

# Recent advances in cell adhesion molecules and extracellular matrix proteins: potential clinical implications

Shaker A. Mousa and David A. Cheresh

The roles of cell adhesion molecules (CAMs) and extracellular matrix proteins (ECMs) in various pathological processes leading to both acute and chronic disease states have recently been documented. The authors report on the development of various therapeutic and diagnostic candidates based on the key role of CAMs in a range of diseases, and discuss the structure-function aspects of cell adhesion and signaling of the different CAMs/ECMs.

Several physiological processes, including cell activation, migration, proliferation and differentiation, require direct contact between cells or extracellular matrix proteins. Cell-cell and cell-matrix interactions are mediated through several different families of cell adhesion molecules (CAMs), including the selectins, the integrins, the cadherins and the immunoglobulins. Newly discovered CAMs, together with the discovery of new roles for integrins, selectins and immunoglobulins in certain disease states, provide great opportunities for the development of therapeutic, and perhaps diagnostic, modalities<sup>1</sup>.

Intensified R&D efforts, directed at manipulating CAM activity through the use of monoclonal antibodies, peptides, peptidomimetics and nonpeptide small molecules, continue

to broaden the scope of key clinical applications (Table 1). This article focuses on current advances in the discovery and development of novel anti-CAM agents for potential therapeutic and diagnostic applications.

## Roles of CAMs in disease states

Cell adhesion molecules play highly significant roles both in normal and in various pathophysiological disease states. For this reason, the selection of a specific and relevant CAM to target a certain disease condition without interfering with other normal cellular functions is a very important prerequisite for ultimate success in developing truly active and safe therapeutic strategies<sup>2-7</sup>. Recent breakthroughs with animal models, the latest advances in the understanding of the signaling pathways, transcriptional regulation and the structure-function aspects of CAMs, as well as the role of CAMs and extracellular matrix proteins (ECMs) in cellular migration, spreading, proliferation and survival, have highlighted the potential for novel strategies based on CAM function.

There have been exciting advances in understanding several CAMs; most notably, the  $\alpha_5\beta_1$ ,  $\alpha_6\beta_1$ ,  $\alpha_4\beta_1$  and  $\alpha_9\beta_1$  integrin receptors and their direct relationships to different disease states represent tremendous therapeutic and diagnostic opportunities<sup>1-8</sup>. Potential roles for specific CAMs in different disease states, including cardiovascular, cancer, inflammatory, ocular, pulmonary, bone, central nervous system, kidney and gastrointestinal system disorders, have been suggested, including the following examples:

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# Recent Advances In Adhesion

**K. L. Mittal**



## **Recent Advances In Adhesion:**

*Recent Advances in Adhesion Science and Technology in Honor of Dr. Kash Mittal* Wojciech (Voytek) Gutowski, Hanna Dodiuk, 2013-12-31 The surface of an object is the first thing we see or touch Nearly every article or object we encounter at home in industry land transportation aerospace or the medical field in some way uses an adhesive a sealant or a decorative coating Adhesion science provides the technology and the know how behind these applications Recent Advances in Adhesion Science and Technology in Honor of Dr Kash Mittal is dedicated to Dr Mittal s outstanding contributions to the global adhesion community and his achievements in disseminating the science of adhesion This Festschrift volume contains selected papers from the Special Symposium on Recent Advances in Adhesion Science and Technology held in honor of Dr Mittal to commemorate the publication of his 100th edited book Written by world renowned researchers the papers have been updated for inclusion in this volume They offer insight into recent developments and the significant ramifications to adhesion science and adhesive technology Nineteen articles are divided into five sections Interfaces Wettability and Adhesion Surface Modification of Polymers Adhesion Aspects of Bio Based Materials and Bioadhesion Adhesives and Their Testing and Nanomaterials and Nanocomposites Reflecting the multidisciplinary nature of adhesion science the topics covered include metal polymer interfaces and ways to improve adhesion lateral force at liquid solid interface particle adhesion in pharmaceutical sciences wood joints formed without use of adhesives reinforced polymer composites using different fillers green composites medium density fiber board surfaces for powder coating adhesion aspects in dentistry E coli interactions in porous media analysis of adhesive behavior in bonded assemblies soy proteins as wood adhesives carbon nanotube based interphase sensors and reaction of multiwalled carbon nanotubes with gaseous atoms

