

---

*The National Medical Series for Independent Study*

---

2nd edition  
**pharmacology**

EDITOR

**Leonard S. Jacob, M.D., Ph.D.**

---

*The National Medical Series for Independent Study*

---

2nd edition  
**pharmacology**

EDITOR

**Leonard S. Jacob, M.D., Ph.D.**

*Research Associate Professor  
of Pharmacology  
Medical College of Pennsylvania  
Adjunct Associate Professor  
of Pharmacology and Medicine  
Temple University School  
of Medicine  
Vice-President, Clinical Research and  
Development (Worldwide)  
Smith Kline & French Laboratories  
Philadelphia, Pennsylvania*

A WILEY MEDICAL PUBLICATION

**JOHN WILEY & SONS**

New York • Chichester • Brisbane • Toronto • Singapore

---

*Harwal Publishing Company, Media, Pennsylvania*

---

Efforts have been made to ensure accuracy and immediacy in drug dosage schedules; however, this book is not intended as a guide to drug therapy. The reader is urged to consult the manufacturer's package insert to ascertain the recommended drug dosage, administration, and contraindications, especially relative to new and seldom-used drugs.

**Library of Congress Cataloging in Publication Data**

Main entry under title:

Pharmacology.

(National medical series for independent study)

(A Wiley medical publication)

Includes index.

1. Pharmacology—Examinations, questions, etc.

I. Jacob, Leonard S. II. Series. III. Series: Wiley medical publication. [DNLM: 1. Pharmacology—examination questions. 2. Pharmacology—outlines.

QV 18 P5363]

RM105.P47 1987 615'.1'076 87-339

ISBN 0-471-85806-4

©1987 by John Wiley & Sons, Inc.

Printed in the United States of America. All rights reserved. Except as permitted under the Copyright Act of 1976, no part of this publication may be reproduced or distributed in any form or by any means or stored in a data base or retrieval system, without the prior written permission of the publisher.

10 9 8 7 6 5 4 3 2 1

# Preface to the Second Edition

The success of the first edition of *Pharmacology* has been remarkable and reflects the overwhelming enthusiasm with which the National Medical Series has been met by its readers. I have attempted here to match the excellence of the first edition and have not deviated from my original objective of producing a concise review book. Ensuring the book's success are the substantial contributions made to the first edition by Drs. John S. Lazo and Edward Hawrot, which are still evident throughout the pages of the second edition. The effort that they extended and the results of that effort must be appreciated as the foundation on which *Pharmacology* rests.

Unlike some medical disciplines, pharmacology is constantly changing. Numerous drugs are approved each year, and others, already approved, are given new indications. Advances continue in many therapeutic areas, including cardiology, endocrinology, and infectious diseases. It is hoped that the second edition of *Pharmacology* will continue to provide the harried medical student with an up-to-date review of a most dynamic subject.

Leonard S. Jacob

# Preface to the First Edition

In the expanding world of science and medicine it is impossible to be "truly" up-to-date in any defined area. Pharmacology is no exception. In any pharmacology course, the student is confronted with a new language to which many additions will occur. New agents, their mechanisms of action, and untoward effects must be continually added to the already overburdened core knowledge of pharmacology. Understanding this new language is not easy because it is predicated on a thorough understanding of the basic medical sciences, including physiology and biochemistry.

I have personally gone through this educational process in the last 10 years, and although it has been rewarding, it has often been confusing. Most standard major textbooks of pharmacology provide an abundance of detail, which precludes the student from ever reading the book within the confined period of a 24- to 36-week course. Additionally, preparing for the National Boards requires the student to distill an extraordinary amount of information. The large number of drug groups has made it difficult to decipher which agent is or is not important. *Pharmacology* is designed as a review textbook, which attempts to present to the student numerous drug groups in an organized fashion.

