

THE DISPENSATORY
OF THE UNITED STATES
OF AMERICA

25

THE DISPENSATORY OF THE UNITED STATES OF AMERICA 20 25th Edition

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Preface

This new edition of the UNITED STATES DISPENSATORY documents the progress of knowledge concerning medicinal agents in an era of unprecedented development and expansion in this field of medical service. In no period of the long history of this book has so much new information been incorporated and so extensive a revision of older information been consummated. This is in large measure attributable to the fact, on the one hand, that many medicinal substances have hardly reached therapeutic maturity before they are replaced by even safer and more effective drugs and, on the other, to the finding of new uses for older drugs as research has disclosed hitherto unrecognized therapeutic applications or led to the isolation, in the case of drugs of natural origin, of potent and therapeutically effective constituents.

The total of new admissions to the United States Pharmacopeia, the National Formulary, the British Pharmacopeia, and the two volumes of the International Pharmacopoeia, together with the new non-official drugs described for the first time in this edition of the DISPENSATORY, exceeds 500.

While maintaining the traditional treatment of drugs according to alphabetic arrangement—which has many advantages—a feature of this edition of the DISPENSATORY is the inclusion of many new general survey articles on pharmacological classes of drugs. Thus, there appear in Part Two articles on the following: Adrenergic Blocking Agents, Anticoagulant Drugs, Antihistamines, Anti-metabolites, Barbiturates, Curarimimetic Agents and their Antagonists, Ganglionic Blocking Agents, Local Anesthetic Agents, Nephrotropic Agents, Parasympathetic Blocking Agents, Parasympathomimetic Agents and Cholinesterase Inhibitors, and Skeletal Antispasmodic Compounds. These articles provide the basis for comparing drugs in the several categories indicated; also, a correlation between pharmacological action and chemical structure is thereby often possible, especially since these general articles are amply illustrated with structural formulas. Certain other general articles have been completely rewritten as, for example, that on Antibiotics, also in Part Two. The established uses of radioisotopes in medicine have naturally necessitated addition of a general article on this subject, in addition to a specific article on the official Sodium Radio-iodide (I^{131}) Solution and innumerable references throughout the book to specific uses of radioisotopes as tracer substances.

As in preceding editions of the DISPENSATORY, all articles are amply documented by original literature references in order to establish the authority for the information that is provided and to facilitate further search of the literature when this is required. In this connection it may be noted that the new information for this edition was chosen from more than 25,000 issues of the approximately 400 medical, pharmaceutical, biological, and chemical journals which are regularly available to the editors as the basis for revision of the DISPENSATORY.

The very thorough investigations now required for new drugs before they are released for clinical use, together with the more extensive clinical reporting of them, has inevitably resulted in lengthier monographs concerning individual drugs. Since oftentimes our readers may wish to have only the most essential information concerning uses of a drug, we have provided for the lengthier articles a brief outline of uses at the beginning of the section thus designated. Where the articles are of necessity very long, a summary section has also been provided, this following the section on uses. Also, to facilitate quick location of specific information about drugs having a variety of actions and uses, the monographs have been conspicuously and informatively captioned to indicate specific actions and uses.

Dosage data have been considerably amplified in this edition. The range of dose, the maximum single dose, and the maximum total dose in 24 hours are provided for most drugs; variations of dosage in different diseases are indicated where such information is required; comparison of different routes of administration is also included where a choice is available. Toxicological data have also been expanded and methods of treatment of poisoning are described in sufficient detail to be of practical utility.

The section on *Veterinary Uses and Doses of Drugs*, which was introduced in the 24th Edition of the Dispensatory and has found wide acceptance, has been enlarged by 63 pages both by inclusion of new drugs and new data for older ones.

To provide space for the abundance of new material included, this edition contains over 200 pages more than its predecessor; 102 pages more were made available by the deletion of general tests, processes and reagents formerly comprising Part Three of the DISPENSATORY which, while important, are of secondary importance to the

main purpose of this book in providing practical and up-to-the-minute information about drugs. Further savings of space were made by deletion or curtailment of information concerning drugs which are no longer or only very rarely used; the editors were not unmindful, however, of the expectation of users of the DISPENSATORY to find information concerning unusual drugs. A new and somewhat more condensed typography in Part Two permitted more information to be included therein.

The editors and associate editors acknowledge especially the assistance of the contributors whose

names are listed opposite the title page; it has become increasingly apparent in this fruitful period of medicinals development that the collaboration of specialists is essential in order to provide the thorough and authoritative treatment of the subject required in the DISPENSATORY. Finally, the many contributions of Walter Kahoe, Ph.D., Director of the Medical Department of J. B. Lippincott Company, toward the culmination of the editorial effort in the production of the printed book are not only acknowledged but greatly appreciated.

ARTHUR OSOL,
Editor-in-Chief

ABBREVIATIONS

- A.A.A.S.*—The American Association for the Advancement of Science.
A.M.A.—The American Medical Association.
Acta chir. Scandinav.—Acta chirurgica Scandinavica.
Acta dermato-venereol.—Acta dermato-venerologica.
Acta med. Scandinav.—Acta medica Scandinavica.
Advances Enzymol.—Advances in Enzymology and Related Subjects of Biochemistry.
Allg. med. Centr.-Ztg.—Allgemeine medicinische Central-Zeitung.
Am. Drug.—American Druggist.
Am. Fur Breeder—American Fur Breeder.
Am. Heart J.—American Heart Journal.
Am. J. Anat.—American Journal of Anatomy.
Am. J. Bot.—American Journal of Botany.
Am. J. Cancer.—American Journal of Cancer.
Am. J. Clin. Path.—American Journal of Clinical Pathology.
Am. J. Digest. Dis.—American Journal of Digestive Diseases and Nutrition.
Am. J. Dis. Child.—American Journal of Diseases of Children.
Am. J. Hyg.—American Journal of Hygiene.
Am. J. Med.—American Journal of Medicine.
Am. J. Med. Sc.—American Journal of Medical Sciences.
Am. J. Obst. Gyn.—American Journal of Obstetrics and Gynecology.
Am. J. Ophth.—American Journal of Ophthalmology.
Am. J. Path.—American Journal of Pathology.
Am. J. Pharm.—American Journal of Pharmacy.
Am. J. Physiol.—American Journal of Physiology.
Am. J. Psychiat.—American Journal of Psychiatry.
Am. J. Pub. Health.—American Journal of Public Health and the Nation's Health.
Am. J. Roentgen.—American Journal of Roentgenology and Radium Therapy.
Am. J. Surg.—American Journal of Surgery.
Am. J. Syph. Gonorr. Ven. Dis.—American Journal of Syphilis, Gonorrhea and Venereal Diseases.
Am. J. Syph. Neurol.—American Journal of Syphilis and Neurology. (Now *Am. J. Syph. Gonorr. Ven. Dis.*)
Am. J. Trop. Med.—American Journal of Tropical Medicine.
Am. J. Vet. Res.—American Journal of Veterinary Research.
Am. Med.—American Medicine.
Am. Perfumer—American Perfumer and Essential Oil Review.
Am. Pract. Dig. Treat.—American Practitioner and Digest of Treatment.
Am. Prof. Pharm.—American Professional Pharmacist.
Am. Rev. Soviet Med.—American Review of Soviet Medicine.
Am. Rev. Tuberc.—American Review of Tuberculosis.
Am. Surg.—The American Surgeon.
Am. Vet. Rev.—American Veterinary Review.
Anais faculdade med. univ. S. Paulo—Anais da faculdade de medicina da universidade de São Paulo.
Analyst—The Analyst.
Anesth.—Anesthesiology.
Anesth. & Analg.—Current Researches in Anesthesia and Analgesia.
Angewandte Chem.—Angewandte Chemie.
Ann. Allergy—Annals of Allergy.
Ann. Biochem. Exp. Med.—Annals of Biochemistry and Experimental Medicine.
Ann. Chem.—Annalen der Chemie, Liebig.
Ann. Chem. Pharm.—Annalen der Chemie und Pharmacie. (Now *Ann. Chem.*)
Ann. chim. app.—Annali di chimica applicata.
Ann. Chim. Phys.—Annales de Chimie et de Physique.
Ann. d'igiene—Annali d'igiene.
Ann. dermat. syph.—Annales de dermatologie et de syphiligraphie.
Ann. Inst. Pasteur—Annales de l'Institut Pasteur.
Ann. Int. Med.—Annals of Internal Medicine.
Ann. méd.-psychol.—Annales médico-psychologiques.
Ann. N. Y. Acad. Sc.—Annals of the New York Academy of Science.
Ann. Otol. Rhin. Laryng.—Annals of Otolaryngology and Laryngology.
Ann. Rev. Biochem.—Annual Review of Biochemistry.
Ann. Rev. Physiol.—Annual Review of Physiology.
Ann. Surg.—Annals of Surgery.
Ann. Trop. Med.—Annals of Tropical Medicine and Parasitology.
Ann. West. Med. Surg.—Annals of Western Medicine and Surgery.
Antibiot. Chemother.—Antibiotics and Chemotherapy.
Apoth.-Ztg.—Apotheker-Zeitung. (See also *Deutsche Apoth.-Ztg.*)
Arbeits. pharmakol. Inst. Dorpat—Arbeiten der pharmakologisches Institut, Dorpat.
Arch. Dermat. Syph.—Archives of Dermatology and Syphilology.
Arch. Dis. Child.—Archives of Disease in Children.
Arch. exp. Path. Pharm.—Archiv für experimentelle Pathologie und Pharmakologie.
Arch. farmacol. sper.—Archivo di farmacologia sperimentale e scienze affini.
Arch. farmacol. terap.—Archivio di farmacologia e terapeutica.
Arch. gén. méd.—Archives générales de médecine.
Arch. ges. Physiol.—Archiv für die gesamte Physiologie des Menschen und der Tiere.
Arch. Gewerbepath. Gewerbehyg.—Archiv für Gewerbepathologie und Gewerbehygiene.
Arch. Gynäk.—Archiv für Gynäkologie.
Arch. Hyg.—Archiv für Hygiene und Bakteriologie.
Arch. Int. Med.—Archives of Internal Medicine.
Arch. Indust. Hyg.—Archives of Industrial Hygiene and Occupational Medicine.
Arch. internat. pharmacodyn. therap.—Archives internationales de pharmacodynamie et de therapie.
Arch. mal. du cœur—Archives des maladies du cœur et des vaisseaux.
Arch. Neurol. Psychiat.—Archives of Neurology and Psychiatry.
Arch. Ophth.—Archives of Ophthalmology.
Arch. Otolaryng.—Archives of Otolaryngology.
Arch. Path.—Archives of Pathology.
Arch. Path. Lab. Med.—Archives of Pathology and Laboratory Medicine. (Now *Arch. Path.*)
Arch. Pediat.—Archives of Pediatrics.
Arch. pediát. Uruguay—Archivos de pediatria del Uruguay.
Arch. Pharm.—Archiv der Pharmacie.
Arch. Phys. Med.—Archives of Physical Medicine.
Arch. Phys. Ther.—Archives of Physical Therapy.
Arch. Schiffs-Tropen-Hyg.—Archiv für Schiffs- und Tropen-Hygiene.
Arch. Surg.—Archives of Surgery.
Arch. urug. de med.—Archivos uruguayos de medicina, cirugía y especialidades.
Aust. Vet. J.—Australian Veterinary Journal.