*Recent Advances in Adhesion Science and Technology in Honor of Dr. Kash Mittal* Wojciech (Voytek) Gutowski, Hanna Dodiuk, 2013-12-31 The surface of an object is the first thing we see or touch Nearly every article or object we encounter at home in industry land transportation aerospace or the medical field in some way uses an adhesive a sealant or a decorative coating Adhesion science provides the technology and the know how behind these applications Recent Advances in

**Recent Advances in Prolactin Research** Maria Diakonova, PhD, 2014-12-03 Recent Advances in Prolactin Research summarizes the current knowledge of prolactin PRL PRL receptor PRL dependent signaling pathways the role of PRL in oncogenesis and PRL crosstalk with other oncogenic factors The chapters are written by experts in these fields and focus on identifying and reviewing timely experimental findings that provide new insights into the expanding role of PRL in the pathophysiology associated with a variety of human conditions Prolactin is a peptide hormone that is best known for its role in lactation Prolactin also has an influence on hematopoiesis and angiogenesis and is involved in the regulation of blood clotting through several pathways Although PRL was discovered more than 80 years ago the understanding of PRL signaling and its relationship to various pathologies is still very incomplete PRL is not only a pituitary hormone with an important role in reproduction but PRL also acts as a cytokine

modulating a wide variety of physiological processes For example data gathered during the last decade have demonstrated that locally produced PRL acts as the autocrine paracrine factor and plays a contributory role during breast oncogenesis In fact the scientific and clinical communities have suggested that the manipulation of the PRL axis may lead to the successful treatment of breast cancer However recent work has demonstrated that the role of the PRL axis is much more complex than first envisaged

**Recent Advances in Epilepsy Research** Devin K. Binder, Helen E. Scharfman, 2013-03-14 Epilepsy research has entered an exciting phase as advances in molecular analysis have supplemented in vitro and in vivo electrophysiologic and phenotypic characterization Recent Advances in Epilepsy Research sets forth a series of chapter reviews by researchers involved in these advances This volume is a composite profile of some exciting recent investigations in select areas of enquiry Key features neurogenetics of seizure disorders new developments in cellular and molecular neurobiology of seizure disorders the role of growth factors in seizures new advances in the roles of metabotropic glutamate receptors and GABA receptors and transporters gap junctions neuroimmunology of epilepsy malformations of cortical development neurogenesis new animal models of epilepsy and the use of brain stimulation to treat epilepsy This book should be of interest to a wide variety of audiences including graduate students in neurobiology and related disciplines neuroscientists medical students neurologists neurosurgeons and industry including pharmaceutical companies and medical device companies There are many ideas in this book that will lead ingenious innovators in academia and industry to develop new and better therapies

**Recent Advances in Experimental Mechanics** E.E. Gdoutos, 2007-05-08 This book contains 71 papers presented at the symposium on Recent Advances in Experimental Mechanics which was organized in honor of Professor Isaac M Daniel The symposium took place at Virginia Polytechnic Institute and State University on th June 23 28 2002 in conjunction with the 14 US National Congress of Applied Mechanics The book is a tribute to Isaac Daniel a pioneer of experimental mechanics and composite materials in recognition of his continuous original diversified and outstanding contributions for half a century The book consists of invited papers written by leading experts in the field It contains original contributions concerning the latest developments in experimental mechanics It covers a wide range of subjects including optical methods of stress analysis photoelasticity moir etc composite materials sandwich construction fracture mechanics fatigue and damage nondestructive evaluation dynamic problems fiber optic sensors speckle metrology digital image processing nanotechnology neutron diffraction and synchrotron radiation methods The papers are arranged in the following nine sections Mechanical characterization of material behavior composite materials fracture and fatigue optical methods n destructive evaluation neutron diffraction and synchrotron radiation methods hybrid methods composite structures and structural testing and analysis