National Board-type questions are presented, and detailed answers are provided. This is done not only to determine the extent of the preparation that might still be needed prior to taking this very important exam but additionally to reinforce important concepts presented in this textbook. It is important to stress that *Pharmacology* should not serve as a replacement for the major textbooks when detailed references are needed but instead should provide the information necessary for preparing for the pharmacology section of the National Medical Boards.

Leonard S. Jacob

# Acknowledgments

The writing and editing of this second edition have been made much easier with the support of Mr. Jonathan Seltzer, a junior medical student at the University of Pennsylvania. His help in documenting the most recent advances in pharmacology is much appreciated. I also wish to extend my thanks to Ms. Gloria Hamilton, editor at Harwal Publishing Company, who provided excellent editorial guidance in insuring an outstanding final product.

# Publisher's Note

The objective of the *National Medical Series* is to present an extraordinarily large amount of information in an easily retrievable form. The outline format was selected for this purpose of reducing to the essentials the medical information needed by today's student and practitioner.

While the concept of an outline format was well received by the authors and publisher, the difficulties inherent in working with this style were not initially apparent. That the series has been published and received enthusiastically is a tribute to the authors who worked long and diligently to produce books that are stylistically consistent and comprehensive in content.

The task of producing the *National Medical Series* required more than the efforts of the authors, however, and the missing elements have been supplied by highly competent and dedicated developmental editors and support staff. Editors, compositors, proofreaders, and layout and design staff have all polished the outline to a fine form. It is with deep appreciation that I thank all who have participated, in particular the staff at Harwal—Debra L. Dreger, Jane Edwards, Gloria Hamilton, Deborah G. Huey, Susan Kelly, Wieslaw B. Langenfeld, Keith LaSala, June Sangiorgio Mash, and Jane Velker.

The Publisher

# Introduction

*Pharmacology* is one of ten basic science review books in the *National Medical Series for Independent Study*. This series has been designed to provide students and house officers, as well as physicians, with a concise but comprehensive instrument for self-evaluation and review within the basic sciences. Although *Pharmacology* would be most useful for students preparing for the National Board of Medical Examiners examinations (Part I and FLEX) as well as FMGEMS, it should also be useful for students studying for course examinations. These books are not intended to replace the standard basic science texts, but, rather, to complement them.

The books in this series present the core content of each basic science area using an outline format and featuring 300 study questions. The questions are distributed throughout the book, at the end of each chapter and in a pretest and post-test. In addition, each question is accompanied by the correct answer, a paragraph-length explanation of the correct answer, and specific reference to the outline points under which the information necessary to answer the question can be found.

We have chosen an outline format to allow maximum ease in retrieving information, assuming that the time available to the reader is limited. Considerable editorial time has been spent to ensure that the information required by all medical school curricula has been included and that the question format parallels that of the National Board examinations. We feel that the combination of the outline and the board-type study questions provides a unique teaching device.

We hope you will find this series interesting, relevant, and challenging. The authors, as well as the John Wiley and Harwal staffs, welcome your comments and suggestions.



# Contents

Preface to the First Edition	ix
Preface to the Second Edition	xi
Acknowledgments	xiii
Publisher's Note	xv
Introduction	xvii
Pretest	1
<b>1</b> General Pharmacologic Principles	13
<b>2</b> Drugs Affecting Peripheral Neurohumoral Transmission	27
<b>3</b> Agents Acting on the Central Nervous System	53
<b>4</b> Anesthetic Agents	77
<b>5</b> Cardiovascular Agents	89
<b>6</b> Diuretic Agents	117
<b>7</b> Drugs Affecting Hematopoiesis and Hemostasis	129
<b>8</b> Autacoids and Their Antagonists	139
<b>9</b> Non-Narcotic Analgesics, Nonsteroidal Anti-Inflammatory Drugs, and Drugs Used in the Treatment of Gout	153
<b>10</b> Agents Affecting Endocrine Function	169
<b>11</b> Cancer Chemotherapy	187
<b>12</b> Anti-Infective Agents	209

