

Understanding the relevance of herb–drug interaction studies with special focus on interplays: a prerequisite for integrative medicine

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Abstract

Integrative medicine refers to the blending of conventional and evidence-based complementary medicines and therapies with the aim of using the most appropriate of either or both modalities for ultimate patient benefits. One of the major hurdles for the same is the chances of potential herb–drug interactions (HDIs). These HDIs could be beneficial or harmful, or even fatal; therefore, a thorough understanding of the eventualities of HDIs is essential so that a successful integration of the modern and complementary alternative systems of medicine could be achieved. Here, we summarize all the important points related to HDIs, including types, tools/methods for study, and prediction of the HDIs, along with a special focus on interplays between drug metabolizing enzymes and transporters. In addition, this article covers future perspective, with a focus on background endogenous players of interplays and approaches to predict the drug–disease–herb interactions so as to fetch the desired effects of these interactions.

Keywords: Ayurveda, drug metabolizing enzymes–transporter interplays, herb–drug–disease interactions, integrative medicine

Introduction

Modern system of medicine has emerged as the primary choice for the treatment of nearly all types of health-related issues, although, it is mainly based on the nonholistic/bug killing/target-based approach, which ultimately leads to future side effects (notable in case of chronic disorders such as cancer, diabetes, arthritis, etc.).^{1–3} However, patients with such chronic illnesses directly/indirectly undergo combinational/multimodal therapy with or without the knowledge of physicians, leading to potential herb–drug interactions (HDIs).¹ The MD Anderson Cancer Centre, in USA, reported that 52% of their cancer patients had used at least one form of complementary and alternative medicine (CAM), and 77% of those were using herbs.⁴ While, according to the World Health Organization (WHO) and other reviews >80% world's population uses CAM for their health care needs and particularly in western countries CAM has become increasingly popular over the last few decades.^{1–5} However,

concomitant usage of herbs and conventional medicines globally could be much higher as healthcare professionals often do not ask about herbal remedies when prescribing and patients do not volunteer that they are taking them.^{1,7–11} Indeed, such a scenario of concomitant usage of herbs/CAM and conventional medicines brings with it the potential problem of HDIs and this issue has emerged as a major hurdle/problem in our journey toward integrative medicine (IM).^{1,2,12} IM refers to the blending of conventional and evidence-based complementary medicines and therapies with the aim of using the most appropriate of either or both modalities for efficient patient care.¹⁴ In short, IM uses all appropriate, evidence-based therapies to achieve health.¹⁵ For example, *Withania somnifera*, have been widely accepted as a novel complementary therapy for integrative oncology care.¹⁶ *W. somnifera* not only helps in controlling the tumor growth but also exerts antioxidant, anti-inflammatory, immunomodulating, and antistress properties that help in combating the cancer and associated complications. It has also been found that, *W. somnifera* enhances the effectiveness of radiation therapy and chemotherapy while potentially mitigating their undesirable side effects.^{16–18} Similar experiences were also observed by Patil et al and Borse et al for *Asparagus racemosus* and/or *Timospora cordifolia* accepted as novel complementary therapy for integrative oncology care.^{19–22} IM/care practices are getting increased day by day throughout the world. For instance, IM is being practiced at BSDT's Ayurvedic Hospital & Research Centre, India, The Osler Center for Integrative Medicine, Arizona Center for Integrative Medicine, and many other places in the world.^{23–26} However, integrative management of the disease is far bigger challenge in spite of high scientific efforts proceeding globally mainly because of the potential risk associated with HDIs.^{27–33} Hence, the focus needs to be shifted on potential interactions between herbs and pharmaceuticals because of the growing popularity of herbal medicines/CAM. Here, it must be highlighted that the probability of HDIs can be much higher than drug–drug interactions, since most herbal medicines (even single-herb products) contain mixtures of pharmacologically active

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Shasha Hu



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Viscous Flow Interaction Studies Robert H. Korkegi, 1975 The research was designed to gain understanding of the flow of air at high speeds over the components of lifting supersonic and hypersonic vehicles wings flaps fins inlets and their interactions with respect to heating surface friction pressure and aerodynamic forces The objective was to help predict a flows on complex aerospace vehicle configurations in high speed flight and b the location of areas of high heating The research covers the areas of laminar and turbulent boundary layers boundary layer transition boundary layer separation base flows and wakes low density flows three dimensional interactions viscous flow problems and some flow measurement techniques