**Progress in Adhesion and Adhesives, Volume 6** K. L. Mittal, 2021-08-16 With the voluminous research being published it is difficult if not impossible to stay abreast of current developments in a given area The review articles in this book consolidate information to provide an alternative way to follow the latest research activity

and developments in adhesion science and adhesives With the ever increasing amount of research being published it is a Herculean task to be fully conversant with the latest research developments in any field and the arena of adhesion and adhesives is no exception Thus topical review articles provide an alternate and very efficient way to stay abreast of the state of the art in many subjects representing the field of adhesion science and adhesives The 19 chapters in this Volume 6 follow the same order as the review articles originally published in RAA in the year 2020 and up to June 2021 The subjects of these 19 chapters fall in the following areas Adhesives and adhesive joints Contact angle Reinforced polymer composites Bioadhesives Icephobic coatings Adhesives based on natural resources Polymer surface modification Superhydrophobic surfaces The topics covered include hot melt adhesives adhesively bonded spar wingskin joints contact angle hysteresis fiber matrix adhesion in reinforced thermoplastic composites bioadhesives in biomedical applications mucoadhesive pellets for drug delivery applications bio inspired icephobic coatings wood adhesives based on natural resources adhesion in biocomposites vacuum UV surface photo oxidation of polymers and other materials vitrimers and their relevance to adhesives superhydrophobic surfaces by microtexturing structural acrylic adhesives mechanically durable water repellent surfaces mussel inspired underwater adhesives and cold atmospheric pressure plasma technology for modifying polymers Audience This book will be valuable and useful to researchers and technologists in materials science nanotechnology physics surface and colloid chemistry in multiple disciplines in academia industry various research institutes and other organizations

**Recent advances in crop protection** P.Parvatha Reddy,2012-09-14 In the recent years the need to increase food production to meet the demands of rapidly increasing population from a limited land resource necessitated the use of intensive farming systems with the inputs like narrow genetic base high dose of fertilizers pesticides irrigation monocropping etc which led to the development of diseases and pest The effect of changing global climate particularly the sharp increase in CO<sub>2</sub> concentration has increased the susceptibility of plants to pathogens and pests Because of the chemicalization of agriculture the age old eco friendly pest management practices like sanitation crop rotation mixed cropping adjustment of date of planting fallowing summer ploughing green manuring composting etc are not being practiced affecting the crops adversely This has encouraged researchers to look for eco friendly and novel approaches for pest management The information on recent advances in crop protection involving bacteria fungi nematodes insects mites and weeds is scattered The book delves upon the most latest developments in crop protection such as avermectins bacteriophages biofumigation biotechnological approaches bio priming of seeds disguising the leaf surface use of non pathogenic strains plant defense activators plant growth promoting rhizobacteria pathogenesis related proteins strobilurin fungicides RNA interference and variety of mixtures cultivar mixtures multilines soil solarization biointensive integrated pest management among several others fusion protein based biopesticides seed mat technology and environmental methods This book is a ready reference for students policy makers scientists researchers and extension workers

**Progress in Adhesion and Adhesives, Volume 7**

K. L. Mittal, 2023-12-07 **PROGRESS IN ADHESION AND ADHESIVES** Keep up to date with the latest on adhesion and adhesives from an expert group of worldwide authors The book series Progress in Adhesion and Adhesives was conceived as an annual publication and the premier volume made its debut in 2015 The series has been well received as it is unique in providing substantive and curated review chapters on subjects that touch many disciplines Peer reviewed and edited by Dr Mittal the individual chapter reviews have become a trusted source of quality information The current book contains eight commissioned chapters and cover topics including stress distribution and design analysis of adhesively bonded tubular composite joints durability of structural adhesive joints mechanical surface treatment of adherends for adhesive bonding surface modification of polymer materials by excimer UV light corona discharge treatment of materials to enhance adhesion adhesion activation of aramid fibers dual cured hydrogels for bioadhesives and biomedical applications and non adhesive SLIPS like surfaces Audience This book will be valuable and useful to adhesionists and adhesive technologists polymer scientists materials scientists as well as those involved interested in adhesive bonding packaging printing modification of polymer surfaces biomedical applications and non adhesive and omniphobic surfaces **Recent Advances in Adhesion**

Lieng-Huang Lee, 1973 **Treatise on Adhesion and Adhesives** Robert L. Patrick, 1981-06-01 **Recent Advances in Fracture Mechanics** W.G. Knauss, R.A. Schapery, 2013-06-29 The papers in this volume represent a considerable cross section of the field of fracture mechanics a testimony to the breadth of interest that Mel and Max Williams friends share with them Several are expanded versions of papers that were given in special sessions honoring them at the 1997 Ninth International Conference on Fracture Mechanics in Sydney Australia The subjects treated in this volume can be classified as follows dynamic fracture problems as viewed primarily from a classical continuum point of view analysis of relatively general crack geometries fracture problems of polymers and other relatively ductile materials scaling rules that allow extension of results obtained at one size to be translated into behavior at different size scales problems dealing with interactions that produce complex stress fields fracture problems directly appropriate to composite materials analysis of stress concentrations in anisotropic elastic solids and the problem of cracks in thin plates bending This volume will be of interest to engineers and scientists working on all aspects of the physics and mechanics of fracture **Adhesion Science and Technology**

