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W A E L M O H A M E D

PHARMACOLOGICAL FOUNDATIONS OF PARKINSON'S DISEASE

FROM MECHANISMS TO CLINICAL PRACTICE



Pharmacological Foundations of Parkinson's Disease

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From Mechanisms to Clinical Practice

Edited by

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Dedication

*To my beloved parents, **Mohamed** and **Nawal**.
Your unwavering love, sacrifices, and endless encouragement
have been the foundation of every step I have taken.
Thank you for your tireless efforts, your patience, and your faith
in me—even when the path was uncertain.
This work is as much yours as it is mine, a reflection of the values
and strength you instilled in me.
May **Allah SWT** forgive all your sins and shower you with
His infinite blessings, mercy, and everlasting peace.
With deepest gratitude and love,*

Wael Mohamed
*Pahang
Malaysia*

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Preface

Acceptance doesn't mean resignation; it means understanding that something is what it is and that there's got to be a way through it.

— Michael J. Fox

The quest to understand and alleviate movement disorders is as ancient as medicine itself. Long before James Parkinson formally described the “shaking palsy” in 1817, royal physicians in the court of Egyptian Pharaohs documented motor dysfunctions and “trembling disease” in medical scrolls like the *Ebers Papyrus* (c. 1550 BCE). In their pursuit to restore control over rigid limbs, these early healers administered plant remedies rich in tropane alkaloids—unknowingly delivering the earliest anticholinergic therapies millennia before the birth of modern neurochemistry.

As science advanced from botanical remedies to cellular networks, pioneers like Santiago Ramón y Cajal revolutionized neuroscience by demonstrating that signals flow **unidirectionally** across neuronal synapses. This understanding of directional signaling unlocked the secrets of the basal ganglia, revealing how the selective degeneration of dopaminergic neurons in the substantia nigra leads to the complex motor and cognitive hallmarks of Parkinson's disease. Today, managing this condition demands a far more sophisticated, multi-targeted pharmacological strategy.

Pharmacological Foundations of Parkinson's Disease: From Mechanisms to Clinical Practice bridges the gap between laboratory benchwork and real-world clinical care. **Section I: Foundations and Pharmacological Principles** establishes the biological core, featuring novel zebrafish disease models, molecular pathogenesis, environmental neurotoxins, circadian rhythm disruptions, and the emerging influence of the oral bacteriome on cognitive decline. It integrates these mechanisms with pharmacokinetics, pharmacodynamics, and cross-cultural considerations for a holistic understanding of drug behavior.

Section II: Established Pharmacotherapies and Future Horizons translates foundational science into clinical action. It examines core dopaminergic strategies, COMT inhibitors, non-dopaminergic pathways, motor and non-motor management, and practical clinical case studies. Looking ahead, it highlights emergent therapeutic agents and next-generation biological interventions.

We stand on the threshold of a revolution in neurotherapeutics. As precision neuropharmacology, targeted gene therapies, and regenerative medicine converge, our horizon shifts from merely slowing neurodegeneration to halting and actively repairing it. This volume is dedicated to empowering the clinicians, pharmacologists, and researchers shaping that future—paving the path toward a world where Parkinson's disease is no longer a lifelong sentence of management, but a fully curable chapter in medical history.

Editor:
**Wael Mohamed
Pahang
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The editor extends sincere gratitude to all contributors whose dedication, expertise, and scholarly commitment have made this volume possible. Each chapter represents a collective effort to advance our understanding of Parkinson's disease and to bridge the gap between molecular science and clinical practice.

Special appreciation is given to the institutions, research groups, and collaborators whose continuous support and encouragement fostered this academic endeavor. In particular, heartfelt thanks are due to members of the **AfrAbia Parkinson's Disease Genomic Consortium (AA-PD-GC)**, whose shared vision and collaborative spirit continue to promote scientific excellence and inclusivity across regions.

The editor also acknowledges the invaluable contributions of patients and their families, whose resilience, hope, and courage in the face of Parkinson's disease remain the truest sources of inspiration behind this work.

With profound personal gratitude, the editor dedicates this achievement to his parents, **Mohamed** and **Nawal**, for their lifelong sacrifices, wisdom, and unwavering prayers. May **Allah SWT** forgive all their sins and shower them with His blessings, mercy, and eternal peace.

Wael Mohamed
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PHARMACOLOGICAL FOUNDATIONS OF PARKINSON'S DISEASE

FROM MECHANISMS TO CLINICAL PRACTICE

EDITED BY: WAEL MOHAMED

Pharmacological Foundations of Parkinson's Disease: From Mechanisms to Clinical Practice provides a robust foundation for understanding the biological, pharmacological, and clinical principles underlying Parkinson's disease management. This reference addresses the urgent need for a comprehensive resource that synthesizes the disease biology, pathogenesis, environmental and cultural factors, and the principles guiding effective pharmacotherapy. It is ideally suited for students, clinicians, and researchers seeking to build a strong scientific and clinical base.

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- Integrates case studies to enhance clinical understanding
- Highlights the emerging therapeutic agents and future directions

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