical functions of this protein Several unique properties of p53 posed a challenge to understa ing its normal function in the initial phase of its research. The low levels of p53 in normal cells its stabilization under situations of genotoxic stress induction of growth arrest and apoptosis with stabilization of the protein obstructed the visibility of its normal unmutated function. The property of p53 that can sense a promoter and transactivate or inhibit is still not well understood It is still not known whether it is the absence of the protein that causes tumorigenesis or if its mutants have a dominant role in inducing cancer p53 Protocols comprises eighteen chapters for the study of the diverse properties of p53 and related proteins The methods included are invaluable for delineating the function of other proteins that may function as tumor suppr sors or growth suppressors. The chapters are not presented in any schematic order for the importance and diversity of the functions of p53 make it imp sible to organize them suitably We have made a sincere effort to collect the methods most useful to those investigators working on tumor suppressors or growth suppressors The purpose of p53 Protocols is not only to provide investigators with methods to analyze similar biochemical

functions but also to familiarize them with the associated problems that arose during the course of investigations

Neurogenetics Nicholas T. Potter, 2008-02-02 The rapid identification and characterization of genes of neurological relevance holds great potential for offering insight into the diagnosis management and und standing of the pathophysiologic mechanisms of neurological diseases This volume in the Methods in Molecular BiologyTM series was conceived to highlight many of the contemporary methodological approaches utilized for the characterization of neu logically relevant gene mutations and their protein products Although an emphasis has been placed upon descriptions of methodologies with a defined clinical utility it is hoped that Neurogenetics Methods and Protocols will appeal not only to clinical laboratory diagnosticians but also to clinicians and to biomedical researchers with an interest in advances in disease diagnosis and the functional consequences of neu logically relevant gene mutations To meet this challenge more than 60 authors graciously accepted my invitation to contribute to the 32 chapters of this book Through their collective commitment and diligence what has emerged is a comprehensive and timely treatise that covers many methodological aspects of mutation detection and screening including disc sions on quantitative PCR trinucleotide repeat detection sequence based mutation detection molecular detection of imprinted genes fluorescence in situ hybridization FISH in vitro protein expression systems and studies of protein expression and function I would like to take this opportunity to formally thank my colleagues for their effort and dedication to this work Cancer Cell Signaling David M. Terrian, 2008-02-05 Cells respond to environmental cues through a complex and dynamic network of signaling pathways that normally maintain a critical balance between cellular proliferation differentiation senescence and death One current research challenge is to identify those aberrations in signal transd tion that directly contribute to a loss of this division limited equilibrium and the progression to malignant transformation The study of cell signaling m ecules in this context is a central component of cancer research From the knowledge of such targets investigators have been able to productively advance many insightful hypotheses about how a particular cancer cell may misinterpret or respond inappropriately to growth regulatory cues in their environment Despite these key insights the rapidly evolving nature of cell signaling research in cancer has necessitated a continuous revision of these theoretical constructs and the updating of methods used in their study One contemporary example of the evolution of this field is provided by an analysis of the Human Genome Project data which reveal a previously unsuspected diversity in the multigene families encoding for most signaling pathway int mediates In assessing the usefulness of a particular methodological approach therefore we will need to keep in mind that there is a premium on those p tocols that can be easily adapted for the analysis of multiple members within a gene family Cancer Cell Signaling Methods and Protocols brings together several such methods in cell signaling research that are scientifically grounded within the cancer biology field

E. coli Plasmid Vectors Nicola Casali, Andrew Preston, 2008-02-03 A comprehensive collection of readily reproducible techniques for the manipulation of recombinant plasmids using the bacterial host E coli The authors describe proven