<b>13</b>	Principles of Drug Interactions	243
<b>14</b>	Poisons and Antidotes	249
	Post-test	257
	Adverse Drug Interactions Index	269
	Index	275

## QUESTIONS

**Directions:** Each question below contains five suggested answers. Choose the **one best** response to each question.

1. Which of the following agents would bring a rapid heart rate (120 beats/minute) back to normal?

- (A) Isoproterenol
- (B) Phentolamine
- (C) Propranolol
- (D) Phenoxybenzamine
- (E) Edrophonium

2. All of the following statements about untoward effects of cardiac glycosides are true EXCEPT

- (A) they have a low margin of safety
- (B) intoxication is often precipitated by the depletion of sodium
- (C) the glycosides can cause vision changes
- (D) decreased renal function can predispose to toxicity
- (E) the glycosides can cause ventricular tachycardia

3. All of the following untoward effects are commonly associated with cancer chemotherapy EXCEPT

- (A) alopecia
- (B) teratogenesis
- (C) leukopenia
- (D) nausea
- (E) exfoliative dermatitis

4. Granulocytopenia, gastrointestinal irritation, gingival hyperplasia, and facial hirsutism are all possible side effects of which one of the following anticonvulsant drugs?

- (A) Phenobarbital
- (B) Carbamazepine
- (C) Acetazolamide
- (D) Phenytoin
- (E) Valproate

5. All of the following statements about toxicology are true EXCEPT

- (A) certain heavy metals can be considered hazardous poisons
- (B) chronic exposure to a toxic substance is likely to produce the same symptoms as acute exposure
- (C) antidotes of poisons can act by preventing absorption of the poison
- (D) antidotes of poisons can act by antagonizing the actions of poisons
- (E) activated charcoal is a management alternative to syrup of ipecac

6. The diuretic of choice for a patient receiving the nephrotoxic antitumor agent cisplatin is

- (A) ethacrynic acid
- (B) mercaptomerin
- (C) acetazolamide
- (D) chlorothiazide
- (E) mannitol

7. The first-pass effect occurs most often after which route of drug administration?

- (A) Oral
- (B) Sublingual
- (C) Intravenous
- (D) Subcutaneous
- (E) Intramuscular

8. The pharmacologic actions of scopolamine most closely resemble those of

- (A) hexamethonium
- (B) atropine
- (C) succinylcholine
- (D) acetylcholine
- (E) curare

9. Ibuprofen can now be bought over-the-counter for use as an analgesic. All of the following statements concerning this drug are true EXCEPT that

- (A) it is a more effective analgesic than aspirin
- (B) it is a more effective anti-inflammatory agent than aspirin
- (C) it is used for the treatment of rheumatoid arthritis
- (D) it is used for the treatment of osteoarthritis
- (E) it can cause gastrointestinal complaints

10. The primary reason for a physician to prescribe human insulin is that

- (A) it has a faster onset of action than other insulins
- (B) it has a shorter duration of action than other insulins
- (C) it can be given to patients who have an allergy to animal insulins
- (D) it is more effective in preventing the complications of diabetes than animal insulins
- (E) it is cheaper than other insulins because it is produced by recombinant technology

11. Cyclophosphamide can be used to treat all of the following neoplastic disorders EXCEPT

- (A) Hodgkin's disease
- (B) Burkitt's lymphoma
- (C) choriocarcinoma
- (D) ovarian carcinoma
- (E) breast carcinoma

12. Atropine is useful in treating poisoning produced by organophosphate insecticides because it

- (A) reactivates inhibited acetylcholinesterase
- (B) stimulates  $\alpha$  receptors directly
- (C) stimulates  $\beta$  receptors directly
- (D) inhibits normal ganglionic transmission
- (E) blocks the action of acetylcholine at both central and peripheral sites

13. Basic considerations in the management of hypertension should include all of the following EXCEPT

- (A) initial drug therapy for mild hypertension could include minoxidil
- (B) a combination of a diuretic and a  $\beta$ -adrenergic blocking agent can be used if either drug is ineffective alone
- (C) when arteriolar vasodilators are used, appropriate sympathetic blockers are administered to prevent a reflex sympathetic response
- (D) hypertensive emergencies are best treated with parenteral therapy
- (E) diuretic agents are effective for patients requiring long-term treatment of hypertension

#### Questions 14 and 15

A 10-year-old boy is admitted to the hospital with an initial diagnosis of acute lymphoblastic leukemia. His liver, spleen, and lymph nodes are extensively infiltrated.

