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Foundations and Advances in Pharmaceutical Sciences

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PREFACE

Pharmaceutical sciences continue to evolve through the integration of natural product research, drug design, formulation development, and pharmacological evaluation. The increasing complexity of healthcare demands a multidisciplinary understanding of medicines, from their origin and development to their therapeutic application and regulatory evaluation. This book, *Integrated Pharmaceutical Sciences: From Natural Sources to Therapeutic Applications*, was prepared to provide a concise and structured overview of major domains within pharmaceutical sciences.

The book presents fundamental and applied concepts related to pharmacognosy, pharmaceutics, pharmaceutical chemistry, and pharmacology in an integrated manner. Each chapter has been designed to provide clear academic content with emphasis on practical relevance, recent developments, and current pharmaceutical approaches. Topics included range from natural drug sources and phytochemicals to novel drug delivery systems, toxicological screening, regulatory aspects, nanotechnology, and personalized medicine.

This book is intended for undergraduate and postgraduate students, researchers, and academic professionals seeking a compact interdisciplinary resource in pharmaceutical sciences. The contributors have aimed to maintain scientific accuracy while presenting the material in a concise and accessible format.

We hope this book will contribute to academic learning and encourage further exploration in the field of pharmaceutical sciences.

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Chapter – 14

Personalized Medicine

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14.1. Introduction

The conventional approach to medical treatment relies heavily on a population-based model. Clinicians prescribe drugs based on their average efficacy demonstrated in large, diverse clinical trials. This standard model assumes that patients with the same clinical diagnosis will respond similarly to a given pharmacological intervention. Clinical experience consistently contradicts this assumption. A significant proportion of patients experience adverse drug reactions or derive no therapeutic benefit from standard, first-line treatments. Personalized medicine is a specialized clinical approach designed to address this inherent biological variability. It uses individual patient characteristics to guide medical decisions and optimize patient outcomes.

The core premise involves tailoring therapeutic interventions to the specific genetic, biochemical, and physiological makeup of the individual patient. Researchers utilize genomic, epigenetic, and clinical data to predict how a patient will metabolize a drug and respond to its mechanism of action. The primary objective is the optimization of therapeutic efficacy alongside the deliberate minimization of adverse pharmacological events. This approach