- Australasian J. Pharm.*—Australasian Journal of Pharmacy.
- Australia, Council for Sc. & Indust., Res. Bull.*—Australia, Council for Science and Industry, Research Bull.
- Bact. Rev.*—Bacteriological Reviews.
- Beitr. Klin. Tuberk.*—Beiträge zur Klinik der Tuberkulose und spezifischen Tuberkulose-Forschung.
- Ber.*—Berichte der deutschen chemischen Gesellschaft.
- Ber. deutsch. pharm. Ges.*—Berichte der deutschen pharmaceutischen Gesellschaft.
- Ber. ges. Physiol.*—Berichte über die gesamte Physiologie und experimentelle Pharmakologie.
- Berl. klin. Wchnschr.*—Berliner klinische Wochenschrift. (Now *Klin. Wchnschr.*)
- Berl. tierärztl. Wchnschr.*—Berliner tierärztliche Wochenschrift.
- Biochem. J.*—Biochemical Journal.
- Biochem. Ztschr.*—Biochemische Zeitschrift.
- Bol. assoc. brasil. farm.*—Boletim da associação brasileira de farmacêuticos.
- Bol. ministério agr.*—Boletim do ministério da agricultura (Brazil).
- Boll. chim. farm.*—Bollettino chimico-farmaceutico.
- Boston Med. Surg. J.*—Boston Medical and Surgical Journal. (Now *New Eng. J. Med.*)
- Bot. Abs.*—Botanical Abstracts.
- Bot. Centralbl.*—Botanisches Centralblatt.
- Bot. Gaz.*—Botanical Gazette.
- B.P.*—The British Pharmacopœia.
- B.P. Add.*—Addendum to the British Pharmacopœia.
- Brasil-med.*—Brasil-medico.
- Brit. Heart J.*—British Heart Journal.
- Brit. J. Derm.*—British Journal of Dermatology.
- Brit. J. Anaesth.*—British Journal of Anaesthesia.
- Brit. J. Exp. Path.*—British Journal of Experimental Pathology.
- Brit. J. Ind. Med.*—British Journal of Industrial Medicine.
- Brit. J. Opth.*—British Journal of Ophthalmology.
- Brit. J. Pharmacol. Chemother.*—British Journal of Pharmacology and Chemotherapy.
- Brit. J. Phys. Med.*—British Journal of Physical Medicine and Industrial Hygiene.
- Brit. J. Radiol.*—British Journal of Radiology.
- Brit. J. Surg.*—British Journal of Surgery.
- Brit. J. Tuberc.*—British Journal of Tuberculosis.
- Brit. J. Urol.*—British Journal of Urology.
- Brit. M. J.*—British Medical Journal.
- Brit. Vet. J.*—British Veterinary Journal.
- Brodi'naya Prom.*—Brodi'naya Promyshlennost.
- Bruxelles-méd.*—Bruxelles-médical.
- Bull. A. S. H. P.*—Bulletin of the American Society of Hospital Pharmacists.
- Bull. Acad. méd. Paris*—Bulletin de l'Académie de médecine.
- Bull. Acad. Med. Toronto*—Bulletin of the Academy of Medicine, Toronto.
- Bull. Am. Coll. Surgeons*—Bulletin of the American College of Surgeons.
- Bull. assoc. chim.*—Bulletin de l'association des chimistes.
- Bull. Chem. Soc. Japan*—Bulletin of the Chemical Society of Japan.
- Bull. gén. thérap.*—Bulletin général de thérapeutique médicale, chirurgicale, obstétricale et pharmaceutique.
- Bull. Health Leag. Nations*—Bulletin of the Health Organization, League of Nations.
- Bull. Hist. Med.*—Bulletin of the Institute of the History of Medicine.
- Bull. Hyg.*—Bulletin of Hygiene.
- Bull. Johns Hopkins Hosp.*—Bulletin of the Johns Hopkins Hospital.
- Bull. méd.*—Le bulletin médical.
- Bull. Nat. Inst. Health*—Bulletin of the National Institutes of Health.
- Bull. New Eng. Med. Center*—Bulletin of the New England Medical Center.
- Bull. N. F. Com.*—Bulletin of the National Formulary Committee.
- Bull. N. Y. Acad. Med.*—Bulletin of the New York Academy of Medicine.
- Bull. Pharm.*—Bulletin of Pharmacy.
- Bull. Rheumat. Dis.*—Bulletin on Rheumatic Diseases.
- Bull. sc. pharmacol.*—Bulletin des sciences pharmacologiques.
- Bull. Sch. Med. Univ. Maryland*—Bulletin of the School of Medicine, University of Maryland.
- Bull. soc. chim.*—Bulletin de la société chimique de France.
- Bull. soc. chim. Belg.*—Bulletin de la sociétés chimiques Belges.
- Bull. soc. chim. biol.*—Bulletin de la société de chimie biologique.
- Bull. soc. franç. dermat. syph.*—Bulletin de la société française de dermatologie et de syphiligraphie.
- Bull. soc. méd.*—Bulletins et memoires de la société médicale des hôpitaux de Paris.
- Bull. soc. path. exot.*—Bulletin de la société de pathologie exotique et de ses filiales.
- Bull. St. Louis M. Soc.*—Bulletin of the St. Louis Medical Society.
- Bull. Torrey Bot. Club*—Bulletin of the Torrey Botanical Club.
- Bull. trav. soc. pharm. Bordeaux*—Bulletin des travaux de la société de pharmacie de Bordeaux.
- Bull. U. S. Army M. Dept.*—Bulletin of the United States Army Medical Department.
- Bull. War Med.*—Bulletin of War Medicine.
- Bur. Standards J. Research*—Bureau of Standards Journal of Research.
- Calif. & West. Med.*—California and Western Medicine.
- Calif. Med.*—California Medicine.
- Can. J. Comp. Med.*—Canadian Journal of Comparative Medicine and Veterinary Science.
- Can. J. Research*—Canadian Journal of Research.
- Can. Med. Assoc. J.*—Canadian Medical Association Journal.
- Can. Pharm. J.*—Canadian Pharmaceutical Journal.
- Can. Pub. Health J.*—Canadian Public Health Journal.
- Can. Vet. Rec.*—Canadian Veterinary Record.
- Cancer Res.*—Cancer Research.
- Centralbl. med. Wissensch.*—Centralblatt für die medizinischen Wissenschaften.
- Cereal Chem.*—Cereal Chemistry.
- Chem. Abs.*—Chemical Abstracts.
- Chem. Centralbl.*—Chemisches Centralblatt.
- Chem. Drug.*—The Chemist and Druggist.
- Chem. Eng. News*—Chemical and Engineering News.
- Chem. Industries*—Chemical Industries.
- Chem. Met. Eng.*—Chemical and Metallurgical Engineering.
- Chem. News*—Chemical News and Journal of Industrial Science.
- Chem. Rev.*—Chemical Reviews.
- Chem. Trade J.*—Chemical Trade Journal and Chemical Engineer.
- Chem.-Ztg.*—Chemiker-Zeitung.
- Chimica e l'industria Milan*—La chimica e l'industria, Milan.
- Chinese J. Physiol.*—Chinese Journal of Physiology.
- Chinese M. J.*—Chinese Medical Journal.
- Cincinnati J. Med.*—Cincinnati Journal of Medicine.
- Cincinnati M. J.*—Cincinnati Medical Journal.
- Cleveland Clin. Quart.*—Cleveland Clinic Quarterly.
- Cleveland M. J.*—Cleveland Medical Journal.
- Clin. J.*—Clinical Journal.
- Clin. Med.*—Clinical Medicine.
- Clin. Proc.*—Clinical Proceedings.