Studying Interpersonal Interaction Barbara M. Montgomery, Steve Duck, 1993-11-01 This volume presents a comprehensive critical examination of current research methods used to study human social behavior as it occurs in interpersonal settings such as families acquaintanceships friendships and romantic partnerships Multidisciplinary in approach the book s chapters are written by leading figures in communication social psychology sociology and family studies who explore the methodological choices a researcher must make in order to study interpersonal interaction To permit clear comparison all chapters in this volume reference the same common research problem to develop examples illustrate controversial issues and describe the potential of the particular method under discussion Written in an accessible style chapters openly discuss the strengths and weaknesses of each method consider underlying philosophy and assumptions and note limitations as well as advantages The result is an originally crafted work that offers readers a unique way to learn about compare and ultimately judge the many methods presently available to the researcher or student of interpersonal interaction Part I considers the assumptions researchers must make about the nature of a social interaction in order to study it Chapters address issues related to formulating research problems choosing a research paradigm determining a viewpoint participant peer or observer from which to gather data deciding on appropriate levels and units of analysis incorporating time and assessing the mutual adaptation that characterizes interpersonal communication Part II focuses on procedures for gathering data These include using accounts and narratives logs and diaries retrospective self reports discourse records direct observation and experimentation Part III highlights new and newly re discovered methods for analyzing interaction data Assuming that the reader is familiar with traditional regression and mean differences approaches chapters build on this knowledge base to discuss content analysis tests of sequential association in categorical data ways of dealing with interdependence in dyadic data and longitudinal analytic techniques such as time series analysis phasic analysis and meta analysis The book concludes with a chapter that both summarizes previous chapters and convincingly argues for methodological pluralism Encompassing the broad range of central concerns in designing research studies from conceptualization through assessment to data analysis this book is an ideal reference source for all those engaged in actual research projects It is also highly valuable for advanced undergraduate and graduate methods courses

Gene-Environment Interactions in Developmental Psychopathology Kenneth A. Dodge, Michael Rutter, 2011-09-01

Bringing together foremost experts this book reviews groundbreaking gene environment research and explores implications for clinical practice prevention and public policy Presented is cutting edge work on the interplay of genetic factors and childhood experiences in the development of mental disorders such as depression conduct disorder and schizophrenia Essential topics include what scientists currently know about susceptibility genes the mechanisms by which maltreatment and other stressors interact with biological susceptibilities across development and factors that make certain children more resilient than others Future directions for personalizing treatment and prevention efforts thus making them more effective are discussed

An Introduction to Interaction Angela Cora Garcia, 2023-04-20 An engaging introduction to the study of spoken interaction this book provides a thorough grounding in the theory and methodology of conversation analysis It covers data collection techniques for analysis and practical applications and guides students through foundational and new research findings on everyday conversations and talk in institutional contexts from media business and education to healthcare and law Now thoroughly updated to showcase contemporary developments in the field this second edition includes New chapters on interaction in psychotherapy educational settings and language learning and teaching Expanded coverage of doctor patient communications customer service and business meetings workplace interviews and online interactions including social media video gaming and livestreams A wider variety of research on other languages including French German Italian Finnish Swedish Arabic Korean Chinese and Japanese Multimodal analyses of interaction focusing on the integration of embodied action and talk Complete with student activities recommended reading sections and a companion website featuring slides quiz questions and links to further transcripts this book is an essential guide for doing conversation analysis and offers fresh insight into how we understand talk

Embodied Interaction Jürgen Streeck, Charles Goodwin, Curtis D. LeBaron, 2011-08-15 Leading international scholars provide a coherent framework for analyzing body movement and talk in the production of meaning

Human-computer Interaction and Management Information Systems: Foundations Ping Zhang, Dennis F. Galletta, 2015-03-26 Human Computer Interaction and Management Information Systems Foundations offers state of the art research by a distinguished set of authors who span the MIS and HCI fields The original chapters provide authoritative commentaries and in depth descriptions of research programs that will guide 21st century scholars graduate students and industry professionals Human Computer Interaction or Human Factors in MIS is concerned with the ways humans interact with information technologies and tasks especially in business managerial organizational and cultural contexts It is distinctive in many ways when compared with HCI studies in other disciplines The MIS perspective affords special importance to managerial and organizational contexts by focusing on analysis of tasks and outcomes at a level that considers organizational effectiveness With the recent advancement of technologies and development of many sophisticated applications human centeredness in MIS has become more critical than ever before This book focuses on the basics of HCI

with emphasis on concepts issues theories and models that are related to understanding human tasks and the interactions among humans tasks information and technologies in organizational contexts in general **Advancements of Mass**