methods for cloning DNA into plasmid vectors transforming plasmids into E coli and analyzing recombinant clones They also include protocols for the construction and screening of libraries as well as specific techniques for specialized cloning vehicles such as cosmids bacterial artificial chromosomes l vectors and phagemids Common downstream applications such as mutagenesis of plasmids recombinant protein expression and the use of reporter genes are also described **Genomics** Michael J. Brownstein, Arkady Khodursky, 2008-02-03 This collection of robust readily reproducible methods for microarray based studies includes expert guidance in the optimal data analysis and informatics On the methods side are proven techniques for monitoring subcellular RNA localization en masse for mapping chromosomes at the resolution of a single gene and for surveying the steady state genome wide distribution of DNA binding proteins in vivo For those workers dealing with massive data sets the book discusses the methodological aspects of data analysis and informatics in the design of microarray experiments the choice of test statistic and the assessment of observational significance data reduction and clustering Protein Misfolding and Disease Peter Bross, Niels Gregersen, 2008-02-02 For decades it has been known that structured conformations are important for the proper functioning of most cellular proteins However appreciation that protein folding to the functional conformations as well as the structural maintenance of protein molecules are very complex processes has only emerged during the last ten years. The intimate interplay uncovered by this scientific development led us to realize that perturbations of the protein folding process and disturbances of conformational maintenance are major disease mechanisms. This development has given rise to the concept of conformational diseases and the broader signature of protein folding diseases comprising diseases in which mutations or environmental stresses may result in a partial misfolding that leads then to alternative conformations capable of disturbing cellular processes. This may happen by self association aggregation as in prion and Alzheimer's diseases or by incorporation of alternatively folded subunits into structural entities as in collagen diseases Another possibility is that folding to the native structure is impaired or abolished resulting in decreased stea state levels of the correctly folded protein as is observed in cystic fibrosis and 1 antitrypsin deficiency as well as in many enzyme deficiencies In addition deficiencies of proteins that are engaged in assisting and supervising protein folding protein quality control may impair the folding of many other proteins resulting in pathological phenotypes Examples of this are the spastic paraplegia attributable to mutations in mitochondrial protease chaperone complexes **Capillary Electrophoresis of Carbohydrates** Pierre Thibault, Susumu Honda, 2008-02-03 A collection of cutting edge techniques for using capillary electrophoresis CE to analyze complex carbohydrates These readily reproducible protocols provide methods for sample preparation analysis of mono and oligosaccharides glycoproteins and glycoconjugates A useful appendix describes the structures of the most commonly encountered carbohydrate residues and olgosaccharides from mammalian and bacterial origins Each protocol contains detailed information on reagents apparatus notes comments and tips on procedures

Cardiac Cell and Gene Transfer Joseph M. Metzger, 2008-02-03 Heart disease is the leading cause of death in

developed countries Recent experimental advances featuring cellular molecular and genetic tools and technologies offer the potential for new therapeutic strategies directed toward remediation of inherited and acquired heart diseases Whether these recent basic science advances will ultimately translate to clinical efficacy for patients with heart disease is unknown and is important to ascertain Cardiac Cell and Gene Transfer Principles Protocols and Applications is designed to provide the reader with up to date coverage of a myriad of specific methodo gies and protocols for gene and cell transfer to the myocardium Each chapter features a Notes section that provides useful how to problem solving insights that are often left unstated in standard published protocols Cardiac Cell and Gene Transfer Principles Protocols and Appli tions addresses principles and applications of cell and gene transfer to the heart including protocols for vector production and purification Detailed step by step methods and applications for first second generation adenoviral vectors adeno associated vectors gutted adenoviral vectors and lentiviral vectors are included Additionally detailed methods for cardiac cell grafting and transplantation are provided and these chapters highlight the prospects of cell based therapies for cardiac repair The book also covers specific in vivo techniques for cardiac gene transfer and specifies subsequent cellular and organ level physiological assessment techniques and protocols Accordingly this book is designed for basic science and clinical researchers in the academic pharmaceutical and biotechnology sectors of the cardiovascular community in Inflammation and Immunity Daniele D'Ambrosio, Francesco Sinigaglia, 2008-02-02 Chemokines and their receptors play a central role in the pathogenesis of numerous perhaps all acute and chronic inflammatory diseases About 50 distinct chemokines produced by a variety cell types and tissues either c stitutively or in response to inflammatory stimuli are involved in a plethora of biological processes These small secreted proteins exert their exquisitely variegated functions upon binding to a family of seven transmembrane spanning G protein coupled receptors GPCRs composed of almost 20 distinct entities The biological activities of chemokines range from the control of leukocyte trafficking in basal and inflammatory conditions to the regulation of hema poiesis angiogenesis tissue architecture and organogenesis The basis for such diversified activities rests on one hand upon the ubiquitous nature of chemokine production and chemokine receptor expression Virtually every cell type can produce chemokines and expresses a unique combination of chemokine receptors On the other hand chemokine receptors make use of a flexible and complex network of intracellular signaling machineries that can regulate a variety of cellular functions ranging from cell migration growth and differentiation to death As knowledge of the size of chemokine and chemokine receptor families rapidly reaches completeness much is still to be uncovered in terms of fu tional architecture of the chemokine system The disparity between the large number of chemokines and that smaller number of receptors is balanced by the promiscuity in ligand receptor interactions with multiple chemokines binding to the same receptor and several chemokines binding to more than one receptor Inflammation Protocols Paul G. Winyard, Derek A. Willoughby, 2008-02-03 Inflammation has been described as the basis of many pathologies of human disease When one