- Clin. Sc.*—Clinical Science.
Clinics—Clinics.
Colorado Med.—Colorado Medicine. (Now Rocky Mountain M. J.)
Compt. rend. acad. sc.—Comptes rendus hebdomadaires des seances de l'académie des sciences.
Compt. rend. soc. biol.—Comptes rendus des seances de la société de biologie.
Confinia Neurol.—Confinia Neurologica.
Connecticut State M. J.—Connecticut State Medical Journal.
Cornell Vet.—The Cornell Veterinarian.
Dansk Tids. Farm.—Dansk Tidsskrift for Farmaci.
Delaware S. M. J.—Delaware State Medical Journal.
Dental Rec.—Dental Record.
Dental Survey—Dental Survey.
Dentistry—Dentistry, a Digest of Practice.
Derm. Wchnschr.—Dermatologische Wochenschrift.
Derm. Ztschr.—Dermatologische Zeitschrift.
Deutsche Apoth.-Ztg.—Deutsche Apotheker-Zeitung.
Deutsche med. J.—Deutsches medizinisches Journal.
Deutsche med. Wchnschr.—Deutsche medicinische Wochenschrift.
Deutsche Mil.—Deutsche Militärarzt.
Deutsche tierärztl. Wochenschr.—Deutsche tierärztliche Wochenschrift.
Deutsche zahnärztl. Wchnschr.—Deutsche zahnärztliche Wochenschrift.
Deutsche Ztschr. ges. gerichtl. Med.—Deutsche Zeitschrift für die gesamte gerichtliche Medizin.
Deutsches Arch. klin. Med.—Deutsches Archiv für klinische Medizin.
Dis. Nerv. Syst.—Diseases of the Nervous System.
Drug. Circ.—Druggists Circular.
Drug Cosmet. Ind.—Drug and Cosmetic Industry.
East African M. J.—East African Medical Journal.
Edinburgh M. J.—Edinburgh Medical Journal.
Endocrinology—Endocrinology.
Enzymologia—Enzymologia.
Ergebn. Enzymforsch.—Ergebnisse der Enzymforschung.
Exp. Med. & Surg.—Experimental Medicine and Surgery.
Eye, Ear, Nose & Throat Monthly—Eye, Ear, Nose and Throat Monthly.
Farm. Revy—Farmaceutisk Revy.
Farmakol. i Toksikol.—Farmakologija i Toksikologija.
Fed. Proc.—Federation Proceedings.
Fettchem. Umschau—Fettchemische Umschau. (Now Fette und Seifen.)
Fette und Seifen—Fette und Seifen.
Folia Medica—Folia Medica, Naples.
Food Res.—Food Research.
Fortschr. Med.—Fortschritte der Medizin.
Fortschr. Ther.—Fortschritte der Therapie.
Fr.—French Codex.
Gastroenterology—Gastroenterology.
Gaz. chim. ital.—Gazzetta chimica italiana.
Gaz. méd. de France—Gazette médicale de France et des pays de langue française.
Gaz. méd. Paris—Gazettes médicale, Paris.
Ger.—German Pharmacopœia.
Geriatrics—Geriatrics.
Guy's Hosp. Rep.—Guy's Hospital Reports.
Heart—Heart.
Heilkunde—Heilkunde.
Helv. Chim. Acta—Helvetica Chimica Acta.
Helv. Physiol. Pharm. Acta—Helvetica Physiologica et Pharmacologica Acta.
Herbarist—Herbarist.
Human Fert.—Human Fertility.
Hyg. Lab. Bull.—Hygienic Laboratory Bulletin. (Now Bull. Nat. Inst. Health.)
Illinois M. J.—Illinois Medical Journal.
Ind. Chemist—Industrial Chemist and Chemical Manufacturer.
Ind. Eng. Chem.—Industrial and Engineering Chemistry.
Ind. Eng. Chem., Anal. Ed.—Industrial and Engineering Chemistry, Analytical Edition.
Ind. Med.—Industrial Medicine.
Indian J. Med. Res.—Indian Journal of Medical Research.
Indian J. Pharm.—Indian Journal of Pharmacy.
Indian Med. Gaz.—Indian Medical Gazette.
Indian Vet. J.—The Indian Veterinary Journal.
Indiana State M. A. J.—Indiana State Medical Association Journal.
Internat. Clin.—International Clinics. (Now New Internat. Clin.)
Internat. J. Med. Surg.—International Journal of Medicine and Surgery.
Internat. Med. Digest—International Medical Digest.
Internat. Rec. Med.—International Record of Medicine and General Practice Clinics.
It.—Italian Pharmacopœia.
J.A.C.S.—Journal of the American Chemical Society.
J. A. Dent. A.—Journal of the American Dental Association.
J. A. Dietet. A.—Journal of the American Dietetic Association.
J. A. Inst. Homeopathy—Journal of the American Institute of Homeopathy.
J.A.M.A.—Journal of the American Medical Association.
J. A. M. Women's A.—Journal of the American Medical Women's Association.
J.A.O.A.C.—Journal of the Association of Official Agricultural Chemists.
J. A. Ph. A.—Journal of the American Pharmaceutical Association.
J. A. Ph. A., Prac. Ed.—Journal of the American Pharmaceutical Association, Practical Edition.
J.A.V.M.A.—Journal of the American Veterinary Medical Association.
J. Agric. Food Chem.—Journal of Agricultural and Food Chemistry.
J. Agric. Res.—Journal of Agricultural Research.
J. Agric. Sc.—The Journal of Agricultural Science.
J. Albert Einstein Med. Center—Journal of the Albert Einstein Medical Center.
J. Allergy—The Journal of Allergy.
J. Anat.—Journal of Anatomy.
J. Ani. Sc.—Journal of Animal Science.
J. Bact.—Journal of Bacteriology.
J. Biol. Chem.—Journal of Biological Chemistry.
J. Bone Joint Surg.—Journal of Bone and Joint Surgery.
J. Calif. State Dent. A.—Journal of the California State Dental Association.
J. Can. Dent. A.—Journal of the Canadian Dental Association.
J. Chem. Educ.—Journal of Chemical Education.
J. Chem. Ind.—Journal of Chemical Industry (Moscow).
J. Chem. S.—Journal of the Chemical Society.
J. Chemother.—Journal of Chemotherapy.
J. chim. phys.—Journal de chimie physique.
J. Clin. Endocrinol.—Journal of Clinical Endocrinology.
J. Clin. Inv.—Journal of Clinical Investigation.
J. Clin. Nutrition—Journal of Clinical Nutrition.
J. Comp. Path. Therap.—The Journal of Comparative Pathology and Therapeutics.
J. Council Sci. Ind. Res.—Journal of the Council for Scientific and Industrial Research.
J. Cutan. Dis.—Journal of Cutaneous Diseases including Syphilis.
J. Dairy Sc.—Journal of Dairy Science.
J. Dent. Research—Journal of Dental Research.
J. Econ. Entomol.—Journal of Economic Entomology.
J. Endocrinol.—Journal of Endocrinology.