14. Which of the following drug combinations would be most appropriate for inducing remission?

- (A) Prednisone and vincristine
- (B) Cyclophosphamide and methotrexate
- (C) Cyclophosphamide and vinblastine
- (D) 6-Mercaptopurine and methotrexate
- (E) Cytarabine and 5-fluorouracil

15. The patient is given allopurinol to reduce the complications of his cancer chemotherapy. The rationale underlying the allopurinol therapy is that

- (A) allopurinol increases the renal clearance of uric acid
- (B) the most effective therapeutic regimens interfere with purine biosynthesis
- (C) rapid lympholysis produces large quantities of uric acid
- (D) lower doses of the remission-inducing drugs can be given
- (E) allopurinol inhibits the metabolism of pyrimidine analogs

16. Oral contraceptives containing an estrogen and norethindrone act mainly by which of the following mechanisms?

- (A) Speeding up the growth of ovarian follicles
- (B) Increasing the secretion of follicle-stimulating hormone (FSH)
- (C) Hastening the release of luteinizing hormone (LH)
- (D) Suppressing ovulation
- (E) Thickening the consistency of the cervical mucus

18. A postmenopausal woman presents with a breast carcinoma that is rich in estrogen receptors. The drug most likely to be administered is

- (A) bleomycin
- (B) vinblastine
- (C) mitomycin
- (D) dacarbazine (DTIC)
- (E) tamoxifen

17. Furosemide is useful for the treatment of all of the following conditions EXCEPT

- (A) congestive heart failure
- (B) acute pulmonary edema
- (C) hypocalcemia
- (D) edema resulting from hepatic or renal disease
- (E) hypertensive crisis

**Directions:** Each question below contains four suggested answers of which **one or more** is correct. Choose the answer

- A** if 1, 2, and 3 are correct
- B** if 1 and 3 are correct
- C** if 2 and 4 are correct
- D** if 4 is correct
- E** if 1, 2, 3, and 4 are correct

### Questions 19 and 20

A child who was in trouble for daydreaming at school turns out to have petit mal (absence) seizures.

19. Suitable drugs for this patient would include which of the following?

- (1) Valproate
- (2) Primidone
- (3) Ethosuximide
- (4) Phenytoin

20. If the child also suffered from night terrors, which of the following drugs could be prescribed for both conditions?

- (1) Meprobamate
- (2) Clonazepam
- (3) Droperidol
- (4) Diazepam

21.  $\beta$ -Adrenergic agonists include which of the following substances?

- (1) Epinephrine
- (2) Isoproterenol
- (3) Norepinephrine
- (4) Phentolamine

22. Characteristics of carbachol include which of the following?

- (1) It is a parasympathetic agent
- (2) It is purely muscarinic in action
- (3) It is resistant to acetylcholinesterase
- (4) It causes mydriasis

23. When used intravenously lidocaine will

- (1) suppress premature ventricular contractions
- (2) reverse atrial arrhythmias
- (3) decrease sodium conductance in automatic cells
- (4) decrease potassium conductance in automatic cells

## SUMMARY OF DIRECTIONS

A	B	C	D	E
1, 2, 3 only	1, 3 only	2, 4 only	4 only	All are correct

24. Quinidine can produce which of the following effects on the heart?

- (1) A reduction in the maximal rate of rise ( $V_{max}$ ) of depolarization
- (2) An increase in the effective refractory period (ERP)
- (3) A decrease in automaticity
- (4) An increase in inotropic action