considers the updated signs of inflammation they would be vasodilation cell migration and in the case of chronic inflam tion cell proliferation often with an underlying autoimmune basis Gen ally inflammation may be divided into acute chronic and autoimmune though the editors believe that most if not all chronic states are often the result of an autoimmune response to an endogenous antigen Thus a proper understanding of the inflammatory basis may provide clues to new therap tic targets not only in classical inflammatory diseases but atherosclerosis cancer and ischemic heart disease as well The lack of advances in classical inflammatory diseases such as rh matoid arthritis may in part arise from a failure to classify the disease into different forms That different forms exist is exemplified in patients with d fering responses to existing antiinflammatory drugs ranging from nonresponders to very positive responders for a particular nonsteroidal an inflammatory drug NSAID Though researchers have progressively unreled the mechanisms the story is far from complete It should also be noted that the inflammatory response is part of the innate immune response or to use John Hunter's words in 1795 inflammation is a salutary response That may be applied in particular to the defensive response to invading micro ganisms Cytokines and **Colony Stimulating Factors** Dieter Körholz, Wieland Kiess, 2008-02-04 The immune system is a complex network in which different cell types and soluble factors interact to efficiently eliminate various kinds of microorganisms as well as aberrant cell clones The roots of immunologic investigations reach far into the past In 430 BC Thucydides reported that survivors of the plague did not present a second time with similar symptoms. The first report of a successful immu therapy was made by Edward Jenner in 1798 who found a protective effect of cowpox vaccination against human pox Since then much knowledge has been accumulated today investigations of the molecular mechanisms of immune regulation are of central research interest The novel insights into gene polymorphisms and gene regulation gathered from this work has improved our knowledge of individual immune reactions and risk factors in overcoming infections Strategies to use the immune system for cancer treatment have been propelled by the discovery of divergent immunoregulatory cytokines and the introduction of new gene therapy strategies to modify immune responses Recently the discovery of various dendritic cells has focused attention on these cell types as central elements of the immune response and to the possibility of dendritic cell expansion maturation and consecutive stimulation with immuno active tumor specific peptides Similarly methods for ex vivo expansion of various stem cell derived cell types have led to an improved therapeutic management of various benign and malignant diseases

Atomic Force Microscopy Pier Carlo Braga, Davide Ricci, 2008-02-02 The natural biological medical and related sciences would not be what they are today without the microscope After the introduction of the optical microscope a second breakthrough in morphostructural surface analysis occurred in the 1940s with the development of the scanning electron microscope SEM which instead of light i e photons and glass lenses uses electrons and electromagnetic lenses magnetic coils Optical and scanning or transmission electron microscopes are called far field microscopes because of the long distance between the sample and the point at which the image is obtained in comparison with the wavelengths of the photons or

electrons involved In this case the image is a diffraction pattern and its resolution is wavelength limited In 1986 a completely new type of microscopy was proposed which without the use of lenses photons or electrons directly explores the sample surface by means of mechanical scanning thus opening up unexpected possibilities for the morphostructural and mechanical analysis of biological specimens These new scanning probe microscopes are based on the concept of near field microscopy which overcomes the problem of the limited diffraction related resolution inherent in conventional microscopes Located in the immediate vicinity of the sample itself usually within a few nanometers the probe records the intensity rather than the interference signal thus significantly improving resolution Since the most we known microscopes of this type operate using atomic forces they are frequently referred to as atomic force microscopes AFMs

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