- J. Exp. Med.*—Journal of Experimental Medicine.
J. Gen. Chem. (U.S.S.R.)—Journal of General Chemistry (U.S.S.R.).
J. Gen. Microbiol.—Journal of General Microbiology.
J. Gen. Physiol.—Journal of General Physiology.
J. Geront.—Journal of Gerontology.
J. Hygiene—Journal of Hygiene.
J. Immunol.—Journal of Immunology.
J. Ind. Hyg. Toxicol.—Journal of Industrial Hygiene and Toxicology.
J. Indian Chem. S.—Journal of the Indian Chemical Society.
J. Indian Inst. Sc.—Journal of the Indian Institute of Science.
J. Indian M. A.—Journal of the Indian Medical Association.
J. Indiana M. A.—Journal of the Indiana State Medical Association.
J. Infect. Dis.—Journal of Infectious Diseases.
J. Internat. Col. Surg.—Journal of the International College of Surgeons.
J. Invest. Dermat.—Journal of Investigative Dermatology.
J. Iowa M. Soc.—Journal of Iowa State Medical Society.
J. Lab. Clin. Med.—Journal of Laboratory and Clinical Medicine.
J. Lancet—Journal-Lancet.
J. Laryng. Otol.—Journal of Laryngology and Otolaryngology.
J. Linn. Soc.—Journal of the Linnean Society.
J. M. A. Alabama—Journal of the Medical Association of the State of Alabama.
J. M. A. Georgia—Journal of the Medical Association of Georgia.
J. M. Soc. New Jersey—Journal of the Medical Society of New Jersey.
J. Maine M. A.—Journal of the Maine Medical Association.
J. méd. chirurg. prat.—Journal de médecine et de chirurgie pratiques.
J. méd. Lyon—Le journal de médecine de Lyon.
J. méd. Paris—Journal de médecine de Paris.
J. Ment. Sc.—Journal of Mental Science.
J. Michigan M. Soc.—Journal of Michigan State Medical Society.
J. Missouri M. A.—Journal of Missouri State Medical Association.
J. Mt. Sinai Hosp.—Journal of the Mount Sinai Hospital, New York.
J. Nat. Cancer Inst.—Journal of the National Cancer Institute.
J. Nat. M. A.—Journal of the National Medical Association.
J. Nat. Malaria Soc.—Journal of the National Malaria Society.
J. Nerv. Ment. Dis.—Journal of Nervous and Mental Disease.
J. Neurophysiol.—Journal of Neurophysiology.
J. Neurosurg.—Journal of Neurosurgery.
J. Nutrition—The Journal of Nutrition.
J. Obst. Gyn. Br. Emp.—Journal of Obstetrics and Gynaecology of the British Empire.
J. Oil & Colour Chem. Assoc.—Journal of the Oil and Colour Chemists' Association.
J. Omaha Mid-West Clin. Soc.—Journal of the Omaha Mid-West Clinical Society.
J. Oral Surg.—Journal of Oral Surgery.
J. Org. Chem.—Journal of Organic Chemistry.
J. Parasitol.—Journal of Parasitology.
J. Parenteral Therapy—Journal of Parenteral Therapy.
J. Path. Bact.—Journal of Pathology and Bacteriology.
J. Pediatr.—Journal of Pediatrics.
J. pharm. Alsace Lorraine—Journal de pharmacie d'Alsace et de Lorraine.
J. pharm. Belg.—Journal de pharmacie de Belgique.
J. pharm. chim.—Journal de pharmacie et de chimie.
J. Pharm. Pharmacol.—The Journal of Pharmacy and Pharmacology.
J. Pharm. Soc. Japan—Journal of the Pharmaceutical Society of Japan.
J. Pharmacol.—Journal of Pharmacology and Experimental Therapeutics.
J. Phys. Chem.—Journal of Physical Chemistry.
J. Physiol.—Journal of Physiology.
J. prakt. Chem.—Journal für praktische Chemie.
J. Prevent. Med.—Journal of Preventive Medicine.
J. Proc. Roy. Soc. N. S. Wales—Journal and Proceedings of the Royal Society of New South Wales.
J. Roy. Army Med. Corps—Journal of the Royal Army Medical Corps.
J. Roy. Soc. W. Australia—Journal of the Royal Society of Western Australia.
J. Russ. Phys. Chem. S.—Journal of the Russian Physical-Chemical Society.
J. Soc. Chem. Ind.—Journal of the Society of Chemical Industry.
J. South African V. M. A.—The Journal of the South African Veterinary Medical Association.
J. Thoracic Surg.—Journal of Thoracic Surgery.
J. Trop. Med. Hyg.—Journal of Tropical Medicine and Hygiene.
J. Urol.—The Journal of Urology.
J. Ven. Dis. Inform.—Journal of Venereal Disease Information.
Jahresber. Pharm.—Jahresbericht der Pharmazie.
Jap. J. Med. Sc.—Japanese Journal of Medical Sciences.
Kentucky M. J.—Kentucky Medical Journal.
Klin. Monatsbl. Augen.—Klinische Monatsblätter für Augenheilkunde.
Klin. therap. Wchnschr.—Klinisch-therapeutische Wochenschrift.
Klin. Wchnschr.—Klinische Wochenschrift.
Kunststoffe—Kunststoffe: Zeitschrift für Erzeugung und Verwendung veredelter oder chemisch hergestellter Stoffe.
Lahey Clin. Bull.—Lahey Clinic Bulletin.
Lancet—The Lancet.
Laryng.—Laryngoscope.
Laval méd.—Laval médical.
L'Union pharm.—L'Union pharmaceutique.
M. S. C. Vet.—The M. S. C. Veterinarian.
Med. Ann. District Columbia—Medical Annals of the District of Columbia.
Med. Bl.—Medizinische Blätter.
Med. Bull. Vet. Admin.—Medical Bulletin of the Veterans' Administration.
Med. Clin. North America—The Medical Clinics of North America.
Med. J. Australia—Medical Journal of Australia.
Med. Klin.—Medizinische Klinik.
Med. Press—Medical Press and Circular.
Med. Rec.—Medical Record.
Med. Rund.—Medizinische Rundschau.
Med. Times—Medical Times.
Médecine—La Médecine.
Medicine—Medicine: Analytical Reviews of General Medicine, Neurology and Pediatrics.
Merck Rep.—The Merck Report.
Merck's Jahresber.—Merck's Jahresbericht über Neuerungen auf den Gebieten der Pharmakotherapie und Pharmazie.
Mfg. Chemist—The Manufacturing Chemist.
Mfg. Perfumer—The Manufacturing Perfumer. (Merged with Mfg. Chemist.)
Mikrochemie—Mikrochemie.
Mil. Surg.—Military Surgeon.
Minn. Med.—Minnesota Medicine.

