

## Nutrition for the Primary Care Provider

**Supported by an unrestricted educational grant from the Nestlé Nutrition Institute.**

Matériel protégé par le droit d'auteur

# **World Review of Nutrition and Dietetics**

**Vol. 111**

Series Editor

**Berthold Koletzko** Munich

---

# Nutrition for the Primary Care Provider

Volume Editor

**Dennis M. Bier** Houston, Tex.

Co-Editors

**Jim Mann** Dunedin

**David H. Alpers** St. Louis, Mo.

**H.H. Este Vorster** Potchefstroom

**Michael J. Gibney** Dublin

20 figures, 8 in color and 50 tables, 2015

**KARGER** Basel · Freiburg · Paris · London · New York · Chennai · New Delhi ·  
Bangkok · Beijing · Shanghai · Tokyo · Kuala Lumpur · Singapore · Sydney

Matériel protégé par le droit d'auteur

---

**Dennis M. Bier**

USDA/ARS Children's Nutrition  
Research Center  
Baylor College of Medicine  
1100 Bates Street  
Houston, TX 77030-2600 (USA)

---

**Jim Mann**

Medicine and Human Nutrition  
University of Otago  
PO Box 56  
Dunedin 9054 (New Zealand)

---

**H.H. Este Vorster**

Faculty of Health Sciences  
Centre of Excellence for Nutrition  
North-West University  
Potchefstroom 2531 (South Africa)

---

**David H. Alpers**

Washington University School of  
Medicine  
660 S. Euclid Ave.  
St. Louis, MO 63110 (USA)

---

**Michael J. Gibney**

School of Agriculture and Food  
Science  
University College Dublin  
Science Centre – South Belfield  
Dublin 4 (Ireland)

## Library of Congress Cataloging-in-Publication Data

Nutrition for the primary care provider / volume editor, Dennis M. Bier ;  
co-editors, Jim Mann, David H. Alpers, H.H. Este Vorster, Michael J. Gibney.

p. ; cm. -- (World review of nutrition and dietetics, ISSN 1660-2242  
; vol. 111)

Includes bibliographical references and index.

ISBN 978-3-318-02666-5 (hard cover : alk. paper) -- ISBN 978-3-318-02667-2  
(e-book)

I. Bier, Dennis M., editor. II. Mann, Jim, editor. III. Alpers, David H.,  
editor. IV. Vorster, H. H., editor. V. Gibney, Michael J., editor. VI.

Series: World review of nutrition and dietetics ; v. 111. 0084-2230

[DNLM: 1. Nutritional Physiological Phenomena. 2. Physicians, Primary  
Care. 3. Nutrition Policy. 4. Nutrition Therapy. W1 WO898 v.111 2014 / QU  
145]

RM216

615.8'54--dc23

2014030004

Bibliographic Indices. This publication is listed in bibliographic services, including Current Contents® and PubMed/MEDLINE.

Disclaimer. The statements, opinions and data contained in this publication are solely those of the individual authors and contributors and not of the publisher and the editor(s). The appearance of advertisements in the book is not a warranty, endorsement, or approval of the products or services advertised or of their effectiveness, quality or safety. The publisher and the editor(s) disclaim responsibility for any injury to persons or property resulting from any ideas, methods, instructions or products referred to in the content or advertisements.

Drug Dosage. The authors and the publisher have exerted every effort to ensure that drug selection and dosage set forth in this text are in accord with current recommendations and practice at the time of publication. However, in view of ongoing research, changes in government regulations, and the constant flow of information relating to drug therapy and drug reactions, the reader is urged to check the package insert for each drug for any change in indications and dosage and for added warnings and precautions. This is particularly important when the recommended agent is a new and/or infrequently employed drug.

All rights reserved. No part of this publication may be translated into other languages, reproduced or utilized in any form or by any means electronic or mechanical, including photocopying, recording, microcopying, or by any information storage and retrieval system, without permission in writing from the publisher.

© Copyright 2015 by S. Karger AG, P.O. Box, CH-4009 Basel (Switzerland)

www.karger.com

Printed in Germany on acid-free and non-aging paper (ISO 9706) by Kraft Druck, Ettlingen

ISSN 1660-2242

e-ISSN 1662-2898

ISBN 978-3-318-02666-5

e-ISBN 978-3-318-02667-2

**KARGER** 125  
YEARS

# Contents

## VII List of Contributors

## XI Foreword

### Nutrition for Health

#### 1 Evidence-Based Approach to Inform Clinical Nutrition Practice

Chung, M. (Boston, Mass.); Lau, J. (Providence, R.I.)