Lieng-Huang Lee, 2013-04-17 The first ACS Adhesion Symposium was held in Washington D C September 1971 During the four years since that meeting much interest in adhesion has been generated among six divisions of the American Chemical Society Then in 1974 the Macromolecular Secretariat appointed me to work closely with the six Session chairmen in organizing this Symposium on Science and Technology of Adhesion Needless to say the success of the Symposium which took place between April 7 and 10 1975 in Philadelphia Pa is due to their excellent cooperation and the enthusiastic response of contributors As originally planned each division was responsible for one session and most of the papers including several late contributions are published in these two volumes of proceedings During the Symposium we held a banquet in honor of

Professor Herman Mark in celebration of his eightieth birthday His Plenary Lecture and the Symposium Address by Professor Murray Goodman are published in full at the beginning of the first volume I thank Professors Mark and Goodman for their excellent presentations on this memorable occasion

**Fundamentals of Adhesion and Interfaces** D. S. Rimai, L. P. DeMejo, K. L. Mittal, 2020-05-18 No detailed description available for Fundamentals of Adhesion and Interfaces

[Recent Advances in Structural Integrity Analysis - Proceedings of the International Congress \(APCF/SIF-2014\)](#) Lin Ye, 2015-02-10 The proceedings of the International Congress c include about 120 papers selected out of 160 papers submitted for presentations at APCF SIF 2014 to be held in Sydney Australia December 9 12 2014 and uniting the Asian Pacific Conference on Fracture and Strength 2014 APCFS 2014 with the International Conference on Structural Integrity and Failure SIF 2014 The congress will be hosted by The University of Sydney and co organized by Australia Fracture Group AFG the Chinese Mechanical Engineering Society Materials Institution CMES MI the Korean Society of Mechanical Engineers Materials and Fracture Division KSME MFD and The Japanese Society of Mechanical Engineers Materials and Mechanics Division JSME MMD The congress follows the series of the previous very successful APCF and SIF international forums in particular APCFS 2012 Busan and the 8th SIF Melbourne 2013 Characterisations of complex mechanisms of damage accumulation and failure Application of new multi scale modelling approaches in problems associated with structural integrity Development of more accurate technologies for structural damage assessment

**Progress in Adhesion and Adhesives, Volume 4** K. L. Mittal, 2019-07-11 A solid collection of interdisciplinary review articles on the latest developments in adhesion science and adhesives technology With the ever increasing amount of research being published it is a Herculean task to be fully conversant with the latest research developments in any field and the arena of adhesion and adhesives is no exception Thus topical review articles provide an alternate and very efficient way to stay abreast of the state of the art in many subjects representing the field of adhesion science and adhesives Based on the success of the preceding volumes in this series Progress in Adhesion and Adhesives the present volume comprises 9 review articles published in Volume 6 2018 of Reviews of Adhesion and Adhesives The subject of these reviews fall into the following general areas 1 Adhesion to wood and wood bonds 2 Adhesive joints 3 Adhesion in microelectronic packaging 4 Surface modification 5 Contact angle wettability and surface free energy The topics covered include Adhesion phenomena in microelectronic packaging adhesives for wood and lignocellulosic materials adhesion to wood and lignocellulosic materials adhesively bonded lap joints having bi adhesive and modulus graded bondlines adhesion between compounded elastomers applications of contact angle measurements in pharmaceuticals and foods oxygen or ammonia plasma treatment of polyolefin surfaces surface free energy determination of powders and particles wood bonds and dispersion adhesion forces between macroscopic objects

[Adhesives Handbook](#) J. Shields, 2013-09-17 Adhesives handbook Third edition is a guidebook that covers the basic concepts of adhesive bonding process The book emphasizes products based on advance synthetic polymers The coverage of the text includes design of the

adhesive joint surface preparation of bonding materials selection of a suitable adhesive and the specification of processing and testing techniques The book will be of great use to design engineers and technicians involved in the materials bonding process in their respective works