- Missouri Agric. Exp. Sta. Res. Bull.*—Missouri Agricultural Experiment Station Research Bulletin.
Missouri Med.—Missouri Medicine.
Mitt. med. Akad. Kioto—Mitteilungen aus der medizinischen Akademie zu Kioto.
Monatsh. Chem.—Monatshefte für Chemie und verwandte Teile anderer Wissenschaften.
Monatsh. f. Vet.-med.—Monatshefte für Veterinarmedizin.
Monatsh. prakt. Tierheilk.—Monatshefte für praktische Tierheilkunde.
Monatsschr. Geburtsh. Gynäk.—Monatsschrift für Geburtshilfe und Gynäkologie.
Münch. med. Wchnschr.—Münchener medizinische Wochenschrift.
N. Carolina M. J.—North Carolina Medical Journal.
N.F.—The National Formulary, Tenth Edition.
N. Y. State J. Med.—New York State Journal of Medicine.
Nat. Res. Council Bull.—National Research Council Bulletin.
Nature—Nature.
Nederland. Tijdschr. Pharm.—Nederlandsch Tijdschrift voor Pharmacie, Chemie en Toxicologie.
New Eng. J. Med.—New England Journal of Medicine.
New Internat. Clin.—New International Clinics.
New Orleans Med. Surg. J.—New Orleans Medical and Surgical Journal.
North Am. Vet.—The North American Veterinarian.
Northwest Med.—Northwest Medicine.
Nouv. Rem.—Nouveaux Remèdes.
Nutrition Rev.—Nutrition Reviews.
Obst. Gyn.—Obstetrics and Gynecology.
Occup. Med.—Occupational Medicine.
Oesterr. Chem.-Ztg.—Oesterreichische Chemiker-Zeitung. (Now Wien. Chem.-Ztg.)
Ohio State M. J.—Ohio State Medical Journal.
Oil and Fat Ind.—Oil and Fat Industries. (Now Oil and Soap.)
Oil and Soap—Oil and Soap.
Oral Surg., Oral Med., Oral Path.—Oral Surgery, Oral Medicine and Oral Pathology.
Orient. J. Dis. Infants—Oriental Journal of Diseases of Infants.
Pediatr.—Pediatrics.
Pennsylvania M. J.—Pennsylvania Medical Journal.
Perf. Ess. Oil Rec.—Perfumery and Essential Oil Record.
Pest. med.-chirurg. Presse—Pester medicinisch-chirurgische Presse.
Pharm. Acta Helv.—Pharmaceutica Acta Helvetiae.
Pharm. Arch.—Pharmaceutical Archives.
Pharm. Era—Pharmaceutical Era.
Pharm. J.—Pharmaceutical Journal.
Pharm. Monatsh.—Pharmazeutische Monatshefte.
Pharm. Presse—Pharmazeutische Presse.
Pharm. Rev.—Pharmaceutical Review.
Pharm. Rund.—Pharmaceutische Rundschau.
Pharm. Tijdschr.—Pharmaceutisch Tijdschrift voor Nederlandsch-Indië.
Pharm. Weekblad.—Pharmaceutisch Weekblad.
Pharm. Zentr.—Pharmaceutische Zentralhalle für Deutschland.
Pharm. Ztg.—Pharmaceutische Zeitung.
Pharmacol. Rev.—Pharmacological Reviews.
Phila. Med.—Philadelphia Medicine.
Philippine J. Sc.—Philippine Journal of Science.
Physiol. Rev.—Physiological Reviews.
Pittsburgh Med. Bull.—Pittsburgh Medical Bulletin.
Plast. Reconstruct. Surg.—Plastic and Reconstructive Surgery.
Postgrad. Med.—Postgraduate Medicine.
Poultry Sc.—Poultry Science.
Pract.—Practitioner.
Pract. Drug.—Practical Druggist.
Praktika Akad. Athēnōn—Praktika Akademia Athēnōn.
Prensa méd. Argent.—La prensa médica Argentina.
Prensa méd. Mexicana—Prensa médica Mexicana.
Presse méd.—Presse médicale.
Proc. A. Diabetes A.—Proceedings of the American Diabetes Association.
Proc. A. Ph. A.—Proceedings of the American Pharmaceutical Association.
Proc. Centr. Soc. Clin. Res.—Proceedings of the Central Society for Clinical Research.
Proc. Chem. S.—Proceedings of the Chemical Society.
Proc. Helminthol. Soc.—Proceedings of the Helminthological Society.
Proc. Imp. Acad. Tokyo—Proceedings of the Imperial Academy (Tokyo).
Proc. Indian Acad. Sc.—Proceedings of the Indian Academy of Sciences.
Proc. Indiana Vet. Med. Assoc.—Proceedings of the Indiana Veterinary Medical Association.
Proc. Int. Congr. Pl. Sc.—Proceedings of the International Congress of Plant Science.
Proc. Mayo—Proceedings of the Staff Meetings of the Mayo Clinic.
Proc. Nat. Acad. Sc.—Proceedings of the National Academy of Science.
Proc. N. J. Ph. A.—Proceedings of the New Jersey Pharmaceutical Association.
Proc. Penn. Ph. A.—Proceedings of the Pennsylvania Pharmaceutical Association.
Proc. Roy. Soc. London—Proceedings of the Royal Society, London.
Proc. Roy. Soc. Med.—Proceedings of the Royal Society of Medicine.
Proc. S. Dakota Acad. Sc.—Proceedings of the South Dakota Academy of Sciences.
Proc. S. Exp. Biol. Med.—Proceedings of the Society for Experimental Biology and Medicine.
Progrès méd.—Le progrès médical.
Psych. Quart.—Psychiatric Quarterly.
Psychosom. Med.—Psychosomatic Medicine.
Pub. Health Rep.—Public Health Reports.
Puerto Rico J. Pub. Health—Puerto Rico Journal of Public Health and Tropical Medicine.
Quart. Bull. Northwest. U. Med. Sch.—Quarterly Bulletin of Northwestern University Medical School.
Quart. J. Exp. Physiol.—Quarterly Journal of Experimental Physiology.
Quart. J. Med.—Quarterly Journal of Medicine.
Quart. J. P.—Quarterly Journal of Pharmacy and Pharmacology.
Quart. J. Stud. Alcohol—Quarterly Journal of Studies on Alcohol.
Queensland Agr. J.—Queensland Agricultural Journal.
Radiology—Radiology.
Rec. trav. chim.—Recueil des travaux chimiques des Pays-Bas.
Rev. assoc. brasil. farm.—Revista da associação brasileira de farmacêuticos.
Rev. brasil. med. farm.—Revista brasileira de medicina e farmácia.
Rev. Canad. Biol.—Revue Canadienne de Biologie.
Rev. chim. ind.—Revista de química industrial (Rio de Janeiro).
Rev. clin. espñ.—Revista clínica española.
Rev. filipina med. farm.—Revista filipina de medicina y farmacia.
Rev. flora med.—Revista de flora medicinal (Rio de Janeiro).
Rev. Gastroenterol.—The Review of Gastroenterology.
Rev. gén. Clin. Thérap.—Revue générale de Clinique et de Thérapeutique.
Rev. méd. hyg. trop.—Revue de médecine et d'hygiène tropicales.
Rev. méd. Liège—Revue médicale de Liège.