#### 7 Nutrient Adequacy

Vorster, H.H. (Potchefstroom)

#### 13 Energy Balance and Body Composition

Schoeller, D.A. (Madison, Wisc.); Thomas, D. (Montclair, N.J.)

#### 19 Appetite: Measurement and Management

Mattes, R.D. (West Lafayette, Ind.)

#### 24 Macronutrients: Requirements and Distribution

Mann, J. (Dunedin)

#### 30 Water-Soluble Vitamins

Said, H.M. (Long Beach, Calif.)

#### 38 Fat-Soluble Vitamins

Johnson, E.J.; Mohn, E.S. (Boston, Mass.)

#### 45 Minerals and Trace Elements

Fairweather-Tait, S.J. (Norwich); Cashman, K. (Cork)

#### 53 Vegetarian Diets

Barr, S.I. (Vancouver, B.C.)

#### 58 Dietary Supplements

Coates, P.M.; Thomas, P.R. (Bethesda, Md.)

### Nutrition for Special Circumstances

#### 64 Nutrition in Pregnancy and Lactation

Kruger, H.S. (Potchefstroom); Butte, N.F. (Houston, Tex.)

#### 71 Exercise and Sports

Maughan, R.J. (Loughborough); Shirreffs, S.M. (Brentford)

#### 76 Food Allergy and Food Intolerance

Leung, J. (Boston, Mass.); Crowe, S.E. (San Diego, Calif.)

#### 82 Religion and Culture

Vorster, H.H. (Potchefstroom)

## Nutrition for Disease States

- 87 Approach to the Patient and Differential Diagnosis**  
Hoffer, L.J. (Montreal, Que.); Bistrrian, B.R. (Boston, Mass.)
- 94 Cardiovascular Disease**  
Risérus, U. (Uppsala)
- 100 Hypertension**  
McLean, R.M. (Dunedin)
- 104 Obesity**  
Gibson, A.A.; Sim, K.A.; Caterson, I.D. (Sydney, N.S.W.)
- 110 Diabetes Mellitus**  
Mann, J. (Dunedin)
- 116 Obesity, Diabetes and the Asian Phenotype**  
Bhardwaj, S.; Misra, A. (New Delhi)
- 123 Cancer Prevention and Treatment**  
Key, T. (Oxford)
- 130 Nutritional Management in HIV/AIDS Infection**  
van Graan, A.E. (Potchefstroom)
- 136 Osteoporosis**  
Adeel, S.; Tangpricha, V. (Atlanta, Ga.)
- 141 Nutrition Support in Gastrointestinal Disease**  
Scolapio, J.S.; Smith, D.J. (Jacksonville, Fla.)
- 146 Liver Diseases**  
Obert, J.; Cave, M.; Marsano, L. (Louisville, Ky.)
- 151 Neurological Disorders**  
Kumar, N. (Rochester, Minn.)
- 164 Anemias due to Essential Nutrient Deficiencies**  
Stabler, S.P. (Aurora, Colo.)
- 169 Anorexia Nervosa**  
Marzola, E. (Turin); Kaye, W.H. (San Diego, Calif.)

## Food Policy

- 174 Global Food Policy and Sustainability**  
Drewnowski, A. (Seattle, Wash.)
- 179 Undernutrition in the Developing World**  
Vorster, H.H. (Potchefstroom)
- 186 The Changing Landscape of Malnutrition: Why It Matters**  
Salam, R.A. (Karachi); Bhutta, Z.A. (Karachi/Toronto, Ont.)
- 193 Food Preparation, Processing, Labeling and Safety**  
Hanekom, S.M. (Potchefstroom)
- 198 The Food Industry and Consumer Nutrition and Health**  
Barclay, D. (Vevey); Haschke, F. (Salzburg)
- 205 Author Index**
- 206 Subject Index**

## List of Contributors

### **Saira Adeel**

Division of Endocrinology, Metabolism and Lipids  
Department of Medicine  
Emory University School of Medicine  
101 Woodruff Circle, NE-WMRB1301  
Atlanta, GA 30322 (USA)  
E-Mail saira.adeel@emory.edu

### **Denis Barclay**

Nestec SA  
Avenue Nestlé 55  
CH-1800 Vevey (Switzerland)  
E-Mail denis.barclay@outlook.com