**Progress in Adhesion and Adhesives, Volume 2** K. L. Mittal, 2017-06-15 With the ever increasing amount of research being published it is a Herculean task to be fully conversant with the latest research developments in any field and the arena of adhesion and adhesives is no exception Thus topical review articles provide an alternate and very efficient way to stay abreast of the state of the art in many subjects representing the field of adhesion science and adhesives Based on the success and the warm reception accorded to the premier volume in this series Progress in Adhesion and Adhesives containing the review articles published in Volume 2 2014 of the journal Reviews of Adhesion and Adhesives RAA volume 2 comprises 14 review articles published in Volume 4 2016 of RAA The subjects of these 14 reviews fall into the following general areas 1 Surface modification of polymers for a variety of purposes 2 Adhesion aspects in reinforced composites 3 Thin films coatings and their adhesion measurement 4 Bioadhesion and bio implants 5 Adhesives and adhesive joints 6 General adhesion aspects The topics covered include surface modification of natural fibers for reinforced polymer composites adhesion of submicrometer thin metals films surface treatments to modulate bioadhesion hot melt adhesives from renewable resources particulate polymer composites functionally graded adhesively bonded joints fabrication of nano biodevices effects of particulates on contact angles thermal stresses in adhesively bonded joints and ways to mitigate these laser assisted electroless metallization of polymer materials adhesion measurement of coatings on biodevices implants cyanoacrylate adhesives and adhesion of green flame retardant coatings onto polyolefins

**Advances in Structural Adhesive Bonding** David A. Dillard, 2023-06-10 Advances in Structural Adhesive Bonding Second Edition reviews developments in adhesive bonding for a range of advanced structural engineering applications This new edition has been fully revised to include the latest advances in materials testing and modeling methods lifecycle considerations and industrial implementation Sections review advances in commonly used groups of structural adhesives covering epoxy acrylic anaerobic and cyanoacrylate polyurethane and silicone adhesives along with toughening Other chapters cover various types of adherends and pre treatment methods for structural materials including metals plastics composites wood and joint design and testing including topics such as fracture mechanics life prediction techniques and advanced testing methods This is a valuable guide for all those working with structural adhesives including those in an industrial setting adhesive specialists structural engineers design engineers R D professionals and scientists as well as academic researchers and advanced students in adhesives joining technology materials science and mechanical engineering Provides detailed coverage on the main adhesive groups including epoxy acrylic cyanoacrylate polyurethane and silicone adhesives Includes the latest developments across adherends pre treatment methods joint design and testing durability and lifecycle related issues Addresses environmental challenges adhesive specification quality control and risk mitigation for specific industrial

application areas      **Adhesion** Wulff Possart, 2006-05-12 Emphasizing the most recent developments this book addresses both the basic and applied aspects of adhesion The authors present the latest results on fundamental aspects adhesion in biology chemistry for adhesive formulation surface chemistry and the pretreatment of adherends mechanical issues non destructive testing and the durability of adhesive joints as well as advanced technical applications of adhesive joints Prominent scientists review the current level of knowledge concerning the role of chemical bonds in adhesion new resins and nanocomposites for adhesives and about the role played by macromolecular architecture in the properties of hot melt and pressure sensitive adhesives Written by 34 acknowledged experts from academic and industrial research facilities this is a valuable source of information for chemists physicists biologists and engineers as well as graduate students interested in fundamental and practical adhesion      **Progress in Adhesion and Adhesives, Volume 8** K. L. Mittal, 2024-10-01 Keep up to date with the latest on adhesion and adhesives from an expert group of worldwide authors The book series Progress in Adhesion and Adhesives was conceived as an annual publication and the premier volume made its debut in 2015 The series has been well received as it is unique and provides substantive and curated review chapters on subjects that touch many disciplines The current book contains nine chapters on topics that include multi component theories in surface thermodynamics and adhesion science plasma deposited polymer layers as adhesion promoters functional interlayers to control interfacial adhesion in reinforced polymer composites hydrophobic materials and coatings from natural sources mechanics of ice adhesion epoxy adhesives technology latest developments and trends hot melt adhesives for automobile assembly lifetime estimation of thermostat adhesives by physical and chemical aging processes and nondestructive evaluation and condition monitoring of adhesive joints Audience The volume will appeal to adhesionists adhesive technologists polymer scientists materials scientists and those involved interested in adhesive bonding plasma polymerization adhesion in polymer composites durability and testing of adhesive joints materials from natural sources and ice adhesion and mitigation

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