- Rev. méd. Suisse Rom.*—Revue médicale de la Suisse Romande.
Rev. neurol.—Revue neurologique.
Rev. quim. pura aplic.—Revista de química pura e aplicada.
Rev. therap. méd.-chirurg.—Revue de thérapeutique médico-chirurgicale.
Riechstoff Ind.—Riechstoff Industrie.
Rif. méd.—La Riforma medica.
Rocky Mountain M. J.—Rocky Mountain Medical Journal.
Royal Col. Phys. Rep. Edinburgh—Royal College of Physicians Laboratory Reports, Edinburgh.
S. Dakota J. M. Pharm.—South Dakota Journal of Medicine and Pharmacy.
Sang—Le sang.
São Paulo med.—São Paulo medico.
Schim. Rep.—Schimmel & Co., Annual Report.
Schweiz. Apoth.-Ztg.—Schweizerische Apotheker-Zeitung.
Schweiz. Arch. Tierheilk.—Schweizerische Archiv für Tierheilkunde.
Schweiz. med. Wchnschr.—Schweizerische medizinische Wochenschrift.
Schweiz. naturforsch. Gesell.—Schweizerische naturforschende Gesellschaft.
Schweiz. Wchnschr. Pharm.—Schweizerische Wochenschrift für Pharmacie.
Sci. Monthly—Scientific Monthly.
Science—Science.
Scientia Pharm.—Scientia Pharmaceutica.
Seifensieder-Ztg.—Seifensieder-Zeitung.
Semaine méd.—Semaine médicale.
Semana médica—La Semana médica.
Skandinav. Arch. Physiol.—Skandinavisches Archiv für Physiologie.
Soap, Perf. & Cos.—Soap, Perfumery and Cosmetics Trade Journal.
South African J. Med. Sc.—South African Journal of Medical Sciences.
South. M. J.—Southern Medical Journal.
South. Med. Surg.—Southern Medicine and Surgery.
Sp.—Spanish Pharmacopeia.
Stanford M. Bull.—Stanford University Medical Bulletin.
Südd. Apoth.-Ztg.—Süddeutsche Apotheker-Zeitung.
Surg. Clinics N. America—Surgical Clinics of North America.
Surg. Gynec. Obst.—Surgery, Gynecology and Obstetrics with International Abstract of Surgery.
Surgery—Surgery.
Texas Repts. Biol. Med.—Texas Reports on Biology and Medicine.
Texas State J. Med.—Texas State Journal of Medicine.
Ther. Geg.—Thérapie de Gegenwart.
Therap. Gaz.—Therapeutic Gazette.
Therap. Halbmonatsh.—Therapeutische Halbmonatshefte.
Therap. Monatsh.—Therapeutische Monatshefte.
Tierärztl. Rundsch.—Tierärztliche Rundschau.
Tôhoku J. Exp. Med.—Tôhoku Journal of Experimental Medicine.
Trade Corres.—Trade Correspondence of the Food and Drug Administration.
Trans. A. Am. Phys.—Transactions of the Association of American Physicians.
Trans. Am. Acad. Ophth.—Transactions of the American Academy of Ophthalmology and Otolaryngology.
Trans. Am. Inst. Chem. Engrs.—Transactions of the American Institute of Chemical Engineers.
Trans. Am. Laryng. Rhin. Otol. Soc.—Transactions of the American Laryngological, Rhinological and Otolological Society.
Trans. Am. Neurol. A.—Transactions of the American Neurological Association.
Trans. Chem. Soc.—Transactions of the Chemical Society of London.
Trans. Roy. Soc. Trop. Med. Hyg.—Transactions of the Royal Society of Tropical Medicine and Hygiene.
Trans. South. Surg. Gynec. A.—Transactions of the Southern Surgical and Gynecological Association.
Trans. Stud. Coll. Phys.—Transactions and Studies of the College of Physicians of Philadelphia.
Trop. Dis. Bull.—Tropical Diseases Bulletin.
U. S. Armed Forces M. J.—United States Armed Forces Medical Journal.
U. S. Army Vet. Bull.—United States Army Veterinary Bulletin.
U.S.D.—The United States Dispensary.
U.S.D.A. Farmers' Bull.—United States Department of Agriculture Farmers' Bulletin.
U.S.D.A. Leaflet.—United States Department of Agriculture Leaflet.
U.S.D.A. Yearbook—United States Department of Agriculture Yearbook.
U. S. Nav. M. Bull.—United States Naval Medical Bulletin.
U.S.P.—The United States Pharmacopeia, Fifteenth Revision.
Ugeskr. f. læger—Ugeskrift for læger.
Union méd. Canada—Union médicale du Canada.
Univ. Hosp. Bull. Ann Arbor—University Hospital Bulletin (Ann Arbor).
Univ. Mich. M. Bull.—University of Michigan Medical Bulletin.
Univ. Penn. Bull. Vet. Ext. Quart.—University of Pennsylvania Bulletin Veterinary Extension Quarterly.
Univ. Penn. M. Bull.—University of Pennsylvania Medical Bulletin.
Uppsala läkaref. förh.—Uppsala läkareförenings förhandlingar.
Urol. Cutan. Rev.—Urologic and Cutaneous Review.
Ven. Dis. Inform.—Venereal Disease Information.
Vet. Bull. Lederle—Veterinary Bulletin (Lederle).
Vet. J.—Veterinary Journal.
Vet. Med.—Veterinary Medicine.
Vet. Rec.—The Veterinary Record.
Vierteljahrsschr. prakt. Pharm.—Vierteljahrsschrift für praktische Pharmazie. (Merged into Arch. Pharm.)
Virchows Arch. path. Anat.—Virchows Archiv für pathologische Anatomie und Physiologie und für klinische Medizin.
Virginia Med. Month.—Virginia Medical Monthly.
Vlaam's Diergeneesk. Tijdschr.—Vlaam's Diergeneeskunde Tijdschrift.
War Med.—War Medicine.
West. J. Surg. Obst. Gyn.—Western Journal of Surgery, Obstetrics and Gynecology.
West Virg. M. J.—West Virginia Medical Journal.
Wien. Chem.-Ztg.—Wiener Chemiker-Zeitung.
Wien. klin. Wchnschr.—Wiener klinische Wochenschrift.
Wien. med. Bl.—Wiener medizinische Blätter. (Now Med. Bl.)
Wien. tierärztl. Monatsschr.—Wiener tierärztliche Monatsschrift.
Wisconsin Exp. Sta. Ann. Rep. Bull.—Wisconsin Experiment Station Annual Report Bulletin.
Wisconsin M. J.—Wisconsin Medical Journal.
Yale J. Biol. Med.—Yale Journal of Biology and Medicine.
Year-book Pharm.—Year-book of Pharmacy and Transactions of British Pharmaceutical Conference.
Zentralbl. Bakt.—Zentralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten.

Zentralbl. Chir.—Zentralblatt für Chirurgie.

Zentralbl. Gynäk.—Zentralblatt für Gynäkologie.

Zentralbl. Haut-Geschlechtskrank.—Zentralblatt für Haut- und Geschlechtskrankheiten sowie deren Grenzgebiete.

Zentralbl. inn. Med.—Zentralblatt für innere Medizin.

Ztschr. anal. Chem.—Zeitschrift für analytische Chemie.

Ztschr. Biol.—Zeitschrift für Biologie.

Ztschr. exp. Path. Ther.—Zeitschrift für experimentelle Pathologie und Therapie.

Ztschr. ges. exp. Med.—Zeitschrift für die gesamte experimentelle Medizin.

Ztschr. ges. Neurol. Psych.—Zeitschrift für die gesamte Neurologie und Psychiatrie.

Ztschr. Hyg. Infektionskr.—Zeitschrift für Hygiene und Infektionskrankheiten.

Ztschr. Immun. exp. Ther.—Zeitschrift für Immunitätsforschung und experimentelle Therapie.

Ztschr. Infektionskr.—Zeitschrift für Infektionskrankheiten, parasitäre Krankheiten und Hygiene der Haustiere.

Ztschr. Kinderh.—Zeitschrift für Kinderheilkunde.

Ztschr. klin. Med.—Zeitschrift für klinische Medizin.

Ztschr. Kreislauf.—Zeitschrift für Kreislaufforschung.

Ztschr. Laryng. Rhin.—Zeitschrift für Laryngologie, Rhinologie, Otologie und ihre Grenzgebiete.

Ztschr. Naturforsch.—Zeitschrift für Naturforschung.

Ztschr. physiol. Chem.—Zeitschrift für physiologische Chemie.

Ztschr. Untersuch. Nahr. Genussm.—Zeitschrift für Untersuchung der Nahrungs- und Genussmittel, sowie der Gebrauchsgegenstände. (Now *Ztschr. Untersuch. Lebensm.*)

Ztschr. Untersuch. Lebensm.—Zeitschrift für Untersuchung der Lebensmittel.