### **Susan I. Barr**

Food, Nutrition & Health  
The University of British Columbia  
2205 East Mall  
Vancouver, BC V6T 1Z4 (Canada)  
E-Mail susan.barr@ubc.ca

### **Swati Bhardwaj**

Nutrition and Fatty Acid Research  
National Diabetes, Obesity and  
Cholesterol Foundation (N-DOC)  
D 16/8, 2nd Floor, Ardee City, Sector 52  
Gurgaon, Haryana, 122011 (India)  
E-Mail swati7681@gmail.com

### **Zulfiqar A. Bhutta**

Center of Excellence in Women and Child Health  
Aga Khan University  
Stadium Road  
PO Box 3500  
Karachi 74800 (Pakistan)  
E-Mail zulfiqar.bhutta@aku.edu

### **Bruce R. Bistrian**

Clinical Nutrition  
Beth Israel Deaconess Medical Center  
1 Deaconess Road  
Boston, MA 02215 (USA)  
E-Mail bbistria@bidmc.harvard.edu

### **Nancy F. Butte**

USDA/ARS Children's Nutrition Research Center  
Department of Pediatrics  
Baylor College of Medicine  
1100 Bates Street  
Houston, TX 77030-2600 (USA)  
E-Mail nbutte@bcm.edu

### **Kevin D. Cashman**

School of Food and Nutritional Sciences and  
Department of Medicine  
Room 242, Food Science Building  
Cork (Ireland)  
E-Mail k.cashman@ucc.ie

### **Ian D. Caterson**

The Boden Institute of Obesity, Nutrition, Exercise  
and Eating Disorders  
The University of Sydney  
Medical Foundation Bldg (K25)  
92-94 Parramatta Road  
Camperdown, NSW 2050 (Australia)  
E-Mail ian.caterson@sydney.edu.au

### **Matt Cave**

University of Louisville and Robley Rex VAMC  
505 S. Hancock Street, CTR512  
Louisville, KY 40202 (USA)  
E-Mail m0cave01@louisville.edu

**Mei Chung**

Nutrition/Infection Unit  
Department of Public Health and Community Medicine  
School of Medicine  
Tufts University  
136 Harrison Avenue, M&V Wing 1st Floor  
Boston, MA 02111 (USA)  
E-Mail mei\_chun.chung@tufts.edu

**Sheila E. Crowe**

Division of Gastroenterology  
Department of Medicine  
University of California at San Diego  
9500 Gilman Drive #0063  
La Jolla, CA 92093-0063 (USA)  
E-Mail secrowe@ucsd.edu

**Paul M. Coates**

Office of Dietary Supplements  
National Institutes of Health  
6100 Executive Boulevard  
Room 3B01, MSC 7517  
Bethesda, MD 20892-7517 (USA)  
E-Mail coatesp@od.nih.gov

**Adam Drewnowski**

Center for Public Health Nutrition  
University of Washington  
355 Raitt Hall #353410  
Seattle, WA 98195-3410 (USA)  
E-Mail adamdrew@uw.edu

**Susan J. Fairweather-Tait**

Norwich Medical School  
University of East Anglia  
Bio-Medical Research Centre (BMRC) 0.04  
Norwich NR4 7TJ (UK)  
E-Mail s.fairweather-tait@uea.ac.uk

**Alice A. Gibson**

The Boden Institute of Obesity, Nutrition, Exercise  
and Eating Disorders  
The University of Sydney  
Medical Foundation Bldg (K25)  
92-94 Parramatta Road  
Camperdown, NSW 2050 (Australia)  
E-Mail alice.gibson@sydney.edu.au

**Susanna Magrietha Hanekom**

Center of Excellence for Nutrition  
North-West University  
Private Bag X6001  
Potchefstroom 2520 (South Africa)  
E-Mail grieta.hanekom@nwu.ac.za

**Ferdinand Haschke**

Department of Pediatrics  
Paracelsus Medical University  
Müllner Hauptstrasse 48  
AT-5020 Salzburg (Austria)  
E-Mail fhaschk@gmail.com

**L. John Hoffer**

Lady Davis Institute for Medical Research  
Jewish General Hospital  
3755 Cote-Ste.-Catherine Road  
Montreal, QC H3T 1E2 (Canada)  
E-Mail l.hoffer@mcgill.ca

