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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 – 3

Basics of Drug Design

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3.1. Introduction

Drug design is the systematic process of inventing new medications based on the knowledge of a biological target. The approach contrasts with traditional drug discovery methods that relied heavily on trial and error or the serendipitous isolation of active ingredients from natural sources. The modern discipline requires a detailed understanding of the molecular interactions between a chemical compound and its specific biological receptor. The primary goal is to create a molecule that will bind selectively to a target site to elicit a desired biological response. This process demands a thorough comprehension of both the physiological mechanisms of the disease and the physical chemistry of the potential drug molecules.

The progression from an initial concept to a viable therapeutic agent involves multiple scientific disciplines. Molecular biology and genomics provide insights into disease pathways. Biochemistry characterizes the structure and function of target proteins. Synthetic organic chemistry supplies the methods to construct novel molecules. Pharmacology evaluates the efficacy and safety of these molecules in biological systems. These fields interact iteratively throughout the drug design process. A researcher synthesizes a compound. A pharmacologist tests it. The results guide the chemist in synthesizing the next, optimized iteration of the molecule.