Ztschr. Vitaminforsch.—Zeitschrift für Vitaminforschung.

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THE DISPENSATORY OF THE UNITED STATES

PART ONE: Drugs recognized by The United States Pharmacopeia, British Pharmacopœia, International Pharmacopœia or The National Formulary

ACACIA. U.S.P., B.P. Gum Arabic, [Acacia]

"Acacia is the dried gummy exudate from the stems and branches of *Acacia Senegal* (Linné) Willdenow, or of other related African species of *Acacia* (Fam. *Leguminosæ*)." U.S.P. The B.P. definition is the same except that it does not specify the geographical origin.

Gum Acacia. *Acaciæ Gummi*; *Gummi Africanum*; *Gummi Mimosæ*; *Gummi Arabicum*. *Fr. Gomme arabique*; *Gomme de Sénégal*. *Ger. Arabisches Gummi*; *Akazien Gummi*; *Senegalgummi*. *It. Gomma Arabica*; *Gomma del Senegal*. *Sp. Goma de acacia*; *Goma Árábica*; *Goma del Senegal*.

The name *Acacia* was employed by the ancient Greeks to designate the gum tree of Egypt, and has been appropriately applied to the genus in which that plant is included. Gum Arabic is recorded by Herodotus (5th century B.C.) as being used by the ancient Egyptians as an adhesive. Its use in medicine is mentioned in several of the Egyptian papyri. Hippocrates refers to it in medical works published between 450–350 B.C.

The genus *Acacia* includes more than 500 species of tropical trees and shrubs, many of which have been of considerable economic importance as sources of gums, tannins, timber, dyes and perfumes. The Ark of the Covenant and the furniture of the Tabernacle are said to have been made from timber yielded by *Acacia Seyal*, the *Shittim wood* tree of the Bible. The same wood was made into coffins for the burial of the Egyptian kings.

The acacias thrive in the forests of northern Africa, occupying a zone stretching across the continent from Abyssinia in the east to Senegal in the west and chiefly between the 12th and 13th degree of latitude. The most important of the gum-yielding acacias is the official *A. Senegal* (Linné) Willd. This is a small tree rarely exceeding a height of 6 m. with a grayish bark, bipinnate leaves, dense spikes of small yellow flowers, and broad pods containing 5 or 6 seeds. It forms large forests in western Africa, north of the river Senegal, and is abundant in eastern Africa, Khor-

dofan, and southern Nubia. It is known by the natives of Senegambia as *Verek* and of Khordofan as *Hashab*.

Nearly all species of acacia growing in Africa yield gum. The commercial *Somali gum*, which is usually of fair quality, is yielded by *A. glaucophylla* Steud. and *A. abyssinica* Hochst., shrubs growing in Abyssinia and the Somali country. The following species yield a gum having a brownish or reddish color, and hence are less valuable, viz., African *A. arabica* Willd. (*Amrad gum*), *A. stenocarpa* Hochst. ex A. Rich., *A. Seyal* Del. and *A. Ehrenbergiana* Hayne. It would appear from the studies of Rangaswami (*Indian J. Pharm.*, 1942, 4, 128) that the pale yellow gum from *A. arabica* produced in S. India nearly approaches that of *A. Senegal* in quality and could be used as a substitute for it. Inferior gums are yielded also by the following: *A. horrida* Willd., which furnishes the so-called *Cape gum*, distinguished by being very brittle and yielding a less adhesive mucilage. *Talca* or *Sennarr gum* is derived from *A. Seyal* Delile and *A. stenocarpa* Hochst. ex A. Rich. This gum has a greenish tinge and yields a ropy mucilage. *Amritsar gum* is obtained from *A. modesta* Wall. It occurs in large brown tears and like *A. arabica* is used in calico printing. *Mogadore gum*, derived from *A. gummiifera* Willd., occurs in dark brown tears which are little fissured. *Australian gum* has usually a reddish color, said to be due to the presence of tannin, although some specimens are light in color and scarcely distinguishable from acacia. This gum is also called *Wattle gum* or *Australian gum*, and is derived from the *Golden Wattle Acacia* (*A. pycnantha* Benth.), a shrub growing in southern Australia. Lutz (*J. pharm. chim.*, 1942, 9:2, 49) gives *Acacia decurrens* Willd. var. *mollissima* Willd. as the source of Wattle Gum. However, the term "Wattle" is used for any one of various species of *Acacia* of Australia, Tasmania and S. Africa which are valued for their gum, bark or wood.

The astringent bark and unripe fruit of the

acacia contain both tannic and gallic acids. The dried juice of the pod was used by the ancient Greeks; and an extract is still sold in the bazaars of India under the name of *Ahakia*.

The gum of the acacias exudes spontaneously from cracks in the bark, and hardens on exposure; but in commercial production incisions are usually made in order to facilitate the exudation. The gum is said also to be found immediately under the bark, where it is sometimes collected in regular cavities. It is formed within the plant by metamorphosis of the cells of the inner bark. The tissues involved are chiefly those of the sieve and the cambium. The formation of the gum is believed to be a pathological process, as gummosis develops more largely upon the wounding of the trees and their infection by bacteria and other parasites. The investigations of Smith tend to show that all vegetable gums are of bacterial origin and that the differences in the several gums are due to the differences in the nature of the bacteria producing them. (*Proc. Linn. Soc. N. S. Wales*, 1904, p. 217.) For further discussion of the origin of acacia gum see Tschirch, "*Handbuch der Pharmakognosie*," and Greenish, "*Materia Medica*," 4th ed.

The trees are not tapped for gum until they are about six years old. Annual yields from 188 to 2856 Gm. in young trees and from 379 to 6754 Gm. in large trees have been reported. The average annual yield of gum from young trees is about 900 Gm. and from old trees over 2 kilos.

Commercial History and Varieties.—There are two principal commercial varieties of gum arabic: 1. The Kordofan, Gedaref or Arabian Gum, and 2. the Senegal or West African Gum, both of these being derived from *A. Senegal*. The former of these has the finer commercial qualities, being nearly white or faint yellowish-white and yielding a more or less transparent viscid mucilage.

KORDOFAN OR ARABIAN GUM.—This is the finest variety of gum arabic obtainable. It is gathered in the Kordofan province of the Sudan. It was formerly the only kind designated as gum arabic and entered commerce almost exclusively through Egypt.

It now occurs in two sub-varieties designated as "Bleached Kordofan Gum" and "Natural Kordofan Gum." The bleached variety is the most highly esteemed and occurs in white or weak yellow angular fragments or ovoid tears the outer surfaces of which bear numerous cracks. The natural variety differs from the former by being more transparent, owing to fewer cracks, and in being more deeply yellow or pinkish in color.

During the conquest of the Sudan by Anglo-Egyptian forces in 1908, a railway was built from Egypt to Khartoum in the Sudan, and since extended from Khartoum to El Obeid and Gedaref, which opened up large areas of acacia country in which the gum is now collected. The chief Egyptian Sudan market is at El Obeid, the shipping companies having their main offices at Khartoum about 500 miles distant. The finest Egyptian gum consists of large roundish or smaller more or less irregular fragments, transparent but usually rendered opaque upon the surface by innumerable

minute fissures. For information concerning method of collection see *U.S.D.*, 24th ed., p. 2.

Talca or *Talha* gum, from *A. stenocarpa* and *A. Seyal*, is exceedingly brittle, and usually semipulverulent. It is a mixture of nearly colorless and brownish gums, is exported at Alexandria, and is sometimes termed *gum savakin* or *Suakin gum*.

SENEGAL OR WEST AFRICAN GUM.—This commercial variety ranks second to the Kordofan gum. It is derived from *A. Senegal* and other species of *Acacia* growing in the Sudan and Senegal. It yields a good adhesive mucilage and is valuable for technical purposes. Some of the best qualities of Senegal gum are also adapted for certain pharmaceutical uses. It was introduced into Europe by the Dutch. The French afterwards planted a colony on the western coast of Africa, and took possession of the trade. The dry winds, which prevail after the rainy season, cause the bark to crack; the juice flows out and hardens in masses. It is claimed that the exudation is also largely caused by a parasitic plant, *Loranthus Acaciæ* Zucc., the gummy exudation freely oozing out at the point where the parasite penetrates the bark. Senegal gum is usually in roundish or oval unbroken tears, or in straight or curled cylindrical pieces of various sizes, in the finest grades whitish or colorless, but generally yellowish, reddish, or brownish-red. The pieces are generally larger than those of Kordofan gum, less brittle, fissured, and pulverizable, and break with a more conchoidal fracture. Vermiform tears are usually present and aid in diagnosing this variety. It is shipped from the Senegal river to France and the United States.