25. Adrenocortical drugs that are anti-inflammatory in pharmacologic doses include which of the following?

- (1) Desoxycorticosterone
- (2) Corticotropin (ACTH)
- (3) Aldosterone
- (4) Cortisol (hydrocortisone)

26. Which of the following points should be kept in mind when considering long-term corticosteroid therapy?

- (1) Abrupt withdrawal may cause signs of adrenal insufficiency
- (2) Therapy may precipitate peptic ulcers
- (3) Patients may become intolerant to stressful situations for as long as 1 year after therapy is stopped
- (4) Therapy may lead to increased infections

27. True statements about the effects of  $H_1$  receptor blockers include which of the following?

- (1) They increase the heart rate
- (2) Their effects usually last 4 to 6 hours
- (3) They decrease gastric secretion
- (4) They cause sedation

28. Which of the following drugs, if given concomitantly with warfarin, would probably require a reduction in warfarin dosage?

- (1) Disulfiram
- (2) Aspirin
- (3) Phenylbutazone
- (4) Barbiturates

29. Correct statements concerning vitamin  $B_{12}$  deficiency include which of the following?

- (1) It can be caused by intrinsic factor deficiency
- (2) Dietary vitamin  $B_{12}$  deficiency is common
- (3) Pernicious anemia requires parenteral vitamin  $B_{12}$  therapy
- (4) Vitamin  $B_{12}$  will reverse the neurologic changes of pernicious anemia

30. True statements about folic acid include which of the following?

- (1) It is a cobalt-containing compound
- (2) It can be given orally or parenterally
- (3) It often causes allergic reactions
- (4) It can reduce the effects of antiseizure agents

31. The following pairs consist of a chelating agent (i.e., an agent used to treat heavy metal poisoning) and a heavy metal. Correctly matched pairs include

- (1) dimercaprol (BAL)—mercury
- (2) calcium disodium EDTA—arsenic
- (3) penicillamine—copper
- (4) deferoxamine—lead

32. True statements concerning the effects of drugs on gastrointestinal motility include which of the following?

- (1) Atropine delays gastric emptying
- (2) Opiates stimulate gastric emptying
- (3) Metoclopramide stimulates gastrointestinal motility
- (4) Scopolamine stimulates gastrointestinal motility

33. Anesthetic drugs and descriptions that are correctly matched include which of the following?

- (1) Lidocaine—an ester but metabolized in the liver
- (2) Mepivacaine—an amide metabolized in the liver
- (3) Procaine—a long-acting topical anesthetic
- (4) Tetracaine—a good spinal anesthetic

34. Which of the following agents might be used as preanesthetic medication?

- (1) Secobarbital
- (2) Morphine
- (3) Diazepam
- (4) Scopolamine

35. If a toxic dose of lidocaine is inadvertently administered locally into the dorsalis pedis artery, which of the following effects may occur?

- (1) Convulsions
- (2) Respiratory depression
- (3) Hypotension
- (4) Increased inotropic effect

36. Correct statements concerning nitrous oxide ( $N_2O$ ) include which of the following?

- (1) The common  $N_2O$  concentration required for the maintenance of anesthesia is 5%
- (2) It has the ability to produce surgical anesthesia when used alone
- (3) It is a weak analgesic
- (4) It can produce bowel distention

37. Vitamin  $B_{12}$  deficiency can result from

- (1) an insufficient dietary supply
- (2) inadequate secretion of intrinsic factor
- (3) ileal disease
- (4) excessive transcobalamin II

38. Which of the following properties would characterize a drug when it is bound to plasma albumin?

- (1) It is biologically inactive
- (2) It can pass through the glomerulus
- (3) It usually can become unbound
- (4) It is promptly metabolized

39. Each statement below describes a characteristic of a particular route of drug administration. True statements include