**Elizabeth J. Johnson**

Jean Mayer USDA Human Nutrition Center on Aging  
Tufts University  
711 Washington Street  
Boston, MA 02111 (USA)  
E-Mail elizabeth.johnson@tufts.edu

**Walter H. Kaye**

UCSD Eating Disorder Research and Treatment Program  
UCSD Department of Psychiatry  
Chancellor Park  
4510 Executive Dr., Suite 315  
San Diego, CA 92121 (USA)  
E-Mail wkaye@ucsd.edu

**Timothy Key**

Cancer Epidemiology Unit  
Nuffield Department of Population Health  
University of Oxford  
Richard Doll Building, Roosevelt Drive  
Oxford OX3 7LF (UK)  
E-Mail tim.key@ceu.ox.ac.uk

**H. Salome Kruger**

Centre of Excellence for Nutrition  
North-West University  
PO Box 20333  
Noordbrug  
Esselen Street  
Potchefstroom 2522 (South Africa)  
E-Mail salome.kruger@nwu.ac.za

**Neeraj Kumar**

Department of Neurology  
Mayo Clinic  
E8A, Mayo Building, 200 First St. SW  
Rochester, MN 55905 (USA)  
E-Mail kumar.neeraj@mayo.edu



**Joseph Lau**

Center for Evidence-Based Medicine  
Public Health Program  
Brown University  
121 S. Main Street, 8th floor  
Providence, RI 02912 (USA)  
E-Mail joseph\_lau@brown.edu

**John Leung**

Food Allergy Center at Tufts Medical Center and  
Floating Hospital for Children  
Departments of Gastroenterology, Pediatric  
Gastroenterology, and Allergy and Immunology  
Tufts Medical Center  
800 Washington Street  
Boston, MA 02111 (USA)  
E-Mail jleung3@tuftsmedicalcenter.org

**Luis Marsano**

University of Louisville and Robley Rex VAMC  
505 S. Hancock Street, CTR512  
Louisville, KY 40202 (USA)  
E-Mail luis.marsano@louisville.edu

**Jim Mann**

Department of Human Nutrition  
University of Otago  
PO Box 56  
Dunedin 9054 (New Zealand)  
Email jim.mann@otago.ac.nz

**Enrica Marzola**

Department of Neuroscience  
University of Turin  
Via Cherasco 11  
IT-10126 Turin (Italy)  
E-Mail enrica.marzola@gmail.com

**Richard D. Mattes**

Department of Nutrition Science  
Purdue University  
212 Stone Hall, 700 W. State Street  
West Lafayette, IN 47907-2059 (USA)  
E-Mail mattes@purdue.edu

**Ronald J. Maughan**

School of Sport, Exercise and Health Sciences  
Loughborough University  
Ashby Road  
Loughborough LE11 3TU (UK)  
E-Mail r.maughan@lboro.ac.uk

**Rachael McLean**

Departments of Preventive and Social Medicine  
and Human Nutrition  
University of Otago  
PO Box 56  
Dunedin 9054 (New Zealand)  
E-Mail rachael.mclean@otago.ac.nz

**Anoop Misra**

Fortis C-DOC Center of Excellence for Diabetes,  
Metabolic Diseases and Endocrinology  
B16 Chirag Enclave  
New Delhi 110016 (India)  
E-Mail anoopmisra@metabolicresearchindia.com

**Emily S. Mohn**

Jean Mayer USDA Human Nutrition Center on Aging  
Tufts University  
711 Washington Street  
Boston, MA 02111 (USA)  
E-Mail emily.mohn@tufts.edu

**Jonathan Obert**

University of Louisville and Robley Rex VAMC  
505 S. Hancock Street, CTR512  
Louisville, KY 40202 (USA)  
E-Mail jonathan.obert@louisville.edu

**Ulf Risérus**

Clinical Nutrition and Metabolism  
Department of Public Health and Caring Sciences  
Uppsala Science Park  
SE-75185 Uppsala (Sweden)  
E-Mail ulf.riserus@pubcare.uu.se

**Hamid M. Said**

University of California/VA Medical Program-151  
5901 E. 7th St  
Long Beach, CA 90822 (USA)  
E-Mail hmsaid@uci.edu

**Rehana A. Salam**

Division of Women and Child Health  
Aga Khan University  
Stadium Road  
PO Box 3500  
Karachi 74800 (Pakistan)  
E-Mail rehana.salam@aku.edu