The total imports of acacia into this country during 1952 were over 20 million pounds, mostly from Sudan, Nigeria, East Africa and India.

Impurities and Adulterations.—As gum arabic is usually collected in huge piles at Khartoum, Gedaref, etc., before being shipped to Port Sudan the sand and impurities are likely to sift to the bottom. As a consequence the first orders will be filled with the cleaner article, while the latter, containing the siftings, may run as high as 4 per cent of ash. The inferior grades are often mixed with, or substituted for, the better kinds, especially in powder.

The chief adulterant and substitute for acacia within recent years has been *Mesquite gum*, from *Prosopis chilensis* (Molina) Stuntz (Fam. *Leguminosæ*), a plant indigenous to Mexico. It occurs in brownish to reddish-brown tears of variable size and differs from acacia in not precipitating from its aqueous solution when solutions of ferric chloride, lead subacetate or sodium borate are added.

Description.—"Unground *Acacia* occurs in spheroidal tears up to 32 mm. in diameter or in angular fragments of white to yellowish white color. It is translucent or somewhat opaque from the presence of numerous minute fissures; very brittle, the fractured surface glassy and occasionally iridescent. It is almost odorless and has a mucilaginous taste.

"*Flake Acacia* occurs in white to yellowish white, thin flakes, appearing under the microscope as colorless, striated fragments.

"*Powdered Acacia* is white to yellowish white.

It occurs in angular microscopic fragments with but slight traces of starch or vegetable tissues present.

"Granular Acacia" is Acacia reduced to fine granules. It is white to pale yellowish white. Under the microscope it appears as colorless, glassy, irregularly angular fragments up to 100 μ in thickness, some of which exhibit parallel linear streaks.

"Solubility."—One Gm. of Acacia dissolves in 2 ml. of water; the resulting solution flows readily and is acid to litmus. It is insoluble in alcohol." *U.S.P.*

Acacia is insoluble in ether, and in oils. In 22 per cent alcohol the solubility is 57 Gm. in 100 ml.; in 40 per cent alcohol, 10 Gm. in 100 ml.; in 50 per cent alcohol, 4 Gm. in 100 ml.

Standards and Tests.—**Identification.**—A flocculent, or curdy, white precipitate is produced immediately when 0.2 ml. of diluted lead subacetate T.S. is added to 10 ml. of a 1 in 50, cold, aqueous solution of acacia. **Total ash.**—Not over 4 per cent. **Acid-insoluble ash.**—Not over 0.5 per cent. **Water.**—Not over 15 per cent. **Optical rotation.**—A 1 in 10 solution is only slightly levorotatory. **Insoluble residue.**—A mixture of 5 Gm. of acacia, 100 ml. distilled water and 10 ml. of diluted hydrochloric acid boiled gently for 15 minutes yields a residue not exceeding 50 mg. **Starch or dextrin.**—Iodine T.S. does not give a bluish or reddish color with a 1 in 50 aqueous solution of acacia, previously boiled and cooled. **Tannin-bearing gums.**—No blackish coloration or precipitate is produced when 0.1 ml. of ferric chloride T.S. is added to 10 ml. of a 1 in 50 aqueous solution of acacia. *U.S.P.*

The B.P. specifies the following identification tests for acacia: (1) A flocculent white precipitate is produced on adding a strong solution of lead subacetate to a 1 in 50 solution of acacia. (2) A deep blue color is produced on adding 0.5 ml. of hydrogen peroxide solution and 0.5 ml. of a 1 in 100 solution of benzidine (in 90 per cent alcohol) to a solution of 250 mg. of acacia in 5 ml. of water, the mixture being allowed to stand. (3) Particles of powdered acacia mounted in solution of ruthenium red show no red color when examined microscopically (distinction from agar and from sterculia). (4) No precipitate is produced on adding 0.2 ml. of a 1 in 5 solution of lead acetate to 10 ml. of a 1 in 50 solution of acacia (distinction from agar and from tragacanth). (5) A mixture of 100 mg. of powdered acacia and 1 ml. of 0.02 *N* iodine does not acquire a crimson or olive-green color (distinction from agar and from tragacanth).

Gum arabic undergoes no change on aging, if kept in a dry place. Its concentrated aqueous solution remains stable for a considerable time, but ultimately becomes sour, acid being formed. The tendency to sour is said to be increased by using hot water in making the solution.

Constituents.—Acacia consists principally of the calcium, magnesium and potassium salts of a polysaccharide known as *arabic acid*, sometimes called *arabin*. On hydrolysis with dilute acid, arabic acid yields *L*-arabinose, *L*-rhamnose, *D*-galactose, and an aldobionic acid containing

D-glucuronic acid and *D*-galactose in glycosidal combination. An oxidase-type enzyme is present in acacia, and it is claimed that diastase is also a constituent.

Incompatibilities.—Bourquelot (*J. pharm. chim.*, 1904, 19, 473, 474) reported that acacia contains an oxidase-type enzyme which may render it unsuitable for use in pharmaceutical preparations which contain easily oxidized active constituents. Thus, Kedvessy (*Chem. Abs.*, 1943, 37, 4531) reported that the vitamin A content of cod liver oil emulsions made with acacia decreased 54 per cent in three weeks. Griffiths *et al.* (*Analyst*, 1933, 58, 65), on the other hand, found that such emulsions can be kept for at least four months without serious loss of vitamin A if stored in well-filled, amber glass bottles and kept in the dark. Substances stated to be incompatible with acacia include aminopyrine, pyrogallol, morphine, vanillin, phenol, thymol, carvol, α - and β -naphthol, pyrocatechol, guaiacol, cresols, creosol, eugenol, acetylugenol, apomorphine, eserine, epinephrine, isobarbaloin, caffeotannic acid, gallic acid and tannin. Kieft (*Pharm. Weekblad*, 1939, 76, 1133) recommended heating acacia at 103° to 105° C. as the best method for destroying its oxidase enzyme. The oxidizing action of acacia mucilage may be destroyed by heating at 100° C.

Acacia is also incompatible with strongly alcoholic liquids, solutions of ferric chloride and lead subacetate, and strong solutions of sodium borate.

Uses.—Sodium chloride injection is of little practical value in the treatment of low blood pressure from hemorrhage or surgical shock because it escapes so rapidly from the blood vessels. This characteristic is generally attributed to its non-colloid character and in 1917 Bayliss suggested the use of a 7 per cent solution of acacia to impart the necessary colloid material. Although the method has received some favorable reports (for literature see Maytum and Magath, *J.A.M.A.*, 1932, 99, 2251) the availability of blood plasma and plasma expanders, such as dextran and polyvinylpyrrolidone, led to an almost complete abandonment of the procedure.

In 1933 Hartmann and co-workers recommended intravenous injection of acacia solutions to relieve the edema of certain types of nephrosis, on the theory that the edema is due to a disturbance of the colloid pressure of blood brought about by a diminution in its protein content. There has been considerable difference of opinion as to whether the final results are beneficial or injurious. Large intravenous doses of acacia in animals (15 to 47 Gm. per kilogram in dogs) produce toxic effects, including reduction of erythrocytes, hemoglobin and hematocrit, hastened sedimentation of erythrocytes, transitory leukopenia and reduction of serum proteins, especially of serum albumin (Hueper, *Am. J. Path.*, 1942, 18, 895). Tissue examination shows enlargement and thickening of the liver. The parenchymal cells around the central vein and in the periportal areas stain lightly, appear distended and contain a vacuolated cytoplasm (foam cells) which does not take the special stains used for fat, glycogen, mucin or amyloid and is probably acacia. Infiltration with inflammatory cells is minimal. The