Spectrometry in Biomedical Research Alisa G. Woods, Costel C. Darie, 2019-07-25 This volume explores the use of mass spectrometry for biomedical applications Chapters focus on specific therapeutic areas such as oncology infectious disease and psychiatry Additional chapters focus on methodology technologies and instrumentation as well as on analysis of protein protein interactions protein quantitation and protein post translational modifications Various omics fields such as proteomics metabolomics glycomics lipidomics and adductomics are also covered Applications of mass spectrometry in biotechnological and pharmaceutical industry are also discussed This volume provides readers with a comprehensive and informative manual that will allow them to appreciate mass spectrometry and proteomic research but also to initiate and improve their own work This book acts as a technical guide as well as a conceptual guide to the newest information in this exciting field

Designing Interactions with Robots Maria Luce Lupetti, Cristina Zaga, Nazli Cila, Selma Šabanović, Malte F. Jung, 2024-11-28 Developing robots to interact with humans is a complex interdisciplinary effort While engineering and social science perspectives on designing human robot interactions HRI are readily available the body of knowledge and practices related to design specifically interaction design often remain tacit Designing Interactions with Robots fills an important resource gap in the HRI community and acts as a guide to navigating design specific methods tools and techniques With contributions from the field s leading experts and rising pioneers this collection presents state of the art knowledge and a range of design methods tools and techniques which cover the various phases of an HRI project This book is accessible to an interdisciplinary audience and does not assume any design knowledge It provides actionable resources whose efficacy have been tested and proven in existing research This manual is essential for HRI design students researchers and practitioners alike It offers crucial guidance for the processes involved in robot and HRI design marking a significant stride toward advancing the HRI landscape The Open Access version of this book available at <http://www.taylorfrancis.com> has been made available under a Creative Commons Attribution Non Commercial No Derivatives CC BY NC ND 4 0 license *Issues in Chemistry and General Chemical Research: 2012 Edition* , 2013-01-10 Issues in Chemistry and General Chemical Research 2012 Edition is a ScholarlyEditions eBook that delivers timely authoritative and comprehensive information about Chirality The editors have built Issues in Chemistry and General Chemical Research 2012 Edition on the vast information databases of ScholarlyNews You can expect the information about Chirality in this eBook to be deeper than what you can access anywhere else as well as consistently reliable authoritative informed and relevant The content of Issues in Chemistry and General Chemical Research 2012 Edition has been produced by the world s leading scientists engineers analysts research institutions and companies All of the content is from peer reviewed sources and all of it is written assembled and edited by the editors at ScholarlyEditions and available exclusively from us You now have a source you can cite with authority confidence and

credibility More information is available at <http://www.ScholarlyEditions.com> **Human-Computer Interaction**

Constantine Stephanidis, Gavriel Salvendy, 2024-09-28 The pervasive influence of technology continuously shapes our daily lives. From smartphones to smart homes, technology is revolutionizing the way we live, work, and interact with each other. Human computer interaction (HCI) is a multidisciplinary research field focusing on the study of people interacting with information technology and plays a critical role in the development of computing systems that work well for the people using them, ensuring the seamless integration of interactive systems into our technologically driven lifestyles. The book series contains six volumes providing extensive coverage of the field, wherein each one addresses different theoretical and practical aspects of the HCI discipline. Readers will discover a wealth of information encompassing the foundational elements, state of the art, review in established and emerging domains, analysis of contemporary advancements brought about by the evolution of interactive technologies and artificial intelligence, as well as the emergence of diverse societal needs and application domains. These books showcase the pivotal role of HCI in designing interactive applications across a diverse array of domains. Explore the dynamic relationship between humans and intelligent environments with a specific emphasis on the role of Artificial Intelligence (AI) and the Internet of Things (IoT). Provide an extensive exploration of interaction design by examining a wide range of technologies, interaction techniques, styles, and devices. Discuss user experience methods and tools for the design of user-friendly products and services. Bridge the gap between software engineering and human computer interaction practices for usability, inclusion, and sustainability. These volumes are an essential read for individuals interested in human computer interaction research and applications.

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