

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

Swapnil P. Borse, BPharm, PhD^{a,b}, Devendra P. Singh, MPharm, PhD^{a,b}, Manish Nivsarkar, PhD^{a,*}

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).^{1,12,13} 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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^a Department of Pharmacology and Toxicology, B.V. Patel Pharmaceutical Education and Research Development (PERD) Centre, Thaltej, ^b NARM University, Sarkhej-Gandhinagar Highway, Ahmedabad, Gujarat, India.

* Corresponding author, B.V. Patel Pharmaceutical Education and Research Development (PERD) Centre, S. G. Highway, Thaltej, Ahmedabad, Gujarat 380054, India. E-mail address: manishnivsarkar@gmail.com (Manish Nivsarkar).

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Interaction Studies Journal

**Maria Luce Lupetti, Cristina Zaga, Nazli
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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

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

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

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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

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web discuss answers as a class revisit this activity after students have completed the reading answer key preparing to read a 1 aspect 2 spread out 3 income note income can be hourly daily weekly yearly etc 4 productive 5 tend to 6 concentration note another common meaning of concentration is focus 7 suburb b

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web 3 use different parts of speech for instance the paraphrased example above uses the noun birth instead of the adjective born to express the same meaning If the original piece is written in the first person I my team etc you will also need to change the point of view to third person he has a team etc

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