**Dale A. Schoeller**

Nutritional Sciences  
University of Wisconsin  
1415 Linden Dr.  
Madison, WI 53706 (USA)  
E-Mail dschoell@nutrisci.wisc.edu

**James S. Scolapio**

Division of Gastroenterology  
University of Florida, Jacksonville Campus  
4555 Emerson Street, Suite 300  
Jacksonville, FL 32207 (USA)  
E-Mail james.scolapio@jax.ufl.edu

**Susan M. Shirreffs**

New Product Research  
GlaxoSmithKline  
980 Great West Road  
Brentford, TW8 9GS (UK)  
E-Mail susan.m.shirreffs@gsk.com

**Kyra A. Sim**

The Boden Institute of Obesity, Nutrition, Exercise  
and Eating Disorders  
The University of Sydney  
Medical Foundation Bldg (K25)  
92-94 Parramatta Road  
Camperdown, NSW 2050 (Australia)  
E-Mail kyra.sim@sydney.edu.au

**Donna J. Smith**

Division of Gastroenterology  
University of Florida, Jacksonville Campus  
4555 Emerson Street, Suite 300  
Jacksonville, FL 32207 (USA)  
E-Mail donna.smith@jax.ufl.edu

**Sally P. Stabler**

Division of Hematology  
School of Medicine  
University of Colorado  
12700 E. 19th Avenue, Room 9122  
RC2, Campus Box B170  
Aurora, CO 80045 (USA)  
E-Mail Sally.Stabler@ucdenver.edu

**Vin Tangpricha**

Division of Endocrinology, Metabolism and Lipids  
Department of Medicine  
Emory University School of Medicine  
101 Woodruff Circle, NE-WMRB1301  
Atlanta, GA 30322 (USA)  
E-Mail vin.tangpricha@emory.edu

**Diana Thomas**

Mathematical Sciences  
Montclair State University  
Richardson Hall 205  
1 Normal Ave  
Montclair, NJ 07043 (USA)  
E-Mail thomasdia@mail.montclair.edu

**Paul R. Thomas**

Office of Dietary Supplements  
National Institutes of Health  
6100 Executive Boulevard  
Room 3B01, MSC 7517  
Bethesda, MD 20892-7517 (USA)  
thomaspaul@od.nih.gov

**Averalda E. van Graan**

Centre of Excellence for Nutrition  
North-West University  
Potchefstroom Campus  
Private Bag X6001  
Potchefstroom 2520 (South Africa)  
E-Mail averalda.vangraan@nwu.ac.za

**H.H. Este Vorster**

Centre of Excellence for Nutrition  
North-West University  
Potchefstroom Campus  
Private Bag X129  
Potchefstroom 2520 (South Africa)  
E-mail este.vorster@nwu.ac.za

## Foreword

Nutrition takes center stage amongst all the lifestyle-related players which contribute to health or disease. Indeed, nutrition underlies the prevention and management of the most prevalent conditions faced by today's primary care providers. In developed countries, the erosion of our dietary habits is a major contributor to conditions such as type 2 diabetes, cardiovascular diseases and obesity. A large proportion of the health care budget of developed countries is consumed by the management of these increasingly widespread disorders. In addition to these well-known conditions, physicians also face a plethora of the more subtle manifestations of inadequate nutrition, such as liver disease, neurological disorders or anemia. And the problem of nutrition-related conditions is not only confined to the borders of the developed world. In developing countries, the specter of malnutrition is two-headed: on the one hand, a large percentage of the population is afflicted by malnutrition, but on the other hand, there is a rising trend in the same noncommunicable diseases that afflict the 'westernized' nations, such as metabolic conditions, obesity and cardiovascular disease.

*Nutrition for the Primary Care Provider* is aimed at physicians around the world who treat patients from all walks of life. The first section of the book is devoted to the basic principles of nutrition, covering the fundamentals of body composition, energy balance and appetite as well as the importance of the different macro- and micronutrients. The following section builds on the principles of the first by focusing on the special needs for specific circumstances including pregnancy, exercise, food allergies and religion. The third section, Nutrition for Disease States, provides an overview of our latest understanding of various disease states and how they are influenced by nutrition. The final section on Food Policy takes a bird's eye view, offering perspectives on global sustainability, the rapidly changing face of malnutrition and the role played by the food industry in consumer health.

We hope that this book will not only serve as a practical reference source but also shape the way physicians use nutrition as a tool to prevent and cure disease.

*Karen Yeow, Medical Writer*