- (1) intravenous administration provides a rapid response
- (2) oral administration requires that the patient be alert
- (3) intramuscular administration requires sterile technique
- (4) subcutaneous administration may cause local irritation

40. Tissues that often are not readily accessible to drugs include which of the following?

- (1) Fetus
- (2) Kidneys
- (3) Brain
- (4) Testes

41. Aspirin, phenylbutazone, and sulfamethoxazole have which of the following characteristics in common?

- (1) They are all highly protein bound
- (2) They all interact with warfarin
- (3) They can all affect platelet function
- (4) They can all cause agranulocytosis

42. Ascariasis can be effectively treated by

- (1) piperazine
- (2) metronidazole
- (3) pyrantel pamoate
- (4) suramin

43. A 67-year-old man presents with acute pulmonary coccidioidomycosis. Proper therapy includes

- (1) high doses of penicillin G
- (2) griseofulvin
- (3) flucytosine
- (4) amphotericin B

44. Characteristics of antineoplastic agents include which of the following?

- (1) They frequently are self-limiting in their killing of cancer cells
- (2) They kill a constant fraction of the tumor cells
- (3) They are preferentially toxic to nonproliferating cells
- (4) They are usually used in combination with each other

45. An 18-year-old woman presents with urgency, frequency, and burning urination. She is afebrile. Urinalysis reveals the presence of red blood cells. Appropriate therapy after urine culture includes which of the following agents?

- (1) Trimethoprim-sulfamethoxazole
- (2) Carbenicillin
- (3) Sulfisoxazole
- (4) Gentamicin

## SUMMARY OF DIRECTIONS

A	B	C	D	E
1, 2, 3 only	1, 3 only	2, 4 only	4 only	All are correct

46. At present, the most commonly used diuretics belong to which of the following classes?

- (1) Mercurials
- (2) Thiazides
- (3) Carbonic anhydrase inhibitors
- (4) High-ceiling diuretics

## Questions 47 and 48

A 70-year-old woman with a history of congestive heart failure, for which she takes digoxin and a diuretic agent, is seen because of an arrhythmia. Electrolyte determination reveals a serum potassium level of 2.8 mEq/L.

47. Diuretics capable of producing this patient's hypokalemia include

- (1) bumetanide
- (2) ammonium chloride
- (3) hydrochlorothiazide
- (4) aminophylline

48. Immediate therapy for this patient should include

- (1) high doses of spironolactone
- (2) insulin and glucose administration
- (3) high doses of amiloride
- (4) potassium supplementation

**Directions:** The groups of questions below consist of lettered choices followed by several numbered items. For each numbered item select the **one** lettered choice with which it is **most** closely associated. Each lettered choice may be used once, more than once, or not at all.

## Questions 49–52

Match each of the following autacoid antagonists to the enzyme that it inhibits.

- (A) Cyclooxygenase
- (B) Peptidyl dipeptidase
- (C) Phospholipase
- (D) Thromboxane synthetase
- (E) Cystathionine synthetase

- 49. Captopril
- 50. Hydralazine
- 51. Ibuprofen
- 52. Prednisolone

## Questions 53–56

For each of the descriptions that follow, select the anesthetic drug most likely to be associated with it.

- (A) Halothane
- (B) Diethyl ether
- (C) Nitrous oxide
- (D) Isoflurane
- (E) Thiopental

- 53. Given intravenously and not adequate for prolonged surgery
- 54. Has the highest minimum alveolar concentration (MAC) value
- 55. Highly explosive agent
- 56. Widely used inhalation agent that can cause liver necrosis



**Questions 57-60**

For each of the following diuretic agents, choose the anatomic site in the renal nephron where the principal action of the agent occurs.

- (A) Glomerulus
- (B) Proximal tubule
- (C) Ascending limb of the loop of Henle
- (D) Distal tubule
- (E) Collecting duct

57. Acetazolamide

58. Spironolactone

59. Furosemide

60. Chlorothiazide